GOVERNMENT POLYTECHNIC, PUNE

(AN AUTONOMOUS INSTITUTE OF GOVT. OF MAHARASHTRA)

180 OB CURRICULUM

(Since 2019-20)

DIPLOMA IN ELECTRONICS & TELECOMMUNICATION ENGINEERING PROGRAMME

IN

DEPARTMENT OF ELECTRONICS & TELECOMMUNICATION ENGINEERING

Government Polytechnic, Pune

(An Autonomous Institute of Government of Maharashtra)

Department of Electronics & Telecommunication Engineering

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Government Polytechnic, Pune

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Department of Electronics & Telecommunication Engineering

Vision and Mission of Institute

VISION

To develop self-reliant, versatile, innovative, quality conscious engineers for betterment of society.

MISSION

- **M1:** Imparting updated curriculum in association with stakeholders.
- **M2:** Providing with the state of art infrastructure & facilities.
- **M3:** Set up strategic alliance with industries.
- **M4:** Enhancing e-governance.
- **M5:** Continuous development of faculty & staff.

Vision and Mission of E&TC Department

VISION

To develop skilled Electronic and Telecommunication engineer to meet challenges of industry and serve for betterment of society.

MISSION

- **M1:** Imparting quality education embedded with professional ethics and entrepreneur qualities by promoting industry institute interaction.
- **M2:** Providing technical knowledge and skills to the students to accept contemporary challenges in the field of electronics and telecommunication engineering through modernization of infrastructure and facilities.
- **M3:** Motivating students to undertake multidisciplinary innovative projects.
- **M4:** Encouraging up-gradation of technical and soft skill set of students, faculties and staff.

PROGRAM OUTCOMES (POs):

1.Basic and discipline specific knowledge:
Apply knowledge of basic mathematics, science and Engineering fundamentals and engineering specialization to solve the Electronics & Telecommunication engineering problems.

2.Problem analysis:
Identify and analyze well defined Electronics & Telecommunication engineering problems using discipline specific knowledge.

3.Design/Development of solutions:
Design solutions for well defined technical problems which will support design of system components or process to meet specified need in Electronics & Telecommunication engineering.

4.Engineering tools, experimentation and testing:
Apply modern Electronics & Telecommunication engineering tools and appropriate technique to demonstrate & practice experimental measurements.

5.Engineering practice for society ,sustainability and environment:
Apply appropriate technology in context of society, sustainability, environment & Ethical Practices.

6.Project & Management:
Use engineering management principles individually, as a team member or a leader to manage projects and effectively communicate about well-defined engineering activities in multidisciplinary field.

7.Life-long learning:
Ability to analyze individual, societal needs and engage in updating in the context of technological changes.

Program Educational Objectives (PEOs)

PEO1: To attain excellence in the profession by applying fundamental and disciplinary knowledge to provide solutions for the societal challenges.

PEO2: To be able to demonstrate entrepreneurship skills and practice lifelong learning for continuous career progression.

PEO3: To utilize their knowledge, skills to find creative and innovative solutions to engineering problems in a multidisciplinary work environment.

Program Specific outcomes (PSOs)

Student will be able to:

- **PSO1:** Apply concepts in the field of Semiconductor technology, Electronics Communication, Instrumentation & embedded system.
- **PSO2:** Use conceptual and practical knowledge of Electronic & Telecommunication engineering with professional ethics to provide effective solutions to social and environmental issues in multidisciplinary systems.
- **PSO3:** Assemble, test and analyze the PCB (Electronics) circuits.

ACKNOWLEDGMENT

I appreciate the trust laid in me by Dr. Abhay Wagh, the Director, Directorate of Technical Education, Mumbai, Maharashtra and Dr. Dattatray Jadhav the Joint Director, Regional Office Directorate of Technical Education, Pune region, Maharashtra and Dr, Vinod Mohitkar, the Director, Maharashtra State Board of Technical Education, Mumbai, Maharashtra as the Chairman PBOS for 180OB Curriculum Design and Development. I am grateful to Dr. Vitthal Bandal, Principal Government Polytechnic, Pune for the trust bestowed on me during the Curriculum Design and Development activities. Dr. Vitthal Badal's guidance, support and affection added to the joy of carrying out the assignments of the Curriculum Design and Development.

I recognise, rejoice and deeply appreciate Mr. Milind Dhongade the Chairman, Board of Studies(BoS) for support and work towards the Curriculum Design and Development and thank all the members of the Board of Studies for their studied guidance and deep involvement as an expert.

I would like thank and express my gratitude towards Dr.Dattatray Jadhav , Joint Director Regional Office Directorate of Technical Education, Pune region ,Maharashtra as The Chairman Board of Governance and the all the members of the Board of Governance (BoG)for all the support given.

I deeply appreciate all the Industry Expert and Academicians in Program wise Board of Studies panel members of Electronics and Telecommunication Engineering Program for the support and work towards the Curriculum Design and Development. Deep involvement, efficient outcome in the meeting held are highly recognised.

I thank Mr. A.S. Zanpure Incharge, Curriculum Development Cell and his team at Institute level for Coordinating all the activities and support during this period.

I highly appreciate the unstinted support of colleagues, which I received during curriculum design and development activities. I recognize, rejoice and deeply appreciate their support and work toward this activity and thank them all, who took on the task of drafting instructional content for the curriculum and sharing their updated curriculum. Deep involvement, hectic activity and efforts of many professional colleagues together with similarity in thought for curricula content for Electronics and Telecommunication Engineering Program, has brought this report to a stage of completion

Shri R.N.Shikari ,
Head of Department and Chairman,
Electronics and Telecommunication Engineering Program

INTRODUCTION

Government Polytechnic Pune established in 1957 is offering three years Diploma Programme in **ELECTRONICS & TELECOMMUNICATION** Engineering since 1967. Subsequently under World Bank Project this institute was awarded the status of an autonomous institute of Government of Maharashtra. There onwards Government Polytechnic Pune is holding the responsibility of designing and revising its own curriculum. The first curriculum was implemented in 1994 under academic autonomy and subsequently it was revised and implemented in 1999, 2004, 2009, 2014 and the current revision 2019 is being implemented from academic year 2019-20. The curriculum revision is now a regular activity and the mandatory requirement of involvement of industry personnel in curriculum revision helps in enhancing the relevance of the programme curriculum. Curriculum development since 1994 is illustrated as below,

Year of revision of curriculum	Name of curriculum	Total credits	Brief Information of Curriculum
1994	190	190	Objective based curriculum, 7 Levels
1999	180	180	Objective based curriculum, 7 Levels
2004	180 R	180	Objective based Revised curriculum, 7 Levels
2009	180Q	180	Quality Function Deployment based curriculum, 7 Levels
2014	180S	180	Objective based **S**cientific curriculum, 5 Levels
2019	180 OB	180	Outcome based curriculum, 5 Levels

From Academic year 2019-20, newly revised curriculum named as **180 OB**, is being implemented for the first year and under revision for second- and third-year courses. Again, it's a 180-credit curriculum but based on outcome. Same procedure is adopted for revising the curriculum with addition of the unit outcomes, course outcomes and mapping of COs with POs and PSOs. The curriculum format for the course is also improvised with the addition of list of major equipment required along with specification, student activities, micro projects, special instructional strategies, learning resources including list of books with ISBN number and addresses of websites.

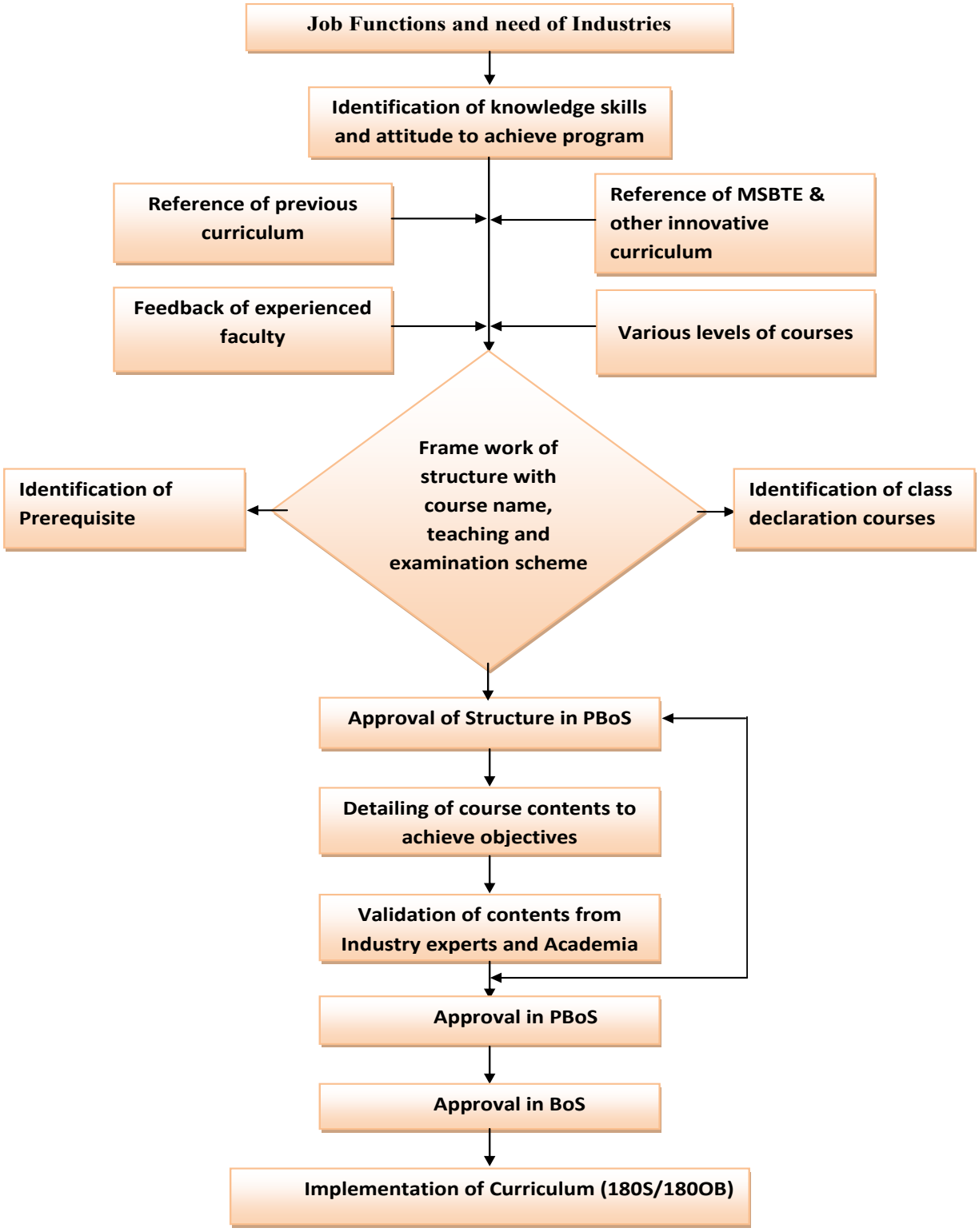
Methodology for revising the curriculum

The courses of curriculum are categorized into five different levels i.e. Foundation Courses, Core Technology courses. Basic Technology Courses, Applied Technology Courses and Diversified Courses. Well defined methodology is adopted for revising the curriculum structure and the content detailing of individual courses is carried out by a group of experts, as shown in below flow diagram. This is then approved by Board of Studies (BOS), Programme Wise Board of Studies (PBOS), and Governing Body (GB).

The process adopted for designing the curriculum is as follows:

1. Identify skills (Cognitive, psychomotor and affective domain) by conducting industrial survey through questionnaire.
2. Record degree of identified skills of Diploma holder in industry on the scale of 1 to 4 (1- Most Important, 2-Important, 3- Less important, 4- Not preferred) through questionnaire.
3. Identify courses based on identified skills in industrial survey/feedback.
4. Categorize courses into three main streams
5. Placing the identified courses in appropriate levels.
6. Identify Course Objectives for each course based on the identified skill
7. Collection of feedback from experienced faculty about content details, teaching scheme and evaluation scheme
8. Revising the components of curriculum based on all the above feedbacks.
9. Validate the revised curriculum by Industry experts and Academia through conference.
10. Obtain equivalence from Maharashtra State Board of Technical Education Mumbai in due course of time.

Based on the feedback, in 180OB curriculum new courses such as Python Programming, Basics Of Internet of Things, Biomedical Engineering, Professional Practices, Entrepreneurship development and start-ups and E-Commerce, Digital Marketing are added at appropriate levels while few courses are improvised e.g. Wireless and Mobile communication, Instrumentation and Control and Consumer Electronics and Project and Seminar . The special feature of this 180 OB curriculum is inclusion of six weeks in-plant training for all the students. Some Pre-requisite courses are also newly added.



Flow diagram of Methodology for Curriculum Revision

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Department of Electronics & Telecommunication Engineering

List of members Governing Body (GB)

Sr. No.	Name and Designation	Designation
1	Dr. Dattatray Jadhav, Joint Director of Technical Education Pune	Chairman
2	Mr. Milind Dhongade, Managing Director, Computer Home, Pune.	Member
3	Mr. Shashank Hiwarkar, Director, ETH Limited, Pune.	Member
4	Mr. Vikas Waghmare, Chief Engineer, Suma Shilp Ltd., Pune.	Member
5	Mr. Kiran Jadhav, Managing Director, Accurate Industrial Control Pvt. Ltd., Pune.	Member
6	Mr. Abhijit Phadke, Director-CTCI Test and Lab ops. Cell, Cummins India Ltd. Pune.	Member
7	Dr. Bharat Ahuja, Director, Government College of Engineering, Pune.	Member
8	Mr. Shahid Usmani, Deputy Secretary, Regional office, MSBTE, Mumbai	Member
9	Dr. S.S. Kadar, Co-ordinator, National Institute for Technical Teachers Training & Research, Extension Center, Pune	Member
10	Regional Officer, Western Regional Office (AICTE), 2nd floor, Industrial Assurance Building, Veer Nariman Road, Church gate, Mumbai.	Member
11	Prof. K. K. Gosh, FIE, Chairman, Pune Local Chapter, Institution of Engineers (India)	Member
12	Mr. P. D. Rendalkar, General Manager, District Industries Centre, Agriculture College Compound, Shivaji Nagar, Pune	Member
13	Dr. Vitthal Bandal, Principal, Government Polytechnic, Pune	Member Secretary

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List of members of Board of Studies (BoS)

Sr. No.	Name and Designation	Designation
1	Mr. Milind Dhongade, Managing Director, Computer Home, Pune	Chairman
2	Dr. Vitthal Bandal, Principal, Government Polytechnic, Pune	Invitee
3	Dr. Sunil Patil, Ex Director, Symbiosis Institute of Telecom Management, Pune	Member
4	Mr. Ravikiran Chaudhari, Foretech Precision Pvt. Ltd., A – 1, Sonal Residency, Ideal Colony, Kothrud, Pune.	Member
5	Mr. Ashok Atkekar, Project Management Consultant, Pune	Member
6	Mr.Avinash Joshi, Cubix Automation, Pune	Member
7	Mr. Sanjay Mahajan, Director, SM Engineers, Pune	Member
8	Mr. Prakash Raut, Superintendent Engineer, Maharashtra State Electricity Distribution Company Ltd., Rasta Peth, Pune	Member
9	Prof. Prakash Wani, Ex. Professor, Dept. of Electronics & Telecommunication Engg., Government College of Engineering, Shivajinagar, Pune.	Member
10	Mrs. Minal Joshi, MD, Uzazi, Pune	Member
11	Dr. Shaheed Usmani, Dy. Secretary, Maharashtra State Board of Technical Education, Pune Region, Pune	Member
12	Mr Vishanath Tambe, Head of Civil Engg. Dept., Government Polytechnic, Pune	Member
13	Mr Vyankatesh Kondawar, Head of Civil Engg. Dept., (Second shift), Government Polytechnic, Pune	Member
14	Dr Sachin Bharatkar, Head of Electrical Engg. Dept., Government Polytechnic, Pune	Member
15	Mr Rajesh Shelke, Head of Electrical Engg. Dept.,(second shift), Government Polytechnic, Pune	Member
16	Mr. Rajreddy Shikari., Head of Electronics and Tele. Engg. Dept., Government Polytechnic, Pune	Member

17	Dr. Sandiapan Narote, Head of Electronics and Tele. Engg. Dept., (Second Shift) Government Polytechnic, Pune	Member
18	Dr. Nitin Kulkarni, Head of Mechanical Engg. Dept., and Academic Coordinator, Government Polytechnic, Pune	Member
19	Mrs. Namita Kadam, Head of Metallurgical Engg. Dept., Government Polytechnic, Pune	Member
20	Dr. Shankar Nikam, I/c Head of Computer Engg. Dept., Government Polytechnic, Pune	Member
21	Mrs. Mrunal Kokate, Head of Information Technology Dept., Government Polytechnic, Pune	Member
22	Mrs Shubahngi Shinde, I/c. Head of Dress Designing & Garment Mfg. Engg. Dept., Government Polytechnic, Pune	Member
23	Dr. V.B. Jaware, Controller of Examinations, Government Polytechnic, Pune	Member
24	Mr. Anant Zanpure, I/C. C.D.C., Government Polytechnic, Pune	Member

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Sr.No.	Name of Member	Designation
1.	Shri R.N.Shikari, HOD. E&TC Dept	Chairman
2.	Dr.R.A.Patil ,Professor EnTC, COE Pune.	Member-Academicia
3.	Dr. A.S.Chandak, HOD, EnTC, CWIT,Pune	Member-Academicia
4.	Shri G.C.Khursade, HOD,EnTC, G P Ratnagiri	Member-Academicia
5.	Shri Dipak M. Ghule,Director,Shraddha Engg,Pune	Member-Industry
6.	Shri R.K.Ranjnekar,Dy. Executive Engg,AIR,Pune	Member-Industry
7.	Shri Shrikant Thakar, Technical assistant EMRC,Savitribai Phule University of Pune	Member-Industry
8.	Shri Sagar Tikar , R&D,TaTa Motors	Member-Industry
9.	Shri N.S.Badve,Manager,Suzlon Energy Ltd,Pune	Member-Industry
10.	Shri V.P.Badhe, M D,Inditech Electrosystems Pvt.Ltd.	Member-Industry
11.	Shri Vijay D. Chaudhari, M.D.Swaraj Robotics and Automation.	Member-Industry
12.	Dr. S.P.Narote HOD. E&TC Dept- Shift II	Member-Academicia
13.	Shri M.J.Deshpande, Sr.Lecturer , E&TC Dept	Member-Academicia
14.	Dr Vasudev Jaware,,CoE,GPPune	Member-Invitee
15.	Dr. Nitin Kulkarni, Academic coordinator, GPPune	Member-Invitee
16.	Shri A.S.Zanpure ,CDC incharge ,GPPune	Member-Invitee
17	Shri S.H.Jadhav, Lecturer , E&TC Dept	Member-Invitee
18	Shri A.D.Vikhankar, Lecturer , E&TC Dept.	Member Invitee
19	Shri G.W.Sonone , Lecturer , E&TC Dept	Member Invitee
20	Smt.P.M.Zilpe , Lecturer , E&TC Dept	Member Invitee
21	Shri. N.D.Toradmal, Lecturer , E&TC Dept	Member Invitee
22	Smt.S.S.Chhatwani, Lecturer , E&TC Dept	Member Invitee
23	Smt. P.G.Gahukar, Lecturer , E&TC Dept	Member Invitee
24	Smt. N.S.Bakde, Lecturer , E&TC Dept	Member Invitee
25	Smt. P.P.Rajhans, Lecturer , E&TC Dept	Member Invitee
26	Smt. P.V.Lengare, Lecturer , E&TC Dept	Member Invitee

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Curriculum Development Cell committee of Institute

Institute Level CDC Team:

Institute Level CDC Team:

Sr. No.	Name of Members	Post at CDC
1	Shri Anant Sharad Zanpure, Lecturer in Mechanical Engineering.	In-Charge
2	Dr Vijaykumar Kishanrao Jadhav , Lecturer in Electrical Engineering.	Member
3	Smt Pranita Mangesh Zilpe, Lecturer in E&TC Engineering.	Member

Program wise CDC In- charges :

Sr. No.	Name of Members	Name of Program
1	Smt. Sindhu R. Panapalli Smt. Jyotsna.S. Thorat	Civil Engineering
2	Smt Ujwala Tulangekar Shri. Sunil P. Date	Electrical Engineering
3	Smt. Pranita Mangesh Zilpe Mrs. Sarika S. Chhatwani	Electronics & Telecommunication
4	Mr. Sudin B. Kulkarni Dr. Aniruddha A. Gadhikar	Mechanical Engineering
5	Shri. A.V.Mehtre	Metallurgical Engineering
6	Smt. Megha G. Yawalkar Mrs. Sayali P. Ambavane Smt. Lalita S. Korde Mr. Tarun P. Sharma	Computer Engineering
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8	Mrs. Namita V. Gondane	Dress Designing & Garment Manufacturing
9	Smt. Shital A. Kakade	Science & Humanities
10	Smt. Dipti V. Saurkar	Science & Humanities
11	Shri. Sachin B. Yede	Science & Humanities
12	Smt. Saroj C. Patil	Science & Humanities

180 OB CURRICULUM STRUTURE AND PATH

DIPLOMA IN ELECTRONICS & TELECOMMUNICATION

Programme Structure TO BE IMPLEMENTED FROM YEAR 2019-20 (180OB-OB1)

Course Code	Course Name	Compulsary/ Optional	Pre-Requ -isite	Teaching Scheme			Total Credits	Examination Scheme								Class Declaration
								Theory			Practical/Oral				Total Marks	
				L	P	T	C	ESE		PA	ESE		PA			
								Min	Max	Max	Min	Max	Min	Max		
LEVEL-1: Foundation Level Courses (All Compulsory)																
HU1101	COMMUNICATION SKILLS I	Compulsory		2	0	1	3	16	40	10	10	25 $	10	25	100	No
HU1102	COMMUNICATION SKILLS II	Compulsory	HU1101	2	0	1	3	16	40	10	NA	NA	20	50	100	No
SC1101	APPLIED MATHEMATICS I	Compulsory		3	0	2	5	32	80	20	NA	NA	10	25	125	No
SC1102	APPLIED MATHEMATICS II	Compulsory	SC1101	3	0	2	5	32	80	20	NA	NA	10	25	125	No
SC1104	ENGINEERING PHYSICS	Compulsory		3	2	0	5	32	#80	20	10	25 *	10	25	150	No
SC1105	ENGINEERING CHEMISTRY	Compulsory		3	2	0	5	32	#80	20	10	25 *	10	25	150	No
6	**Level Total**			**16**	**4**	**6**	**26**	**160**	**400**	**100**	**30**	**75**	**70**	**175**	**750**	
LEVEL-2: Core Technology Courses A(All Compulsory)																
CM2102	FUNDAMENTALS OF ICT	Compulsory		1	2	0	3	NA	NA	NA	10	25 *	10	25	50	No
EE2103	FUNDAMENTALS OF ELECTRICAL ENGINEERING	Compulsory		3	2	0	5	32	80	20	10	25 $	10	25	150	No
ET2101	BASIC ELECTRONICS ENGINEERING	Compulsory		4	2	0	6	32	80	20	10	25 *	20	50	175	No
ET2102	C LANGUAGE PROGRAMMING	Compulsory		3	2	1	6	32	80	20	10	25 *	20	50	175	No
ET2103	ELECTRONIC WORKSHOP	Compulsory		1	4	0	5	NA	NA	NA	10	25 *	20	50	75	No
ME2104	ENGINEERING GRAPHICS	Compulsory		2	2	0	4	NA	NA	NA	NA	NA	20	50	50	No
6	**Sub Total**			**14**	**14**	**1**	**29**	**96**	**240**	**60**	**50**	**125**	**100**	**250**	**675**	
LEVEL-2: Core Technology Courses B(All Compulsory)																
SC2104	ADVANCED MATHEMATICS III	Compulsory	SC1102	2	0	1	3	16	40	10	NA	NA	10	25	75	No
SC2105	ADVANCED MATHEMATICS IV	Compulsory	SC1102	2	0	1	3	16	40	10	NA	NA	10	25	75	No
2	**Sub Total**			**4**	**0**	**2**	**6**	**32**	**80**	**20**	**0**	**0**	**20**	**50**	**150**	
	Level Total			**18**	**14**	**3**	**35**	**128**	**320**		**50**	**125**	**120**	**300**	**825**	
LEVEL-3: Basic Technology Courses (All Compulsory)																
ET3102	ELECTRONIC CIRCUITS AND NETWORKS	Compulsory		3	2	1	6	32	80	20	10	25 *	10	25	150	No
ET3103	APPLIED ELCTRONICS	Compulsory	ET2101	4	4	0	8	32	80	20	20	50 *	10	25	175	Yes
ET3104	ELECTRONIC INSTRUMENTATION	Compulsory		2	2	0	4	16	40	10	10	25 *	10	25	100	No

ET3105	PRINCIPLES OF COMMUNICATION	Compulsory		4	2	0	6	32	80	20	10	25 **$**	10	25	150	Yes
ET3106	LINEAR INTEGRATED CIRCUITS	Compulsory	ET2101	3	2	1	6	32	80	20	10	25 *	10	25	150	No
ET3107	POWER ELECTRONICS	Compulsory	ET2101	3	2	0	5	32	80	20	10	25 **$**	10	25	150	No
ET3108	DIGITAL ELECTRONICS	Compulsory		3	2	1	6	32	80	20	10	25 *	10	25	150	No
ET3109	MICROCONTROLLER AND APPLICATION	Compulsory	ET3108	4	4	0	8	32	80	20	20	50 *	10	25	175	Yes
8			**Level Total**	**26**	**20**	**3**	**49**	**240**	**600**	**150**	**100**	**250**	**80**	**200**	**1200**	
LEVEL-4: Applied Technology A(Auxiliary Courses - One Compulsory and Any One Opt...)																
AU4101	ENVIRONMENTAL SCIENCE	Compulsory		0	2	0	2	NA	NA	NA	NA	NA	20	50	50	No
AU4102	RENEWABLE ENERGY TECHNOLOGIES	Optional		2	0	0	2	16	#40	10	NA	NA	NA	NA	50	No
AU4103	ENGINEERING ECONOMICS	Optional		2	0	0	2	16	#40	10	NA	NA	NA	NA	50	No
AU4104	ETHICAL SOURCES AND SUSTAINABILITY	Optional		2	0	0	2	16	#40	10	NA	NA	NA	NA	50	No
AU4105	DIGITAL MARKETING	Optional		0	2	0	2	NA	NA	NA	10	25 **$**	10	25	50	No
2			**Sub Total**	**2**	**2**	**0**	**4**	**16**	**40**	**10**	**0**	**0**	**20**	**50**	**100**	
LEVEL-4: Applied Technology B(Management Level Courses - One Compulsory and Any One Optional)																
MA4101	ENTREPRENEURSHIP AND STARTUPS	Compulsory		2	0	0	2	16	#40	10	NA	NA	NA	NA	50	No
MA4102	INDUSTRIAL ORGANISATION AND MANAGEMENT	Optional		2	0	0	2	16	#40	10	NA	NA	NA	NA	50	No
MA4103	MATERIALS MANAGEMENT	Optional		2	0	0	2	16	#40	10	NA	NA	NA	NA	50	No
MA4104	DISASTER MANAGEMENT	Optional		2	0	0	2	16	#40	10	NA	NA	NA	NA	50	No
MA4105	INTRODUCTION TO E-COMMERCE	Optional		2	0	0	2	16	#40	10	NA	NA	NA	NA	50	No
MA4106	INFORMATION MANAGEMENT	Optional		2	0	0	2	16	#40	10	NA	NA	NA	NA	50	No
2			**Sub Total**	**4**	**0**	**0**	**4**	**32**	**80**	**20**	**0**	**0**	**0**	**0**	**100**	
LEVEL-4: Applied Technology C(Programme Specific Courses (All Compulsory))																
CM4104	PROFESSIONAL PRACTICES - I	Compulsory		0	2	0	2	NA	NA	NA	NA	NA	20	50	50	No
CM4105	PROFESSIONAL PRACTICES-II	Compulsory		0	2	0	2	NA	NA	NA	NA	NA	20	50	50	No
ET4101	INDUSTRY INPLANT TRAINING	Compulsory	LEVEL 1 AND LEVEL 2 COURSES TERM GRANT	0	6	0	6	NA	NA	NA	20	50 **$**	20	50	100	No
ET4102	PROJECT	Compulsory	90 CREDITS AND LEVEL 1 PASSED	0	4	0	4	NA	NA	NA	20	50 **$**	20	50	100	Yes

ET4103	SEMINAR	Compulsory	90 CREDITS AND LEVEL 1 PASSED	0	2	0	2	NA	NA	NA	10	25 **$**	10	25	50	Yes
ET4104	MAINTENANCE OF ELECTRONICS AND EDA TOOLS	Compulsory		0	4	0	4	NA	NA	NA	20	50 *	20	50	100	No
ET4105	CONSUMER ELECTRONICS	Compulsory		3	2	0	5	32	80	20	10	25 **$**	10	25	150	No
ET4106	BASICS OF INTERNET OF THINGS	Compulsory		3	2	0	5	32	80	20	10	25 *	10	25	150	Yes
ET4107	DIGITAL COMMUNICATION	Compulsory	ET3105	3	2	0	5	32	80	20	10	25 *	10	25	150	Yes
ET4108	MOBILE AND WIRELESS COMMUNICATION	Compulsory	ET4107	4	2	0	6	32	80	20	10	25 **$**	10	25	150	Yes
ET4109	INSTRUMENTATION AND CONTROL	Compulsory	ET3104	3	2	1	6	32	80	20	10	25 **$**	10	25	150	Yes
11			**Sub Total**	**16**	**30**	**1**	**47**	**160**	**400**	**100**	**120**	**300**	**160**	**400**	**1200**	
			Level Total	**22**	**32**	**1**	**55**	**208**	**520**		**120**	**300**	**180**	**450**	**1400**	
LEVEL-5: Diversified Courses A(Elective I (Any One))																
ET5101	EMBEDDED SYSTEMS	Optional	ET3109	3	2	0	5	32	80	20	10	25 *	10	25	150	Yes
ET5102	ROBOTICS	Optional	ET3109	3	2	0	5	32	80	20	10	25 **$**	10	25	150	Yes
ET5103	FIBER OPTIC COMMUNICATION	Optional	ET3105	3	2	0	5	32	80	20	10	25 **$**	10	25	150	Yes
1			**Sub Total**	**3**	**2**	**0**	**5**	**32**	**80**	**20**	**10**	**25**	**10**	**25**	**150**	
LEVEL-5: Diversified Courses B(Elective II (Any One))																
ET5104	COMPUTER NETWORKING AND DATA COMMUNICATION	Optional	CM2102	3	2	0	5	32	80	20	10	25 **$**	10	25	150	Yes
ET5105	INDUSTRIAL AUTOMATION	Optional	ET4109	3	2	0	5	32	80	20	10	25 **$**	10	25	150	Yes
ET5106	PYTHON PROGRAMMING	Optional		3	2	0	5	32	80	20	10	25 *	10	25	150	Yes
1			**Sub Total**	**3**	**2**	**0**	**5**	**32**	**80**	**20**	**10**	**25**	**10**	**25**	**150**	
LEVEL-5: Diversified Courses C(Elective III (Any One))																
ET5107	MICROWAVE AND RADAR COMMUNICATION	Optional	ET3105	3	2	0	5	32	80	20	10	25 **$**	10	25	150	No
ET5108	SATELLITE COMMUNICATION	Optional	ET3105	3	2	0	5	32	80	20	10	25 **$**	10	25	150	No
ET5109	BIOMEDICAL INSTRUMENTATION	Optional	ET3104	3	2	0	5	32	80	20	10	25 **$**	10	25	150	No
1			**Sub Total**	**3**	**2**	**0**	**5**	**32**	**80**	**20**	**10**	**25**	**10**	**25**	**150**	
			Level Total	**9**	**6**	**0**	**15**	**96**	**240**		**30**	**75**	**30**	**75**	**450**	
			Total Credits	**91**	**76**	**13**	**180**	**832**	**2080**		**330**	**825**	**480**	**1200**	**4625**	

Note: Prerequisite condition for registration to each class declaration course is that all level 1 courses must be passed.

Legends : **L**- Lecture, **P**- Practical, **T**- Tutorial, **C**- Credits ,**ESE**-End Semester Examination,**PA**- Progressive Assessment (Test I,II/TermWork) , *****- Practical Exam, **$**- Oral Exam, **#**- Online Examination Each Lecture/Practical period is of one clock hour;

Details About 180OB-OB1 Structure

Note: **The figures at Sr. No. 3,4,5,9,10 may slightly vary depending upon optional courses offered by the programme.**

1.	**Total Credits**	**180**
2.	**Total No. Courses**	**40+0(Non Credit Courses)**
3.	**No of Courses with Theory Examination**	**30**
4.	**No. of Courses with Practical/Oral Examination**	**28**
5.	**No. of Courses without Theory Examination**	**11+0(Non Credit Courses)**
6.	**Total Marks**	**4625**
7.	**Marks For Class Declaration**	**1550**
8.	**Theory Paper Marks for Class Declaration**	**900**
9.	**Theory:Practical Ratio as per Credits**	**51:49**
10.	**Theory:Practical Ratio as per Marks**	**56:44**
11.	**Class Declaration Courses**	**11**

DIPLOMA IN ELECTRONICS & TELECOMMUNICATION

Programme Structure TO BE IMPLEMENTED FROM YEAR 2019-20 (180OB-POB1)

Course Code	Course Name	Compulsary/ Optional	Pre-Requ-isite	Teaching Scheme			Total Credits	Examination Scheme								Class Declaration
								Theory			Practical/Oral				Total Marks	
				L	P	T	C	ESE		PA	ESE		PA			
								Min	Max	Max	Min	Max	Min	Max		
LEVEL-1: Foundation Level Courses (All Compulsory)																
HU1101	COMMUNICATION SKILLS I	Compulsory		2	0	1	3	16	40	10	10	25 $	10	25	100	No
HU1102	COMMUNICATION SKILLS II	Compulsory	HU1101	2	0	1	3	16	40	10	NA	NA	20	50	100	No
SC1101	APPLIED MATHEMATICS I	Compulsory		3	0	2	5	32	80	20	NA	NA	10	25	125	No
SC1102	APPLIED MATHEMATICS II	Compulsory	SC1101	3	0	2	5	32	80	20	NA	NA	10	25	125	No
SC1104	ENGINEERING PHYSICS	Compulsory		3	2	0	5	32	#80	20	10	25 *	10	25	150	No
SC1105	ENGINEERING CHEMISTRY	Compulsory		3	2	0	5	32	#80	20	10	25 *	10	25	150	No
6	**Level Total**			**16**	**4**	**6**	**26**	**160**	**400**	**100**	**30**	**75**	**70**	**175**	**750**	
LEVEL-2: Core Technology Courses A(All Compulsory)																
CM2102	FUNDAMENTALS OF ICT	Compulsory		1	2	0	3	NA	NA	NA	10	25 *	10	25	50	No
EE2103	FUNDAMENTALS OF ELECTRICAL ENGINEERING	Compulsory		3	2	0	5	32	80	20	10	25 $	10	25	150	No
ET2101	BASIC ELECTRONICS ENGINEERING	Compulsory		4	2	0	6	32	80	20	10	25 *	20	50	175	No
ET2102	C LANGUAGE PROGRAMMING	Compulsory		3	2	1	6	32	80	20	10	25 *	20	50	175	No
ET2103	ELECTRONIC WORKSHOP	Compulsory		1	4	0	5	NA	NA	NA	10	25 *	20	50	75	No
ME2104	ENGINEERING GRAPHICS	Compulsory		2	2	0	4	NA	NA	NA	NA	NA	20	50	50	No
6	**Sub Total**			**14**	**14**	**1**	**29**	**96**	**240**	**60**	**50**	**125**	**100**	**250**	**675**	
LEVEL-2: Core Technology Courses B(All Compulsory)																
ET2104	INDUSTRIAL MEASURMENT	Compulsory		4	2	0	6	32	80	20	10	25 $	10	25	150	No
1	**Sub Total**			**4**	**2**	**0**	**6**	**32**	**80**	**20**	**10**	**25**	**10**	**25**	**150**	
	Level Total			**18**	**16**	**1**	**35**	**128**	**320**		**60**	**150**	**110**	**275**	**825**	
LEVEL-3: Basic Technology Courses (All Compulsory)																
ET3102	ELECTRONIC CIRCUITS AND NETWORKS	Compulsory		3	2	1	6	32	80	20	10	25 *	10	25	150	No
ET3103	APPLIED ELCTRONICS	Compulsory	ET2101	4	4	0	8	32	80	20	20	50 *	10	25	175	Yes
ET3104	ELECTRONIC INSTRUMENTATION	Compulsory		2	2	0	4	16	40	10	10	25 *	10	25	100	No
ET3105	PRINCIPLES OF COMMUNICATION	Compulsory		4	2	0	6	32	80	20	10	25 $	10	25	150	Yes

ET3106	LINEAR INTEGRATED CIRCUITS	Compulsory	ET2101	3	2	1	6	32	80	20	10	25 *	10	25	150	No
ET3107	POWER ELECTRONICS	Compulsory	ET2101	3	2	0	5	32	80	20	10	25 **$**	10	25	150	No
ET3108	DIGITAL ELECTRONICS	Compulsory		3	2	1	6	32	80	20	10	25 *	10	25	150	No
ET3109	MICROCONTROLLER AND APPLICATION	Compulsory	ET3108	4	4	0	8	32	80	20	20	50 *	10	25	175	Yes
8			**Level Total**	**26**	**20**	**3**	**49**	**240**	**600**	**150**	**100**	**250**	**80**	**200**	**1200**	
LEVEL-4: Level 4 (Applied Technology) A(Auxiliary Courses - One Compulsory and Any One Optional)																
AU4101	ENVIRONMENTAL SCIENCE	Compulsory		0	2	0	2	NA	NA	NA	NA	NA	20	50	50	No
AU4102	RENEWABLE ENERGY TECHNOLOGIES	Optional		2	0	0	2	16	#40	10	NA	NA	NA	NA	50	No
AU4103	ENGINEERING ECONOMICS	Optional		2	0	0	2	16	#40	10	NA	NA	NA	NA	50	No
AU4104	ETHICAL SOURCES AND SUSTAINABILITY	Optional		2	0	0	2	16	#40	10	NA	NA	NA	NA	50	No
AU4105	DIGITAL MARKETING	Optional		0	2	0	2	NA	NA	NA	10	25 **$**	10	25	50	No
2			**Sub Total**	**2**	**2**	**0**	**4**	**16**	**40**	**10**	**0**	**0**	**20**	**50**	**100**	
LEVEL-4: Level 4 (Applied Technology) B(Management Level Courses - One Compulsory and Any One Optional)																
MA4101	ENTREPRENEURSHIP AND STARTUPS	Compulsory		2	0	0	2	16	#40	10	NA	NA	NA	NA	50	No
MA4102	INDUSTRIAL ORGANISATION AND MANAGEMENT	Optional		2	0	0	2	16	#40	10	NA	NA	NA	NA	50	No
MA4103	MATERIALS MANAGEMENT	Optional		2	0	0	2	16	#40	10	NA	NA	NA	NA	50	No
MA4104	DISASTER MANAGEMENT	Optional		2	0	0	2	16	#40	10	NA	NA	NA	NA	50	No
MA4105	INTRODUCTION TO E-COMMERCE	Optional		2	0	0	2	16	#40	10	NA	NA	NA	NA	50	No
MA4106	INFORMATION MANAGEMENT	Optional		2	0	0	2	16	#40	10	NA	NA	NA	NA	50	No
2			**Sub Total**	**4**	**0**	**0**	**4**	**32**	**80**	**20**	**0**	**0**	**0**	**0**	**100**	
LEVEL-4: Level 4 (Applied Technology) C(Programme Specific Courses (All Compulsory))																
CM4104	PROFESSIONAL PRACTICES - I	Compulsory		0	2	0	2	NA	NA	NA	NA	NA	20	50	50	No
CM4105	PROFESSIONAL PRACTICES-II	Compulsory		0	2	0	2	NA	NA	NA	NA	NA	20	50	50	No
ET4101	INDUSTRY INPLANT TRAINING	Compulsory	LEVEL 1 AND LEVEL 2 COURSES TERM GRANT	0	6	0	6	NA	NA	NA	20	50 **$**	20	50	100	No
ET4102	PROJECT	Compulsory	90 CREDITS AND LEVEL 1 PASSED	0	4	0	4	NA	NA	NA	20	50 **$**	20	50	100	Yes

ET4103	SEMINAR	Compulsory	90 CREDITS AND LEVEL 1 PASSED	0	2	0	2	NA	NA	NA	10	25 **$**	10	25	50	Yes
ET4104	MAINTENANCE OF ELECTRONICS AND EDA TOOLS	Compulsory		0	4	0	4	NA	NA	NA	20	50 *	20	50	100	No
ET4105	CONSUMER ELECTRONICS	Compulsory		3	2	0	5	32	80	20	10	25 **$**	10	25	150	No
ET4106	BASICS OF INTERNET OF THINGS	Compulsory		3	2	0	5	32	80	20	10	25 *	10	25	150	Yes
ET4107	DIGITAL COMMUNICATION	Compulsory	ET3105	3	2	0	5	32	80	20	10	25 *	10	25	150	Yes
ET4108	MOBILE AND WIRELESS COMMUNICATION	Compulsory	ET4107	4	2	0	6	32	80	20	10	25 **$**	10	25	150	Yes
ET4109	INSTRUMENTATION AND CONTROL	Compulsory	ET3104	3	2	1	6	32	80	20	10	25 **$**	10	25	150	Yes
11			**Sub Total**	**16**	**30**	**1**	**47**	**160**	**400**	**100**	**120**	**300**	**160**	**400**	**1200**	
			Level Total	**22**	**32**	**1**	**55**	**208**	**520**		**120**	**300**	**180**	**450**	**1400**	
LEVEL-5: Diversified Courses A(Elective I (Any One))																
ET5101	EMBEDDED SYSTEMS	Optional	ET3109	3	2	0	5	32	80	20	10	25 *	10	25	150	Yes
ET5102	ROBOTICS	Optional	ET3109	3	2	0	5	32	80	20	10	25 **$**	10	25	150	Yes
ET5103	FIBER OPTIC COMMUNICATION	Optional	ET3105	3	2	0	5	32	80	20	10	25 **$**	10	25	150	Yes
1			**Sub Total**	**3**	**2**	**0**	**5**	**32**	**80**	**20**	**10**	**25**	**10**	**25**	**150**	
LEVEL-5: Diversified Courses B(Elective II (Any One))																
ET5104	COMPUTER NETWORKING AND DATA COMMUNICATION	Optional	CM2102	3	2	0	5	32	80	20	10	25 **$**	10	25	150	Yes
ET5105	INDUSTRIAL AUTOMATION	Optional	ET4109	3	2	0	5	32	80	20	10	25 **$**	10	25	150	Yes
ET5106	PYTHON PROGRAMMING	Optional		3	2	0	5	32	80	20	10	25 *	10	25	150	Yes
1			**Sub Total**	**3**	**2**	**0**	**5**	**32**	**80**	**20**	**10**	**25**	**10**	**25**	**150**	
LEVEL-5: Diversified Courses C(Elective III)																
ET5107	MICROWAVE AND RADAR COMMUNICATION	Optional	ET3105	3	2	0	5	32	80	20	10	25 **$**	10	25	150	No
ET5108	SATELLITE COMMUNICATION	Optional	ET3105	3	2	0	5	32	80	20	10	25 **$**	10	25	150	No
ET5109	BIOMEDICAL INSTRUMENTATION	Optional	ET3104	3	2	0	5	32	80	20	10	25 **$**	10	25	150	No
1			**Sub Total**	**3**	**2**	**0**	**5**	**32**	**80**	**20**	**10**	**25**	**10**	**25**	**150**	
			Level Total	**9**	**6**	**0**	**15**	**96**	**240**		**30**	**75**	**30**	**75**	**450**	
			Total Credits	**91**	**78**	**11**	**180**	**832**	**2080**		**340**	**850**	**470**	**1175**	**4625**	

Note: Prerequisite condition for registration to each class declaration course is that all level 1 courses must be passed.

Legends : **L**- Lecture, **P**- Practical, **T**- Tutorial, **C**- Credits ,**ESE**-End Semester Examination,**PA**- Progressive Assessment (Test I,II/TermWork) , *****- Practical Exam, **$**- Oral Exam, **#**- Online Examination Each Lecture/Practical period is of one clock hour;

Details About 180OB-POB1 Structure

Note: **The figures at Sr. No. 3,4,5,9,10 may slightly vary depending upon optional courses offered by the programme.**

1.	**Total Credits**	**180**
2.	**Total No. Courses**	**39+0(Non Credit Courses)**
3.	**No of Courses with Theory Examination**	**29**
4.	**No. of Courses with Practical/Oral Examination**	**29**
5.	**No. of Courses without Theory Examination**	**11+0(Non Credit Courses)**
6.	**Total Marks**	**4625**
7.	**Marks For Class Declaration**	**1550**
8.	**Theory Paper Marks for Class Declaration**	**900**
9.	**Theory:Practical Ratio as per Credits**	**51:49**
10.	**Theory:Practical Ratio as per Marks**	**56:44**
11.	**Class Declaration Courses**	**11**

Semester	Course Code	Name of Course	Prerequisite	TH	PR	TU	CREDITS
1	HU1101	Communication Skill I (CS-I)		2		1	3
	SC1104	Engineering Physics(EPHY)		3	2		5
	SC1101	Applied Mathmatics I(M1)		3	2		5
	ME2104	Engineering Graphics(EG)		2	2		4
	ET2103	Electronics workshop(EWS)		1	4		5
	AU4101	Environment Science(EVS)		0	2		2
	CM 2102	Fundamentals of Information and Communication Technology(ICT)		1	2		3
						CREDITS	**27**
2	HU1102	Communication Skill II (CS-II)	HU1101	2		1	3
	SC1105	Engineering Chemistry(ECHE)		3	2		5
	SC1102	Applied Mathmatics II(M2)	SC1101	3	2		5
	ET2102	C language Programming (CLP)		3	2	1	6
	ET2101	Basic Electronics Engineering (BTX)	SC1104	4	2		6
	EE2103	Fundamental of Electrical Engineering(FEE)		3	2		5
	CM4104	Professional Practice I(PP1)		0	2	0	2
						CREDITS	**32**
3	SC2104	Advance Mathmatics I(AM1)	SC1102	**2**	**0**	**1**	3
	ET3104	Electronic Instrumentation (EI)		2	2		4
	ET3103	Applied Electronics(AETX)	ET2101	4	4		8
	ET3108	Digital Electronics (DE)		**3**	**2**	**1**	6
	ET3102	Electronic Circuits and Network(ECN)		3	2	1	6
	ET3105	Principles of Communication(POC)		4	2		6
						CREDITS	**33**
4	SC2105	Advance Mathmatics II(AMII)	SC1102	2	0	1	3
	ET3107	Power Electronics(PE)	ET2101	3	2		5
	ET3106	Linear Integrated Circuits(LIC)	ET2101	**3**	**2**	**1**	6
	ET3109	Microcontroller Fundamentals(MCF)	ET3108	4	4		8
	ET4105	Consumer Electronics(CEL)		3	2		5
	CM4105	Professional Practice-II(PP2)		0	2	0	2
						CREDITS	**29**
	ET4101	**Industry Inplant Training**	**LEVEL1 A& LEVEL2 TERM GRANT**	0	6		**6**
5	AU4102	Renewable Energy Technologoes (4A)(RSEM)		2	0		2
	ET4104	Maintainance of Eletronics & EDA Tools (MED)		0	4		4
	ET4109	Instrumentation and Control systems (I&C)	ET3104	3	2	1	6
	ET4107	Digital Communication(DCO)	ET3105	3	2		5
	MA4104	Entrepreneureship & Startup (EDP)		2	0		2
	ET5101/2/3	Elective-I from Group A	ET3105/ ET3109	3	2		5
	ET4103	Seminar	90 Credits, Level 1	0	2		2
						CREDITS	**32**
6							
	ET4106	Basics of Internet of Things(IoT)		3	2		5
	ET5104/5/6	Elective-II from Group B	ET4109/ ET3108/ CM2102	3	2		5
	ET4108	Mobile & Wireless Communication	ET4107	4	2		6
	MA 410	Any 1 management course from group 4B		2	0		2
	ET5107/8/9	Elective-III from group C	ET3105 /ET3104	3	2		5
	ET4102	Project	90 Credits, Level 1	0	4		4
						CREDITS	**27**
						TOTAL CREDITS	**180**

SEMESTER 5 IS EFFECTIVELY OF 26 CREDITS

Head Of Department

DEPARTMENT OF ELECTRONICS & TELECOMMUNICATION
QFD SAMPLE PATH (REGULAR) 180(OB) for SHIFT II

Semester	Course Code	Name of Course	Prerequisite	TH	PR	TU	CREDITS
1	HU1101	Communication Skill I (CS-I)		2		1	3
	SC1104	Engineering Physics(EPHY)		3	2		5
	SC1101	Applied Mathmatics I(M1)		3	2		5
	ME2104	Engineering Graphics(EG)		2	2		4
	ET2103	Electronics workshop(EWS)		1	4		5
	AU4101	Environment Science(EVS)		0	2		2
	CM 2102	Fundamentals of Information and Communication Technology(ICT)		1	2		3
						CREDITS	**27**
2	HU1102	Communication Skill II (CS-II)	HU1101	2		1	3
	SC1105	Engineering Chemistry(ECHE)		3	2		5
	SC1102	Applied Mathmatics II(M2)	SC1101	3	2		5
	ET2102	C language Programming (CLP)		3	2	1	6
	ET2101	Basic Electronics Engineering (BTX)		4	2		6
	ET3104	Electronic Instrumentation(EI)		2	2		4
	CM4104	Professional Practice I(PP1)		0	2	0	2
						CREDITS	**31**
3	SC2104	Advance Mathmatics I(AM1)	SC1102	**2**	**0**	**1**	3
	EE2103	Fundamental of Electrical Engineering(FEE)		3	2		5
	ET3103	Applied Electronics(AETX)	ET2101	4	4		8
	ET3108	Digital Electronics (DE)		**3**	**2**	**1**	6
	ET3102	Electronic Circuits and Network(ECN)		3	2	1	6
	ET3105	Principles of Communication(POC)		4	2		6
						CREDITS	**34**
4	SC2105	Advance Mathmatics II(AMII)	SC1102	2	0	1	3
	ET3107	Power Electronics(PE)	ET2101	3	2		5
	ET3106	Linear Integrated Circuits(LIC)	ET2101	**3**	**2**	**1**	6
	ET3109	Microcontroller Fundamentals(MCF)	ET3108	4	4		8
	ET4105	Consumer Electronics(CEL)		3	2		5
	CM4105	Professional Practice-II(PP2)		0	2	0	2
					CREDITS		**29**
	ET4101	**Industry Inplant Training**	**LEVEL1 A& LEVEL2 TERM GRANT**	0	6		**6**
5	AU4102	Renewable Energy Technologoes (4A)(RSEM)		2	0		2
	ET4104	Maintainance of Eletronics & EDA Tools (MED)		0	4		4
	ET4109	Instrumentation and Control systems (I&C)	ET3104	3	2	1	6
	ET4107	Digital Communication(DCO)	ET3105	3	2		5
	MA4104	Entrepreneureship & Startup (EDP)	ET3105/	2	0		2
	ET5101/2/3	Elective-I from Group A	ET3109	3	2		5
	ET4103	Seminar	90 Credits,level 1	0	2		2
						CREDITS	**32**
	ET4106	Basics of Internet of Things(IoT)		3	2		5
	ET5104/5/6	Elective-II from Group B	ET4109/ ET3108/ CM2102	3	2		5
	ET4108	Mobile & Wireless Communication	ET4107	4	2		6
	MA 410	Any 1 management course from group 4B		2	0		2
	ET5107/8/9	Elective-III from group C	ET3105 /ET3104	3	2		5
	ET4102	Project	90 Credits, Level 1	0	4		4
						CREDITS	**27**
						TOTAL CREDITS	**180**

SEMESTER 5 IS EFFECTIVELY OF 26 CREDITS

Head Of Department

DEPARTMENT OF ELECTRONICS & TELECOMMUNICATION
DSY EXEMPTIONS OFFERED -180 OB

Semester	Course Code	Name of Course	Prerequisite	TH	PR	TU	CREDITS
1	HU1101	Communication Skill I (CS-I)		2		1	3
	SC1104	Engineering Physics(EPHY)		3	2		5
	SC1101	Applied Mathmatics I(M1)		3	2		5
	ME2104	Engineering Graphics(EG)		2	2		4
	ET2103	Electronics workshop(EWS)		1	4		5
	AU4101	Environment Science(EVS)		0	2		2
	CM 2102	Fundamentals of Information and Communication Technology(ICT)		1	2		3
					CREDITS		**27**
2	HU1102	Communication Skill II (CS-II)	HU1101	2		1	3
	SC1105	Engineering Chemistry(ECHE)		3	2		5
	SC1102	Applied Mathmatics II(M2)	SC1101	3	2		5
	ET2102	C language Programming (CLP)	CM 2102	3	2	1	6
	ET2101	Basic Electronics Engineering (BTX)	SC1104	4	2		6
	EE2103	Fundamental of Electrical Engineering(FEE)		3	2		5
	CM4104	Professional Practice I(PP1)		0	2	0	2
					CREDITS		**32**
							59
					TOTAL CREDITS EXEMPTED		

Head Of Department

DEPARTMENT OF ELECTRONICS & TELECOMMUNICATION

SAMPLE PATH (DSY) 180(OB) for SHIFT I

Semester	Course Code	Name of Course	Prerequisite	TH	PR	TU	CREDITS	
1	HU1101	Communication Skill I (CS-I)		2		1	3	EXEMPTION
	SC1104	Engineering Physics(EPHY)		3	2		5	EXEMPTION
	SC1101	Applied Mathmatics I(M1)		3	2		5	EXEMPTION
	ME2104	Engineering Graphics(EG)		2	2		4	EXEMPTION
	ET2103	Electronics workshop(EWS)		1	4		5	EXEMPTION
	AU4101	Environment Science(EVS)		0	2		2	EXEMPTION
	CM 2102	Fundamentals of Information and Communication Technology(ICT)		1	2		3	EXEMPTION
					CREDITS		**27**	
2	HU1102	Communication Skill II (CS-II)	HU1101	2		1	3	EXEMPTION
	SC1105	Engineering Chemistry(ECHE)		3	2		5	EXEMPTION
	SC1102	Applied Mathmatics II(M2)	SC1101	3	2		5	EXEMPTION
	ET2102	C language Programming (CLP)	CM 2102	3	2	1	6	EXEMPTION
	ET2101	Basic Electronics Engineering (BTX)	SC1104	4	2		6	EXEMPTION
	EE2103	Fundamental of Electrical Engineering(FEE)		3	2		5	EXEMPTION
	CM4104	Professional Practice I(PP1)		0	2	0	2	EXEMPTION
					CREDITS		**32**	
3	SC2104	Advance Mathmatics I(AM1)	SC1102	**2**	**0**	**1**	3	
	ET3104	Electronic Instrumentation (EI)		2	2		4	
	ET3103	Applied Electronics(AETX)	ET2101	4	4		8	
	ET3108	Digital Electronics (DE)		**3**	**2**	**1**	6	
	ET3102	Electronic Circuits and Network(ECN)		3	2	1	6	
	ET3105	Principles of Communication(POC)		4	2		6	
					CREDITS		**33**	
4	SC2105	Advance Mathmatics II(AMII)	SC1102	2	0	1	3	
	ET3107	Power Electronics(PE)	ET2101	3	2		5	
	ET3106	Linear Integrated Circuits(LIC)	ET2101	**3**	**2**	**1**	6	
	ET3109	Microcontroller Fundamentals(MCF)	ET3108	4	4		8	
	ET4105	Consumer Electronics(CEL)		3	2		5	
	CM4105	Professional Practice-II(PP2)		0	2	0	2	
					CREDITS		**29**	
	ET4101	**Industry Inplant Training**	**LEVEL1 A& LEVEL2 TERM GRANT**	0	6		**6**	
5	AU4102	Renewable Energy Technologoes (4A)(RSEM)		2	0		2	
	ET4104	Maintainance of Eletronics & EDA Tools (MED)		0	4		4	
	ET4109	Instrumentation and Control systems (I&C)	ET3104	3	2	1	6	
	ET4107	Digital Communication(DCO)	ET3105	3	2		5	
	MA4104	Entrepreneureship & Startup (EDP)		2	0		2	
	ET5101/2/3	Elective-I from Group A	ET3105/ ET3109	3	2		5	
	ET4103	Seminar	90 Credits	0	2		2	
						CREDITS	**32**	
6								
	ET4106	Basics of Internet of Things(IoT)		3	2		5	
	ET5104/5/6	Elective-II from Group B	ET4109/ ET3108/ CM2102	3	2		5	
	ET4108	Mobile & Wireless Communication	ET4107	4	2		6	
	MA 410	Any 1 management course from group 4B		2	0		2	
	ET5107/8/9	Elective-III from group C	ET3105 /ET3104	3	2		5	
	ET4102	Project	90 Credits, Level 1	0	4		4	
						CREDITS	**27**	
						TOTAL CREDITS	**180**	

SEMESTER 5 IS EFFECTIVELY OF 26 CREDITS

Head Of Department

DEPARTMENT OF ELECTRONICS & TELECOMMUNICATION

SAMPLE PATH (DSY) 180(OB) for SHIFT II

Semester	Course Code	Name of Course	Prerequisite	TH	PR	TU	CREDITS	
1	HU1101	Communication Skill I (CS-I)		2		1	3	EXEMPTION
	SC1104	Engineering Physics(EPHY)		3	2		5	EXEMPTION
	SC1101	Applied Mathmatics I(M1)		3	2		5	EXEMPTION
	ME2104	Engineering Graphics(EG)		2	2		4	EXEMPTION
	ET2103	Electronics workshop(EWS)		1	4		5	EXEMPTION
	AU4101	Environment Science(EVS)		0	2		2	EXEMPTION
	CM 2102	Fundamentals of Information and Communication Technology(ICT)		1	2		3	EXEMPTION
					CREDITS		**27**	
2	HU1102	Communication Skill II (CS-II)	HU1101	2		1	3	EXEMPTION
	SC1105	Engineering Chemistry(ECHE)		3	2		5	EXEMPTION
	SC1102	Applied Mathmatics II(M2)	SC1101	3	2		5	EXEMPTION
	ET2102	C language Programming (CLP)		3	2	1	6	EXEMPTION
	ET2101	Basic Electronics Engineering (BTX)		4	2		6	EXEMPTION
	EE2103	Fundamental of Electrical Engineering(FEE)		3	2		5	EXEMPTION
	CM4104	Professional Practice I(PP1)		0	2	0	2	EXEMPTION
					CREDITS		**32**	
3	SC2104	Advance Mathmatics I(AM1)	SC1102	**2**	**0**	**1**	3	
	ET3104	**Electronic Instrumentation(EI)**		**2**	**2**		**4**	**To be offered to DSY at ENTRY LEVEL in 3rd semester**
	ET3103	Applied Electronics(AETX)	ET2101	4	4		8	
	ET3108	Digital Electronics (DE)		**3**	**2**	**1**	6	
	ET3102	Electronic Circuits and Network(ECN)		3	2	1	6	
	ET3105	Principles of Communication(POC)		4	2		6	
					CREDITS		**33**	
4	SC2105	Advance Mathmatics II(AMII)	SC1102	2	0	1	3	
	ET3107	Power Electronics(PE)	ET2101	3	2		5	
	ET3106	Linear Integrated Circuits(LIC)	ET2101	**3**	**2**	**1**	6	
	ET3109	Microcontroller Fundamentals(MCF)	ET3108	4	4		8	
	ET4105	Consumer Electronics(CEL)		3	2		5	
	CM4105	Professional Practice-II(PP2)		0	2	0	2	
					CREDITS		**29**	
	ET4101	**Industry Inplant Training**	**A& LEVEL2 TERM GRANT**	0	6		**6**	
5	AU4102	Renewable Energy Technologoes (4A)(RSEM)		2	0		2	
	ET4104	Maintainance of Eletronics & EDA Tools (MED)		0	4		4	
	ET4109	Instrumentation and Control systems (I&C)	ET3104	3	2	1	6	
	ET4107	Digital Communication(DCO)	ET3105	3	2		5	
	MA4104	Entrepreneureship & Startup (EDP)	ET3105/	2	0		2	
	ET5101/2/3	Elective-I from Group A	ET3109	3	2		5	
	ET4103	Seminar	90 Credits	0	2		2	
						CREDITS	**32**	
	ET4106	Basics of Internet of Things(IoT)		3	2		5	
	ET5104/5/6	Elective-II from Group B	ET4109/ ET3108/ CM2102	3	2		5	
	ET4108	Mobile & Wireless Communication	ET4107	4	2		6	
	MA 410	Any 1 management course from group 4B		2	0		2	
	ET5107/8/9	Elective-III from group C	ET3105 /ET3104	3	2		5	
	ET4102	Project	90 Credits, Level 1	0	4		4	
						CREDITS	**27**	
						TOTAL CREDITS	**180**	

SEMESTER 5 IS EFFECTIVELY OF 26 CREDITS

Head Of Department

DEPARTMENT OF ELECTRONICS & TELECOMMUNICATION							
QFD SAMPLE PATH (PART_TIME)							
Semester	**Course Code**	**Name of Course**	**Prerequisite**	**TH**	**PR**	**TU**	**CREDITS**
1	HU1101	Communication Skill I		2		1	3
	SC1104	Engineering Physics		3	2		5
	SC1101	Applied Mathmatics I		3	2		5
	ME2104	Engineering Graphics		2	2		4
	AU4101	Environment Science		0	2		2
	CM2102	Information and Communication Technology		1	2		3
					CREDITS		**22**
2	HU1102	Communication Skill II	HU1101	2		1	3
	SC1105	Engineering Chemistry		3	2		5
	SC1102	Applied Mathmatics II	SC1101	3	2		5
	ET2101	Basic Electronics Engineering		4	2		6
	ET2103	Electronics workshop		1	4		5
					CREDITS		**24**
3	EE2103	Fundamental of Electrical Engineering		3	2		5
	ET2102	C language Programming		3	2	1	6
	ET3103	Applied Electronics	ET2101	4	4		8
	ET3104	Electronic Instrumentation		2	2		4
						CREDITS	**23**
	AU4102	Management		2	0	1	3
4	ET3105	Principles of Communication		4	2		6
	ET3108	Digital Electronics		**3**	**2**	**1**	6
	CM4104	Professional Practice I		0	2	0	2
	ET2104	Industrial Measurement		4	2	0	6
						CREDITS	**23**
5	ET3102	Electronic Circuits and Network		3	2	1	6
	ET3107	Power Electronics	ET2101	3	2		5
	ET3109	Microcontroller & Applications	ET3108	4	4		8
	ET4104	EDA Tools		0	4		4
						CREDITS	**23**
6	ET3106	Linear Integrated Circuits	ET2101	**3**	**2**	**1**	6
	ET4105	Consumer Electronics		3	2		5
	ET4109	Instrumentation and Control systems	ET3104	3	2	1	6
	CM4105	Professional Practice II		0	2	0	2
						CREDITS	**19**
7	ET4101	**# Industry Inplant Training**		0	6		**6**
	ET4108	Digital Communication	ET3105	3	2		5
	ET4106	Basics of Internet of Things		3	2		5
	ET5101/2/3	Elective-I from group A	ET3105/ET3109	3	2		5
	AU4101	Entrepreneureship Development		2	0		2
	ET4103	Seminar	90 CREDITS	0	2		2
						CREDITS	**19**
8	MA	Any 1 management course from group 4B		2			2
	ET5104/5/6	Elective-II from Group B	ET4109/ET3108/ CM2102	3	2		5
	ET4104	Wireless and Mobile Communication		3	2		5
	ET5107/8/9	Elective-III from group C	ET3105/ET3104	3	2		5
	ET4102	Project		0	4		4
						CREDITS	21
						TOTAL CREDITS	**180**

#PTD studentS HAVE TO COMPLETE A PROJECT REPORT …NEED TO DO DURING SUMMER VACATION

Head Of Department

Level 1 Curriculum

Government Polytechnic, Pune

'180 OB' – Scheme

Programme	Diploma in **CE/EE/ET/ME/MT/CM/IT/DDGM**
Programme Code	**01/02/03/04/05/06/07/08/15/16/17/18/19/21/22/23/24/26**
Name of the Course	**Communication Skills -I**
Course Code	**HU1101**
Prerequisite course code and name	**NA**
Class Declaration	**No**

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)		Examination Scheme				
					Theory		Practical		Total Marks
L	T	P	C		ESE	PA	$ESE	PA	
02	01	00	03	Marks	40	10	25	25	100
				Exam Duration	2 Hrs	1/2 Hr	--	--	--

Legends: L- Lecture, P- Practical, T- Tutorial, C- Credits, ESE-End Semester Examination, PA- Progressive Assessment (Test I, II/ Term Work), *- Practical Exam, $- Oral Exam, #- Online Examination. Each Lecture/Practical period is of one clock hour.

2. RATIONALE

Communication skills is a natural and necessary part of an organizational life. The goal of communication skills course is to produce civic-minded and competent communicators. At the end, students will acquire proficiency in oral and written methods along with nonverbal communication.

3. COMPETENCY

The aim of this course is to attend following industry competency through various teaching learning experiences:

- **To develop English Language Speaking Abilities, enrich fluency, and to make students get acquainted with basics of communication skills.**

4. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry-oriented COs associated with the above-mentioned competency**:**

1. Communicate effectively to overcome barriers.
2. Apply Nonverbal codes for effective communication.
3. Apply Learning Skills.
4. Interpret information to present orally.
5. Use Language lab for improving listening and speaking abilities

5. SUGGESTED PRACTICALS/ EXERCISES

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Relevant CO	Approx. Hrs. required
1	1	Introduction to Communication Cycle	1	1
2	1	Analyze Communication Events.	1	1
3	2	Collect Different Pictures Depicting Body actions.	2	2
4	2	Utilize Signs, Symbols & color codes.	2	1
5	3	*Loud Reading of Given Paragraph.	3	2
6	3	*Utilize Techniques of Listening with the help of lingua phone	3	2
7	4	Topic Writing on Current Issues	4	2
8	4	Comprehending Information and extempore it	4	1
9	5	Practice Vocabulary I (Identify words from various Technical Jargons.)	5	2
10	5	Practice Vocabulary II(Homophones/abbreviations/Synonyms/antonyms)	5	2
11	1 to 5	Complete the Micro-project as per the guidelines in point no 11 -compulsory.	1 to 5	2
		Total Hrs		**16**

*Perform assignment no.5 or 6.

Sr. No.	Performance Indicators	Weightage in %
a.	Arrangement of available equipment / test rig or model	-
b.	Setting and operation	-
c.	Safety measures	-
d.	Observations and Recording	40
e.	Interpretation of result and Conclusion	-
f.	Answer to sample questions	30
g.	Submission of report in time	30
	Total	**100**

6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practical, as well as aid to procure equipment by authorities concerned**.**

Sr. No.	Equipment Name with Broad Specifications	Experiment Sr. No
1	Language Lab	5,6

7. THEORY COMPONENTS

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit 1 : Introduction and Principles of Communication (08 Hrs, 12 Marks)	
1a. Interpret different communication skills 1b. Define elements of communication 1c. Describe process of communication 1d. Identify barriers for finding remedies 1e. Interpret principles of communication	1.1 Introduction to communication 1.2 Definition and elements of communication 1.3 Process of communication 1.4 Barriers to communication and remedies to overcome it. 1.5 Principles of communication
Unit 2 : Nonverbal Skills (06 Hrs, 10 Marks)	
2a.Differentiate graphic communication 2b.Use different nonverbal codes 2c.Interpret various graphic forms.	2.1 Graphic communication 2.2 Nonverbal codes [Kinesics, Proxemics, Chronemics, Haptics 2.3 Vocalics Dress and Appearance] 2.4 Reading graphic forms[Bar graphPie chart]
Unit 3 : Learning Skills (06 Hrs, 04 Marks)	
3a.Recall listened information 3b.Apply oral skills 3c.Perceives various fonts & use it 3d.Compose sentences & paragraphs	3.1 Listening skills 3.2 Speaking skills 3.3 Reading skills 3.4 Writing Skills
Unit 4 Comprehension (06 Hrs, 06 Marks)	
4a. Improve writing techniques 4b. Interpret information 4c. Summarize to extempore	4.1 Topic Writing (current issues) 4.2 Comprehend various information 4.3 Extempore some current Activities
Unit 5 Language Skills (06 Hrs, 08 Marks)	
5a. Use phonetic signs and symbols for pronunciation 5b. Practice Pronunciation using lingua-phone 5c. Utilize listening skills 5d. Classify jargon wise vocabulary for improvement	5.1 Phonetics(Practice of pronunciation) 5.2 Listening skills 5.3 Use of lingua-phone (language lab) 5.4 Vocabulary building

8. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction and principles of communication	08	04	06	02	12
II	Nonverbal Communication	06	02	02	06	10
III	Learning Skills	06	00	00	04	04
IV	Comprehension	06	00	02	04	06
V	Language skills	06	00	02	06	08
Total		**32**	**06**	**12**	**22**	**40**

9. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a. Prepare journal based on practical performed inLing phone laboratory. Journal consists of drawing, observations, required equipment's, date of performance with teacher signature.
b. Collection of Paper cuttings from magazines, Newspapers, periodicals etc
c. Encyclopedia

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
c. With respect to item No.8, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
d. Guide student(s) in undertaking micro-projects.
e. Correlate subtopics with power plant system and equipment.

f. Use proper equivalent analogy to explain different concepts.
g. Use Flash/Animations to explain various components, operation and
h. Teacher should ask the students to go through instruction and Technical manuals

11. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to them. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***

The micro-project could be industry application-based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs and integrate PrOs, UOs and ADOs (Affective Domain Outcomes). Each student will have to maintain a dated work diary of individual contributions to the project work and give a seminar presentation before submission. The student should submit a micro-project by the end of the semester to develop the industry-oriented COs.

A suggestive list of micro-projects is given here. The concerned faculty could add similar micro-projects:

a. Student must collect pictures depicting various body actions.
b. Students should utilize signs, symbols, signals and color code to represent traffic signals.
c. Student should prepare a table of Jargon wise vocabulary of various technical domains.
d. Student should extempore on a given topic.
e. Student should collect abbreviations related to corporate world.

12. SUGGESTED LEARNING RESOURCES

Sr. No.	Title	Author	Publisher, Edition and Year of publication, ISBN Number
1	Communication skills	Joyeeta Bhatacharya	Macmillan Co.
2	Written communication in English	Sarah Freeman	Orient Longman Ltd. ISBN- 13 : 978-8125004264
3	Developing Communication skills	Krishna Mohan and Meera Banerji	Macmillan India Ltd. 0333929195 9780333929193

13. SOFTWARE/LEARNING WEBSITES

1. www.talkenglish.com
2. Edutech.com
3. Swayam.com
4 .www.mooc.org

14. PO - COMPETENCY- CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	-	-	1	-	-	1
CO2	3	-	-	-	1	-	1
CO3	3	1	-	-	1	1	1
CO4	3	-	-	-	1	-	1
CO5	2	-	-	-	1	-	1

	PSO1	PSO2	PSO3
CO1	-	-	-
CO2	-	1	-
CO3	-	-	-
CO4	-	1	-
CO5	-	1	-

Sign: Name: Mrs. S.C.Patil (Course Expert)	Sign: Name : Mrs.N.S.Kadam (Head of Department)
Sign: Name: Shri. R. N. Shikari (Programme Head)	Sign: Name : Mr.A.S.Zanpure (CDC)

Government Polytechnic, Pune

'180 OB' – Scheme

Programme	Diploma in **CE/EE/ET/ME/MT/CM/IT/DDGM**
Programme code	**01/02/03/04/05/06/07/08/15/16/17/18/19/21/22/23/24/26**
Name of Course	**Communication Skills II**
Course Code	**HU1102**
Prerequisite course code and name	**HU1101 Communication Skills I**
Class Declaration	**No**

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)		Examination Scheme				
					Theory		Practical		Total Marks
L	T	P	C		ESE	PA	ESE	PA	
02	01	00	03	Marks	40	10	--	50	100
				Exam Duration	2 Hrs	1/2 Hr	---	--	--

Legends: L- Lecture, P- Practical, T- Tutorial, C- Credits, ESE-End Semester Examination, PA- Progressive Assessment (Test I, II/ Term Work), *- Practical Exam, $- Oral Exam, #- Online Examination. Each Lecture/Practical period is of one clock hour.

2. RATIONALE

Communication skills course is used in all spheres of human life – personal, social and professional. Students will get fair knowledge of communication skills to handle the future jobs in industry. This course includes the practice of oral and written communication, correspond with others and give presentations**.**

3. COMPETENCY

The aim of this course is to attend following industry competency through various teaching learning experiences:

- **To build confidence in written correspondence required in technical fields.**

4. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry-oriented COs associated with the above-mentioned competency**:**

1. Prepare various speeches for presentation
2. Write application for Business purposes.
3. Write various technical reports.
4. Write business letters.

5. SUGGESTED PRACTICALS/ EXERCISES

S. No.	Unit No.	Practical Exercises (Learning Outcomes in Psychomotor Domain)	CO No.	Approx. Hrs. required
1	1	Practice to write various speeches like vote of thanks, guest introduction etc.	1	2
2	1	Write job application, resume, leave application	3	2
3 *	2	Draft a project report to start a new industry (Or to write down the market survey report)	2	2
4	3	Prepare industrial visit report after visit	3	1
5	3	Write a placing an order letter, complaint letter	3	2
6	4	Write a joining letter	4	1
7 *	3	Draft a notice, circular and memorandum	3	2
8	3	Write a fall in production report	3	1
9	3	Work progress report	3	1
10	4	Description of devices	4	2
11	All	Complete a micro project based on guidelines provided in Sr. No. 11	All	2
		Total		16

*** Perform Pr.No. 3 or 7**

Sr.No.	Performance Indicators	Weightage in %
a.	Arrangement of available equipment / test rig or model	-
b.	Setting and operation	-
c.	Safety measures	-
d.	Observations and Recording	50
e.	Interpretation of result and Conclusion	20
f.	Answer to sample questions	20
g.	Submission of report in time	10
	Total	**100**

6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

NA

7. THEORY COMPONENTS

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit 1 Writing Speeches (08 Hrs, 10 Marks)	
1a. Give in own words the introduction of guest. 1b. Express feelings in own words to welcome 1c. Express feelings in own words for Farewell Speech 1d . Give in own words the vote of thanks	1.1 Introduction of guest 1.2 Welcome speech 1.3 Farewell speech 1.4 Vote of thanks
Unit 2 Writing Applications (06 Hrs, 08 Marks)	
2a. Write official correspondence for Job 2b. Application with Resume 2c. Write application for leave. 2d. Write application for getting NOC from corporation. 2e. Students can write various applications	2.1 Job application with resume 2.2 Leave application 2.3 Miscellaneous applications
Unit 3 Writing Reports and Notices (10 Hrs, 10 Marks)	
3a. Students can write Industrial visit report after visit. 3b. Students can write survey report. 3c. Students can write Fall in production report. 3d. Students can draft circular and other notices. 3e. Students can draft Memos.	3.1 Visit report 3.2 Survey report (feasibility report) 3.3 Fall in production report 3.4 Circular/notice 3.5 Memos
Unit 4 Drafting Business Letters (08 Hrs, 12 Marks)	
4a. Students can write Enquiry Letter. 4b. Students can write Placing an order letter. 4c. Student can write Complaint Letter. 4d. Students can write Appointment Letter. 4e. Students can draft Joining Letter.	4.1 Enquiry letter 4.2 Placing an order letter 4.3 Complaint letter 4.4 Appointment letter 4.5 Joining letter

8. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Writing speeches	**08**	**2**	**2**	**6**	**10**
II	Writing applications	**06**	**2**	**2**	**4**	**08**
III	Writing Reports and Notices	**10**	**2**	**2**	**6**	**10**
IV	Drafting Business Letters	**08**	**2**	**4**	**6**	**12**
Total		**32**	**8**	**10**	**22**	**40**

9. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a. Prepare journal based on practical performed in Lingua- phone- laboratory. Journal consists of drawing, observations, required equipment's, date of performance with teacher signature.

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
c. With respect to item No.8, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
d. Guide student(s) in undertaking micro-projects.
e. Correlate subtopics with power plant system and equipments.
f. Use proper equivalent analogy to explain different concepts.
g. Use Flash/Animations to explain various components, operation and
h. Teacher should ask the students to go through instruction and technical manuals

11. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to them. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***

The micro-project could be industry application-based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs and integrate PrOs, UOs and ADOs (Affective Domain Outcomes). Each student will have to maintain a dated work diary of individual contributions to the project work and give a seminar presentation before submission. The student should submit a micro-project by the end of the semester to develop the industry-oriented COs.

A suggestive list of micro-projects is given here. The concerned faculty could add similar micro-projects:

1. Practice to write various speeches and give speech on any of it.
2. Draft personal Resume/ Biodata/CV
3. For drafting project report to start a new industry student should have a market survey and search other accepts to be and an entrepreneur
4. Prepare an industrial visit report after visiting an industry.
5. Describe various technical devices and prepare a PPT on any one of it.

12. SUGGESTED LEARNING RESOURCES

Sr.No.	Title	Author	Publisher, Edition and Year of publication, ISBN Number
1	Communication skills	Joyeeta Bhatacharya	Macmillan Co.
2	Written communication in English	Sarah Freeman	Orient Longman Ltd. ISBN- 13 : 978-8125004264
3	Developing Communication skills	Krishna Mohan and Meera Banerji	Macmillan India Ltd. 0333929195 9780333929193
4	A Workbook Communication Skills	Sanjay Kumar and Push Lata	Oxford University Press. India. ISBN -9780199488803
5	Advanced skills for communication in English	Jeya Santhi.V., Dr. R.Selvam	New Century Book House. ISBN -978-81-2343-101-7

13. SOFTWARE/LEARNING WEBSITES

1. www.talkenglish.com
2. Edutech.com
3. www.makeuseof.com
4. www.mooc.org

14. PO –PSO- - CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	-	1	3	1	2
CO2	3	1	-	-	2	1	3
CO3	3	3	-	1	2	1	3
CO4	3	2	-	1	2	-	3

	PSO1	PSO2	PSO3
CO1	-	-	-
CO2	1	1	-
CO3	1	1	-
CO4	1	1	-

15. Prepared by :

Sign: Name: Smt. S.C.Patil (Course Expert)	Sign: Name: Smt. N. S. Kadam (Head of Department)
Sign: Name: Shri. R. N. Shikari (Program Head)	Sign: Name :Shri.A.S.Zanpure (CDC)

GOVERNMENT POLYTECHNIC, PUNE

'180 OB' – Scheme

Programme	Diploma in **CE/EE/ET/ME/MT/CM/IT**
Programme code	**01/02/03/04/05/06/07/15/16/17/18/19/21/22/23/24/26**
Name of Course	**APPLIED MAHEMATICS I**
Course Code	SC1101
Prerequisite	--
Class Declaration	**NO**

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)		Examination Scheme				
					Theory		Tutorials		Total Marks
L	T	P	C		ESE	PA	ESE	PA	
03	02	00	05	Marks	80	20	00	25	125
				Exam Duration	3 Hrs	1 Hr	00	--	—

Legends: L- Lecture, P- Practical, T- Tutorial, C- Credits, ESE-End Semester Examination, PA- Progressive Assessment (Test I, II/ Term Work), *- Practical Exam, $- Oral Exam, #- Online Examination. Each Lecture/Practical period is of one clock hour.

2. RATIONALE

The students of Diploma in Engineering and technology must acquire some essential Competencies in Mathematics

3. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Solve various engineering related problems using the principles of applied mathematics**

4. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency**:**

1. Apply the concepts of algebra to solve engineering related problems.
2. Utilize basic concepts of trigonometry to solve elementary engineering problems.
3. Solve basic engineering problems under given conditions of straight lines.
4. Solve the problems based on measurement of regular closed figures and regular solids.

5. SUGGESTED PRACTICALS/ EXERCISES

Experiment Sr. No.	Practical Exercises (Learning Outcomes in Psychomotor Domain)	Unit No.	Approx. Hrs. required
1	Solve simple problems of Logarithms based on definition and laws	1	2
2	*Solve problems on determinant to find area of triangle, and solution of simultaneous equation by Cramer's Rules.	1	4
3	*Resolve into partial fraction using linear non repeated, repeated, and irreducible factors	1	4
4	Solve problems on Compound, Allied, multiple and sub multiple angles.	2	4
5	Practice problems on factorization and de factorization.	2	2
6	Solve problems on inverse circular trigonometric ratios.	2	2
7	Practice problems on equation of straight lines using different forms.	3	4
8	Solve problems on perpendicular distance, distance between two parallel lines, and angle between two lines.	3	2
9	Solve problems on Area, such as rectangle, triangle, and circle.	4	2
10	Solve problems on surface and volume, sphere, cylinder and cone.	4	2
11	Complete a Micro- project as per the guidelines in point no. 11 towards the fulfillment of the COs of the course.	ALL	4
	Total		32

Sr. No.	Performance Indicators	Weightage in %
a.	Prepare experimental set up	-
b.	Handling of instruments during performing practical.	-
c.	Follow Safety measures	-
d.	Accuracy in calculation	20
e.	Answers to questions related with performed practices.	40
f.	Submit journal report on time	20
g.	Follow Housekeeping	10
h.	Attendance and punctuality	10
Total		**100**

6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will be used in uniformity in conduct of practical, as well as aid to procure equipment by authorities concerned**.**

S. No.	Equipment Name with Broad Specifications	PrO. No.
1	LCD Projector	1-11
2	Interactive Classroom	1-11

7. THEORY COMPONENTS

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Units I : Algebra (12 hrs, 24 marks)	
1a. Solve the given simple problem based on laws of logarithm. 1b. Calculate the area of the given triangle by determinant method. 1c. Solve given system of linear 1d. Equations using by Cramer's rule. 1e. Obtain the proper and improper partial fraction for the given simple rational function	1.1 Logarithm: Concept and laws of logarithm 1.2 Determinant a. Value of determinant of order 3x3 b. Solutions of simultaneous equations in three unknowns by Cramer's rule. 1.3 Partial Fractions: Types of partial fraction based on nature of factors and related Problems.
Unit II:Trigonometry (18 hrs, 24 marks)	
2a. Apply the concept of Compound angle, allied angle, and multiple angles to solve the given simple engineering problem(s) 2b. Apply the concept of Sub- multiple angle to solve the given simple engineering related problem 2c. Employ concept of factorization and de-factorization formulae to solve the given simple engineering problem(s). 2d. Investigate given simple problems utilizing inverse trigonometric ratios	2.1 Trigonometric ratios of allied angles, compound angles, multiple angles (2A, 3A), submultiples angle.(without proof) 2.2 Factorization and De factorization formulae (without proof). 2.3 Inverse Trigonometric Ratios and related problems 2.4 Principle values and relation between trigonometric and inverse trigonometric ratios.
Unit III: Co ordinate geometry (09 hrs, 16 marks)	
3a. Calculate angle between given two straight lines. 3b. Formulate equation of straight lines related to given engineering problems. 3c. Identify perpendicular distance from the given point to the line.. 3d.Calculate perpendicular distance between the given two lines.	3.1 Straight line and slope of straight line a. Angle between two lines. b. Condition of parallel and perpendicular lines. 3.2 Various forms of straight lines. a. Slope point form, two point form. b. Two points intercept form. c. General form. 3.3 Perpendicular distance from a Point on the line. 3.4 Perpendicular distance between two parallel lines

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit IV:Mensuration (09 hrs, 16 marks)	
4a. Calculate the area of given triangle and circle 4b. Determine the area of the given square, parallelogram, rhombus, trapezium. 4c. Compute surface area of given cuboids, sphere, cone and cylinder. 4d. Determine volume of given cuboids, sphere, cone and cylinder.	4.1 Area of regular closed figures, Area of triangle, square, parallelogram, rhombus, trapezium and circle. 4.2 Volume of cuboids, cone, cylinders and sphere.

8. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Algebra	12	6	12	6	24
II	Trigonometry	18	6	6	12	24
III	Co ordinate geometry	09	2	6	8	16
IV	Mensuration	09	2	6	8	16
Total		**48**	**16**	**30**	**34**	**80**

9. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

a. Identify engineering problems based on real world problems and solve with the use of free tutorials available on internet.
b. Use graphical software's: EXCEL, DPLOT and GRAPH for related topics.
c. Use Mathcad as Mathematical Tool and solve the problems on Calculus.
d. Indentify problems based on applications of differential equations and solve these problems

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
c. Use Flash/Animations to explain various components, operation and
d. Teacher should ask the students to go through instruction and Technical manuals

11. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs.(Affective Domain Outcomes) .Each student will have to maintain activity chart consisting of individual contribution in the project work and give a seminar presentation of it before submission.. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

a. Prepare charts using determinant to find area of regular shapes.
b. Prepare models using trigonometry to solve engineering problems.
c. Prepare models using regular closed figures and regular solids to solve engineering problems.
d. Prepare models using Mensuration to solve engineering problems.

12. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1.	Higher Engineering Mathematics	Grewal B. S.	Khanna publication New Delhi , 2013 ISBN: 8174091955
2.	A text book of Engineering Mathematics	Dutta. D	New age publication New Delhi, 2006 ISBN: 978-81-224-1689-3
3.	Advance Engineering Mathematics	Kreysizg, Ervin	Wiley publication New Delhi 2016 ISBN: 978-81-265-5423-2
4.	Advance Engineering Mathematics	Das H.K.	S Chand publication New Delhi 2008 ISBN: 9788121903455
5.	Engineering Mathematics Volume I (4^{th} edition)	Sastry S.S.	PHI Learning, New Delhi, 2009 ISBN: 978-81-203-3616-2

13. SOFTWARE/LEARNING WEBSITE

a. www.scilab.org/ -SCI Lab
b. www.mathworks.com/product/matlab/ -MATLAB
c. Spreadsheet Applications
d. www.dplot.com
e. https://www.khanacademy.org/math?gclid=CNqHuabCys4CFdOJaddHoPig

14. **PO - COMPETENCY- CO MAPPING**

CO-PO Matrices of course

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
1	2	2	1	-	-	-	1
2	3	3	1	-	-	1	2
3	3	3	-	-	-	-	1
4	3	3	1	1	-	-	1

CO-PSO Matrices of course

	CE			ME		MT				EE			
CO	PSO 1	PSO 2	PS O3	PS O1	PSO 2	PSO 1	PSO 2	PSO 3	PSO 4	PSO 1	PSO 2	PSO 3	PSO 4
1	1	-	-	-	2	1	-	-	-	2	2	2	-
2	-	1	-	-	2	-	-	-	-	2	2	2	-
3	1	2	-	-	2	-	-	-	-	-	1	1	-
4	1	2	-	-	2	1	-	-	-	1	-	2	-

	ET			CM		IT		
CO	PSO 1	PSO 2	PSO 3	PSO 1	PSO 2	PSO1	PSO2	PSO3
1	1	1	-	-	2	-	2	1
2	1	-	-	-	1	-	1	1
3	1	-	-	-	-	-	-	-
4	1	-	-	-	1	-	1	-

PREPARED BY:

Sign: Name: Shri S. B. Yede Shri V. B. Shinde Smt. P. R. Nemade (Course Experts)	Sign: Name: Mrs. N. S. Kadam (Head of Department)
Sign: Name: Shri. R. N. Shikari (Programme Head)	Sign: Name: Shri A. S. Zanpure (CDC)

GOVERNMENT POLYTECHNIC, PUNE

'180 OB' – Scheme

Programme	Diploma in **CE/EE/ET/ME/MT/CM/IT**
Programme code	**01/02/03/04/05/06/07/15/16/17/18/19/21/22/23/24/26**
Name of Course	**APPLIED MAHEMATICS II**
Course Code	SC1102
Prerequisite	SC1101 – Applied Mathematics I
Class Declaration	**NO**

1. TEACHING AND EXAMINATION SCHEM

Teaching Scheme (In Hours)			Total Credits (L+T+P)		Examination Scheme				
					Theory		Tutorials		Total Marks
L	T	P	C		ESE	PA	ESE	PA	
03	02	00	05	Marks	80	20	00	25	125
				Exam Duration	3 Hrs	1 Hr	00	--	—

Legends: L- Lecture, P- Practical, T- Tutorial, C- Credits, ESE-End Semester Examination, PA- Progressive Assessment (Test I, II/ Term Work), *- Practical Exam, $- Oral Exam, #- Online Examination. Each Lecture/Practical period is of one clock hour.

2. RATIONALE

This subject intends to teach students basic facts, concepts, principles and procedure of Mathematics as a tool to analyze Engineering problems and as such it lays down foundation for the understanding of engineering science and core technology subjects

3. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Solve various engineering related problems using the principles of applied mathematics**

4. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency**:**

1. Calculate the equation of tangent, maxima, minima, by differentiation.
2. Solve the given problems of integration using basic formulae.
3. Use basic concepts of statistics to solve engineering related problems.
4. Apply the concept of numerical methods to find the roots of equation.
5. Apply the concept of matrix to solve the engineering problems.

5. SUGGESTED PRACTICALS/ EXERCISES

Experiment Sr. No.	Practical Exercises (Learning Outcomes in Psychomotor Domain)	Unit No.	Approx. Hrs. required
1	Solve problems based on finding value of the function at different points	1	2
2	*Solve problems based on standard formulae of derivatives	1	2
3	*Solve problems to find derivatives of implicit function and parametric function.	1	2
4	Solve problems to find derivative of logarithmic and exponential functions	1	2
5	Solve problems based on finding equation of tangent and normal.	1	2
6	Solve problems based on finding maxima, minima of function	1	2
7	Solve problems based on finding radius of curvature at a given point.	1	2
8	Solve the problems based on standard formulae of integration.	2	2
9	Solve problems on finding range, coefficient of range and mean deviation.	3	2
10	*Solve problems on standard deviation.	3	2
11	*Solve problems on coefficient of variation and comparison of two sets. 2	3	2
12	Solve the algebraic equation using Bisection method, Regula falsi method and Newton –Raphson method	4	2
13	Solve the simultaneous equation using Gauss elimination method, Gauss Seidal and Jacobi's method	4	2
14	Solve elementary problems on Algebra of matrices.	5	2
15	Solve solution of Simultaneous Equation using inversion method.	5	4
16	*Complete a Micro- project as per the guidelines in point no. 11 towards the fulfillment of the COs of the course.	ALL	4
	Total		32

***Experiment No. 16 compulsory, perform experiment 2 or 3 and experiment 10 or 11.**

S.No.	Performance Indicators	Weightage in %
a.	Prepare experimental set up	-
b.	Handling of instruments during performing practical.	-
c.	Follow Safety measures	-
d.	Accuracy in calculation	20
e.	Answers to questions related with performed practices.	40
f.	Submit journal report on time	20

S.No.	Performance Indicators	Weightage in %
g.	Follow Housekeeping	10
h.	Attendance and punctuality	10
Total		**100**

6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will be used in uniformity in conduct of practicals, as well as aid to procure equipment by authorities concerned**.**

S. No.	Equipment Name with Broad Specifications	PrO. No.
1	LCD Projector	1-15
2	Interactive Classroom	1-15

7. THEORY COMPONENTS

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit I : Differential Calculus (24 hrs, 40 marks)	
1a. Solve the given simple problems based on functions. 1b. Solve the given simple problems based on rules of differentiation. 1c. Obtain the derivatives of logarithmic, exponential functions. 1d. Apply the concept of differentiation to find given equation of tangent and normal. 1f. Apply the concept of differentiation to calculate maxima and minima and radius of curvature for given function.	1.1 Functions and Limits : a. Concept of function and simple b. Concept of limits without examples. 1.2 Derivatives: a. Rules of derivatives such as sum, Product, Quotient of functions. b. Derivative of composite functions to find derivative of given function (chain Rule), implicit and parametric functions. c. Derivatives of inverse, logarithmic and exponential functions. 1.3 Applications of derivative : a. Second order derivative without examples. b. Equation of tangent and normal c. Maxima and minima d. Radius of curvature
Unit II: Integration (06 hrs, 10 marks)	
2a. Solve the given simple problem(s) based on rules of integration.	2.1 Simple Integration: Rules of integration and integration of standard functions
Unit III: Statistics (06 hrs, 10 marks)	
3a. Obtain the range and coefficient of range of the given grouped and ungrouped data. 3b. Calculate mean and standard deviation of discrete and grouped data related to the given simple engineering problem.	3.1 Range, coefficient of range of discrete and grouped data. 5.2 Mean deviation and standard from mean of grouped and ungrouped data, weighted means 3.3 Variance and coefficient of variance. 3.4 Comparison of two sets of observation.

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
3c. Determine the variance and coefficient of variance of given grouped and ungrouped data. 3d. Justify the consistency of given simple sets of data.	
Unit IV: Numerical Methods (06 hrs, 10 marks)	
4a. Apply the concept of approximate to find root of algebraic equation 4b. Apply the concept of iteration to solve the system of equations in three unknowns.	4.1 Solution of algebraic equations : a. Bisection method, b. Regula falsi method and c. Newton –Raphson method. 4.2 Solution of simultaneous equations containing three Unknowns : a. Gauss elimination method. b. Iterative methods- Gauss Seidal and Jacobi's method
Unit V: Matrices (06 hrs, 10 marks)	
5a. Solve given system of linear equations using matrix inversion method	5.1 Matrices, algebra of matrices, transpose adjoint and inverse of matrices. 5.2 Solution of simultaneous equations by matrix inversion method.

8. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	**Differential Calculus**	24	8	12	20	40
II	**Integration**	06	2	8	--	10
III	**Statistics**	06	2	--	8	10
IV	**Numerical methods**	06	2	4	4	10
V	**Matrices**	06	2	4	4	10
Total		48	**16**	**28**	**36**	**80**

9. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

a. Identify engineering problems based on real world problems and solve with the use of free tutorials available on internet.
b. Use graphical software's: EXCEL, DPLOT and GRAPH for related topics.
c. Use Mathcad as Mathematical Tool and solve the problems on Calculus.
d. Indentify problems based on applications of differential equations and solve these problems

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
c. Use Flash/Animations to explain various components, operation and
d. Teacher should ask the students to go through instruction and Technical manuals

11. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***
The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs.(Affective Domain Outcomes) .Each student will have to maintain activity chart consisting of individual contribution in the project work and give a seminar presentation of it before submission.. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.
A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

a. Prepare the model using the concept of tangent and normal bending of roads in case of sliding of a vehicle.
b. Prepare the model using the concept of radius of curvature to bending of railway tracks.
c. Prepare charts for grouped and ungrouped data.
d. Write algorithm to find the approximate roots of algebraic equations.
e. Write algorithm to find the approximate roots of transcendental equations.
f. Write algorithm to solve system of linear equations.
g. Prepare models using matrices to solve simple problems based on cryptography.

12. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1.	Higher Engineering Mathematics	Grewal B. S.	Khanna publication New Delhi , 2013 ISBN: 8174091955
2.	A text book of Engineering Mathematics	Dutta. D	New age publication New Delhi, 2006 ISBN: 978-81-224-1689-3
3.	Advance Engineering Mathematics	Kreysizg, Ervin	Wiley publication New Delhi 2016 ISBN: 978-81-265-5423-2
4.	Advance Engineering Mathematics	Das H.K.	S Chand publication New Delhi 2008 ISBN: 9788121903455
5.	Engineering Mathematics Volume I (4^{th} edition)	Sastry S.S.	PHI Learning, New Delhi, 2009 ISBN: 978-81-203-3616-2

13 .SOFTWARE/LEARNING WEBSITES

a. *www.scilab.org/ -SCI Lab*
b. *www.mathworks.com/product/matlab/ -MATLAB*
c. *Spreadsheet Applications*
d. *www.dplot.com*
e. *https://www.khanacademy.org/math?gclid=CNqHuabCys4CFdOJaddHoPig*

14. PO - COMPETENCY- CO MAPPING

CO-PO Matrices of course

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
1	3	3	1	-	-	-	1
2	2	2	-	-	-	1	1
3	3	3	-	-	-	-	1
4	3	3	1	1	-	-	1
5	3	3	1	-	-	-	2

CO-PSO Matrices of course

	CE			ME		MT				EE			
CO	PSO 1	PSO 2	PSO 3	PSO 1	PSO 2	PSO 1	PSO 2	PSO 3	PSO 4	PSO 1	PSO 2	PSO 3	PSO 4
1	1	2	-	-	2	-	-	-	-	1	2	2	-
2	-	1	-	-	1	1	1	-	-	1	2	2	-
3	2	2	-	-	3	-	-	-	-	1	1	1	1
4	2	-	-	-	2	1	-	-	-	1	1	3	1
5	1	1	-	-	1	-	-	--	-	1	1	1	1

	ET			CM		IT		
CO	PSO 1	PSO 2	PSO 3	PSO 1	PSO 2	PSO1	PSO2	PSO3
1	2	-	-	-	2	-	2	
2	1	-	-	-	-	-	-	
3	1	-	-	-	2	-	2	
4	1	-	-	-	2	-	2	2
5	2	-	-	-	2	-	2	2

PREPARED BY:

Sign: Name: Shri. S. B. Yede Shri. V.B.Shinde Smt. P. R. Nemade (Course Experts)	Sign: Name: Mrs. N. S. Kadam (Head of Department)
Sign: Name: Shri. R. N. Shikari (Programme Head)	Sign: Name: Shri A. S. Zanpure (CDC)

Government Polytechnic , Pune

'180 OB' – Scheme

Programme	Diploma in CE/**EE**/**ET**/ME/MT/**CM**/**IT**/DDGM
Programme Code	01/**02**/**03**/04/05/**06**/**07**/08/15/**16**/ **17**/18/19/21/**22**/**23**/24/**26**
Name of the Course	Engineering Physics
Course Code	SC1104
Prerequisite	NA
Class Declaration	No

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)		Examination Scheme				
					Theory		Practical		Total Marks
L	T	P	C		ESE	PA	*ESE	PA	150
03	00	02	05	Marks	#80	20	25	25	
				Exam Duration	2 Hrs	1 Hrs	2 Hrs	--	--

Legends : L- Lecture, P- Practical, T- Tutorial, C- Credits ,ESE-End Semester Examination,PA- Progressive Assessment (TestI, II/TermWork) , *- Practical Exam, $- Oral Exam, #- Online Examination each Lecture/Practical period is of one clock hour;

2. RATIONALE

This course is designed in the way by which fundamental information will help the diploma engineers to apply the basic principles and concepts of physics to solve broad-based engineering problems. The study of basic principles and concepts of motion, light, electricity, and modern physics will help in understanding the technology courses where emphasis is on the applications of these in different technology applications.

3. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Apply principles of physics to solve broad-based engineering problems.**

4. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency**:**

1. Estimate errors in measurement and Apply laws of motion in various applications.
2. Use basic principles of light in technical field.

3. Illustrate the basic principles of electrostatics in engineering field.
4. Apply basic principles of electricity to solve engineering problems.
5. Apply basic principles of magnetism to solve engineering problems.
6. Describe the principle and its application of modern physics in Engineering.

5. SUGGESTED PRACTICALS/ EXERCISES

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Relevant CO	Approx. Hrs. required
1	1	Identify given instrument and i) Mention name and range of given instrument. ii) Calculate least count of given instrument. iii) List the uses of given instrument.	1	02
2	1	Use Vernier caliper to : i) Identify and calculate instrumental error. ii) Measure dimensions of different objects. iii) Estimate error in the measurement (if any).	1	04*
3	1	Use micrometer screw gauge to: i) Identify and calculate instrumental error. ii) Measures dimensions and determine volume of given object. iii) Estimate error in the measurement.	1	04*
4	1	Use simple pendulum to determine acceleration due to gravity.	1	02*
5	2	Determine refractive index of glass slab using total internal reflection.	2	02
6	2	Study the properties and working of laser using He-Ne laser beam.	2	02*
7	4	Use the principle of series / parallel resistance in solving electrical engineering problems.	4	02
8	4	Construct circuit to verify Ohm's law and i) Determine resistance of given material of wire. ii) Calculate specific resistance of given material of wire.	1,3,4	02*
9	4	Use meter bridge to: i) Determine resistance of given material of wire. ii) Calculate specific resistance of given material of wire.	1,4	04*
10	4	Use potentiometer to : i) Determine potential gradient of given cell (Principle of potentiometer). ii) Calibrate given voltmeter.	1,3,4	04*
11	4	Use potentiometer to : i) Compare emf of two cells	1,3,4	02

12	4	Use potentiometer to: i) Find internal resistance of a cell.	1,3,4	02
13	5	Use magnetic compass to draw magnetic lines of force of magnet of different shapes.	5	02
14	6	Use photoelectric cell to study effect of : i) Intensity of light on photoelectric current. ii) Applied potential on photoelectric current.	6	04*
15	All	Complete a Micro- project based on guidelines provided in Sr .no. 11	1 to 6	04*
		Total Hrs		**32**

Note: A suggestive list of Practical no.is given in the above table. Minimum 10 practical need to be performed out of which practicals marked as * are compulsory. Any one practical out of Sr. No. 1,5,7,11,12 & 13 need to be performed.

S. No.	Performance Indicators	Weightage in %
a.	Arrangement of available equipment / test rig or model	10
b.	Setting and operation	10
c.	Safety measures	10
d.	Observations and Recording	20
e.	Interpretation of result and Conclusion	20
f.	Answer to sample questions	20
g.	Submission of report in time	10
	Total	**100**

6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practicals, as well as aid to procure equipment by authorities concerned**.**

S. No.	Equipment Name with Broad Specifications	Experiment Sr. No.
1	Vernier Caliper : Range: 0-15 cm, Resolution 0.01 cm.	1,2
2	Micrometer screw gauge: Range 0-25 mm, Resolution 0.01 mm.	1,3,8,9
3	Simple pendulum, Stop Watch.	4
4	Glass Slab 75x50x12mm.	5
5	He-Ne laser kit	6
6	Battery eliminator (0-12 V, 2 A)	7,8,9,10,11,12
7	Voltmeter(0-10 V), ammeter (0-5 A)	8
8	Meter Bridge (100 cm), Galvanometer (30-0-30) and jockey.	9
9	Potentiometer (400 cm).	10, 11, 12
10	Potentiometer, Daniell cell, Leclanche cell.	11,12
11	Bar Magnet, Magnetic Needle.	13
12	Photoelectric cell.	14

7. THEORY COMPONENTS

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit I General Physics (8 hrs, 12 marks)	
1a. List fundamental and derived quantities with their unit. 1b. Explain various systems of unit and its need for the measurement. 1c. Estimate errors in measurement. 1d. Derive relation between linear velocity and angular velocity. 1e. Calculate angular velocity of the given body 1f. Distinguish between centripetal and centrifugal force. 1g. Derive equation of SHM.	**1.1 Units and Measurement** Introduction, Definition of unit, Fundamental and derived units, Different System of units, Errors in measurements. **1.2 Circular Motion**: Definition, Uniform circular motion(UCM) Displacement, angular velocity, angular acceleration and units, relation between linear and angular velocity, relation between linear acceleration and angular acceleration, explanation of centripetal and centrifugal force, examples, applications of centripetal and centrifugal force, analytical treatment. **1.2 SHM**: Concept of time period, Frequency, Amplitude, Wavelength, Relation between wave velocity frequency and wavelength. Definition of SHM, examples of SHM, SHM as a projection of UCM on the diameter, Equation of SHM starting from mean position, analytical treatment.
Unit II Optics and Laser (6 hrs, 12 marks)	
2a. State laws of reflection and refraction. 2b. Describe phenomenon of total internal reflection. 2c. Calculate acceptance angle and numerical aperture for given optical fiber. 2d. Distinguish between optical fiber communication system and ordinary system. 2e. Differentiate between properties of ordinary light and laser light. 2f. Explain spontaneous and stimulated emission. 2g. Describe working of He-Ne laser with energy level diagram. 2h. State applications of laser in different field.	**2.1 Light:** Introduction to reflection and refraction of light, Laws of reflection and refraction, Snell's law, Refractive index, Physical significance of refractive index, Critical angle, Total internal refraction of light, analytical treatment. **2.2 Fiber optics**: Propagation of light through optical fiber, Structure of optical fiber, Numerical aperture, Acceptance angle, Acceptance cone, Types of optical fibers, Applications of optical fiber, Comparison of optical fiber communication with electrical cable communication. **2.3 LASER:** Definition, Properties of

	LASER, Spontaneous and Stimulated emission, Population inversion, Metastable state, Pumping, Life time, He-Ne laser-construction and working with energy level diagram, Engineering applications of laser.
Unit III Electrostatics (10 hrs, 16 marks)	
3a. Calculate electrostatic force, electric field and electric potential difference of the given static charge. 3b. Describe properties of electric lines of force. 3c. Explain working of capacitor. 3d. Calculate the equivalent capacity and energy stored in the combination of the capacitors are 3e. Establish relation between parameters affecting capacitance of condenser.	**3.1 Electric charge**, Coulomb's law in Electrostatics, unit of charge, electric field, intensity of electric field, electric lines of forces (Properties), electric flux, flux density, analytical treatment. **3.2 Electric potential:** Explanation, Definition**,** Potential due to a point charge, potential due to a charged sphere, potential of earth, absolute electric potential, analytical treatment. **3.3 Electric Capacitor :**Capacitance Introduction**,** of conductor, unit, principle of condenser, parallel plate condenser, capacitances in series and parallel, analytical treatment.
Unit IV Current Electricity (10 hrs, 16 marks)	
4a. State Ohm's law 4b. Establish relation between resistance and length , cross section area of given material of wire 4c. Calculate the value of given resistance using the principle of Whetstone's bridge. 4d. Explain principle of potentiometer 4e. Calculate the emf of given cell using potentiometer. 4f. Calculate energy consumption of different electric appliances.	**4.1 Current**, Resistance and its unit, Dependence of resistance- length, area of cross-section, temperature, Ohms law, specific resistance and its unit, Whetstone's network construction and principle, Meter bridge, Balancing condition of meter bridge, Measurement of unknown resistance using meter bridge, analytical treatment. **4.2 Potentiometer,** Principle of potentiometer**,** Potential gradient, Construction of potentiometer, Applications of potentiometer, E.M.F., Comparison of E.M.F. using potentiometer. **4.3 Electric work**- Electric power, Electric energy, Units and Calculations of electric bill.

Unit V Electromagnetism (8 hrs, 14 marks)	
5a. State Ampere's right hand and Fleming's left hand rule. 5b. Explain Biot- Savert's Law (Laplace's Law), 5c. Calculate Magnetic induction for given conductor.	**5.1 Magnetic effect of electric current**, Ampere's rule, Coulombs inverse square law in magnetism, Intensity of magnetic field, Magnetic induction, Biot-Savert's Law (Laplace's Law), Fleming's left hand rule, Force experienced by current carrying straight conductor placed in magnetic field, analytical treatment.
Unit VI Modern Physics (6 hrs, 10 marks)	
6a. Explain production of X-rays. 6b. Describe properties and applications of X-ray in different field. 6c. Describe properties of photon 6d. Derive Einstein's photoelectric equation. 6e. Explain working of given photoelectric device.	**6.1 X- ray:** principle, production of X- rays using Coolidge tube, origin of X-rays, types of X-rays, properties of X-rays, engineering applications of X-rays, analytical treatment. **6.2 Photo electricity**: photoelectric effect, Plank's quantum theory, concept of photon, properties of photon, threshold frequency, threshold wavelength, stopping potential, photoelectric work function, Einstein's photoelectric equation, photocell (circuit diagram and working), applications of photoelectric cell, analytical treatment.

8. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	**General Physics**	**8**	2	4	6	12
II	**Optics and Laser**	**6**	2	4	6	12
III	**Electrostatics**	**10**	4	4	8	16
IV	**Current Electricity**	**10**	4	4	8	16
V	**Electromagnetism**	**8**	2	4	8	14
VI	**Modern Physics**	**6**	2	4	4	10
Total		**48**	**16**	**24**	**40**	**80**

9. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a. Prepare journal based on practical performed in Physics laboratory. Journal consists of drawing, observations, required equipment's, date of performance with teacher signature.

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
c. With respect to item No.9, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
d. Use proper equivalent analogy to explain different concepts.
e. Use Flash/Animations to explain various components and operation.
f. Teacher should ask the students to go through instruction and Technical manuals.

10. SUGGESTED MICRO-PROJECTS

Only one Micro Project is planned to be undertaken by a student assigned to him/her in the beginning of the semester. She/He ought to submit it by the end of semester to develop industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs. The Micro-Project could be industry application based, internet based, workshop based, laboratory based or field based. The assessment of micro-project is to be done under Practical (PA) Assessment. The Micro Project preferably assign to the group of (4-6) students or an individual taking into the considerations the capabilities and circumstances at the time .
A suggested list is given here. Similar micro-project could be added by the concerned faculty.

a. **Systems and Units** : Prepare Chart on comparison of systems of units for different physical quantities..
b. **Magnetism :** Prepare chart on magnetic lines of force of bar magnet.
c. **Optics :**Prepare chart to study Total Internal Reflection/LASER.
d. **X-Ray** :Prepare chart showing properties of X-rays/Photoelectric cell.
e. Prepare Chart to Study **Ohm's Law**.

12. SUGGESTED LEARNING RESOURCES

S. No.	Title	Author	Publisher, Edition Year of publication and ISBN Number
1	Physics Textbook Part I- Class XI	J.V.Narlikar, A.W.Joshi, et al.	National Council of Education Research and Training, New Delhi,2010, ISBN:8174505083
2	Physics Textbook Part II- Class XI	J.V.Narlikar, A.W.Joshi, et al.	National Council of Education Research and Training, New Delhi,2015, ISBN:8174505660
3	Physics Textbook Part I- Class XII	J.V.Narlikar, A.W.Joshi, et al.	National Council of Education Research and Training, New Delhi,2013, ISBN:8174506314
4	Physics Textbook Part II- Class XII	J.V.Narlikar, A.W.Joshi, et al.	National Council of Education Research and Training, New Delhi,2013, ISBN:8174506713
5	Fundamentals of Physics	David Halliday, Robert Resnick and Jearl Walker	7th EditionJohn Wily (2004) ISBN:9781118230718, 111823071X
6	Engineering Physics	R.K. Gaur and S. L. Gupta	Dhanpat Rai Publications ISBN 9788189928223 (1981)
7	Applied Physics	Prakash Manikpure	S. Chand Publishing ISBN 9788121919548
8	Applied Physics	Arthur Beiser	Schaum's Outline Series McGraw-HILL ISBN:9780071426114
9	Engineering Physics	Avadhanulu, Kshirsagar	S Chand ISBN 9788121908177

13. SOFTWARE/LEARNING WEBSITES

1) https://en.wikipedia.org/wiki/**Engineering_physics**
2) www.nanowerk.com
3) www.brainscape.com
4) https://www.open2study.com/courses/basic-physics
5) http://nptel.ac.in/course.php?disciplineId=115
6) http://nptel.ac.in/course.php?disciplineId=104
7) http://hperphysics.phy-astr.gsu.edu/hbase/hph.html
8) www.physicsclassroom.com
9) www.physics.org

14. PO - COMPETENCY- CO MAPPING
(Information Technology)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	1	2	2	1	3
CO2	3	3	2	2	3	1	3
CO3	3	3	2	2	3	1	3
CO4	3	3	2	2	3	1	3
CO5	3	1	-	2	3	-	3
CO6	3	1	1	2	3	1	3
Summary	**3**	**2**	**2**	**2**	**3**	**1**	**3**

CO	PSO1	PSO2	PSO3
1	3	-	-
2	3	-	-
3	3	-	-
4	3	-	-
5	3	-	-
6	3	-	-
Summary	**3**	**-**	**-**

14 . PO - COMPETENCY- CO MAPPING
(Electronics and Telecommunication Engineering)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	1	2	2	1	3
CO2	3	3	2	2	3	1	3
CO3	3	3	2	2	3	1	3
CO4	3	3	2	2	3	1	3
CO5	3	1	-	2	3	-	3
CO6	3	1	1	2	3	1	3

CO	PSO1	PSO2	PSO3
1	3	2	-
2	3	2	-
3	3	2	-
4	3	2	-
5	3	2	-
6	3	2	

14. PO - COMPETENCY- CO MAPPING
(Computer Engineering)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	1	2	2	1	3
CO2	3	3	2	2	3	1	3
CO3	3	3	2	2	3	1	3
CO4	3	3	2	2	3	1	3
CO5	3	1	-	2	3	-	3
CO6	3	1	1	2	3	1	3

CO	PSO1	PSO2
1	3	1
2	3	-
3	3	-
4	3	-
5	3	1
6	3	1

14 . PO - COMPETENCY- CO MAPPING
(Electrical Engineering)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	1	2	2	1	3
CO2	3	3	2	2	3	1	3
CO3	3	3	2	2	3	1	3
CO4	3	3	2	2	3	1	3
CO5	3	1	-	2	3	-	3
CO6	3	1	1	2	3	1	3

CO/PO	PSO1	PSO2	PSO3	PSO4
1	3	1	2	-
2	3	2	2	1
3	1	3	-	1
4	3	2	1	2
5	3	2	1	1
6	2	2	1	1

Sign: Name: Smt. D. V. Saurkar Dr. R. B. Birajadar (Course Expert)	Sign: Name : Mrs.N.S.Kadam (Head of Department)
Sign: Name: Shri R.N.Shikari (Programme Head)	Sign: Name : Shri.A.S.Zanpure (CDC)

Government Polytechnic, Pune

'180OB' – Scheme

Programme	Diploma in CE/**EE**/**ET**/ME/MT/CM/IT/DDGM
Programme code	01/**02**/**03**/04/05/06/07/08/15/**16**/**17**/18/19/21/22/23/24/26
Name of Course	Engineering Chemistry
Course Code	SC1105
Prerequisite	NA
Class Declaration	NA

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)		Examination Scheme				
					Theory		Practical		Total Marks
L	T	P	C		#ESE	PA	*ESE	PA	
03	00	02	05	Marks	80	20	25	25	150
				Exam Duration	2 Hrs	1 Hr	2 Hr	--	--

Legends: L- Lecture, P-Practical, T-Tutorial, C-Credits, ESE-End semester examination, PA- Progressive Assessment(Test I,II/Term work), *-Practical examination, $-Oral Examination, #-Online Examination, Each Lecture/Practical period is of one clock hour.

2. RATIONALE

Applications of Material Science and Chemical Principles have resulted into the development of new materials used in modern medicines and automobiles, synthetic fibers, polymers, alloys, new energy sources and many other important products and processes.

Material Science is an important and expanding branch in the scientific engineering and economic field of our society.

The topic atomic structure includes the basic structure of matter, which governs the Mechanical, Electrical and Magnetic properties of the matter.

Corrosion and methods of prevention will make students realize the importance of care and maintenance of machines and equipment. Study of different polymers, insulators, adhesives and their chemical behavior will be useful in their applications in electrical appliances and electronics industries. Study of impurities and hardness in water and methods for water softening will help the students to make proper use of water.

Nanomaterials are widely used in the engineering field. It will help to understand the need of nanomaterial in different engineering fields.

3. COMPETENCY

The aim of this course is to help the students

- To solve engineering problems applying principles of chemistry

4. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

1. Distinguish materials on the basis of atomic structure.
2. Solve the problems based on Faraday's laws.
3. Select metals and nonmetals for given applications.
4. Use corrosion preventive measures in industry.

5. SUGGESTED PRACTICALS/ EXERCISES

Expt Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Relevant CO	Approx. Hrs. required
1.	1	Write the electronic configuration of atoms from Z=1 to Z=30	1	2
1.	1	Write the formation of compounds NaCl, AlCl3, H2O, CO2, N2	1	2
1.	1	*Determine acidic and basic radical from unknown solution (solution 1)	1	4
1.	1	*Determine acidic and basic radical from unknown solution (solution 2)	1	4
1.	2	Determine electrochemical equivalent of copper metal using Faraday's first law and Faraday's second law.	2	2
1.	3	Use Hydrometer for testing Battery	2	2
1.	3	Measure the voltage developed due to chemical reactions by setting up the Daniel cell.	2	2
1.	4	Determine the percentage of iron in a given steel sample by redox titration.	3	4
1.	5	Prepare phenol formaldehyde resin.	1	2
1.	5	Determine acid value of given resin	1	2
1.	6	Determine electrode potential of various metals to study their tendency to corrosion.	4	2
12.	6	Determine the rate of corrosion of Aluminium in acidic and basic medium.	4	4
13	1 to 7	*Complete a Micro- project as per the guidelines in point no. 11	1 to 4	4
			TOTAL	32

*** Experiments Sr.No.13 compulsory. Perform Expt.Sr.No.3 or 4**

Sr.No.	Performance Indicators	Weightage in %
a.	Prepare experimental set up	20
b.	Handling of instruments during performing practical.	20
c.	Follow Safety measures	10
d.	Accuracy in calculation	20
e.	Answers to questions related with performed practices.	10
f.	Submit journal report on time	10
g.	Follow Housekeeping	5
h.	Attendance and punctuality	5
Total		**100**

6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practicals, as well as aid to procure equipment by authorities concerned**.**

S. No.	Equipment Name with Broad Specifications	Experiment Sr. No.
1	Electronic balance with the scale range of 0.001 gm to 500 gm	All
2	Hydrometer	6

7. THEORY COMPONENTS:

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
UNIT I: Atomic Structure (05 hrs, 10marks)	
1a.Explain the characteristics of fundamental particles of an atom. 1b. Distinguish between atomic number and atomic mass number 1c. Distinguish between orbit and orbital. 1d. Explain the significance of quantum numbers. 1e. Explain the formation of given molecule. 1f. State Aufbau's principle and Hund's rule. 1g. Define metallic bond with example. 1h. Draw orbital electronic configurations (s, p, d, f) of elements	1.1 Definition of atom, structure of atom, Characteristics of fundamental particles of an atom, definition of atomic number, atomic mass number and their difference 1.2 Orbits: Bohr's energy levels, sub-energy levels, s, p, d, f orbital, shapes and description of s and p orbital. Definition and significance of quantum numbers 1.3 Aufbau's principle, Hund's rule,orbital electronic configurations (s, p, d, f) of elements having atomic number 1 to 30. 1.4 Definitions of valence electrons, valence, types of valencies, Definition of electrovalency, positive and negative electrovalency. 1.5 Formation of Electrovalent compounds-*Nacl, $Alcl_3$* Definition of covalency, single, double and triple covalent bonds, formation of Covalent compounds *H_2O, CO_2, N_2*

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
UNIT II: Electrochemistry:(06hrs,10marks)	
2a. Differentiate between atom and ion. 2b. Explain the assumptions of Arrhenius theory of electrolytic dissociation. 2c. Describe the process of electroplating by taking suitable examples. 2d. Explain the mechanism of electrolysis for the given electrolyte. 2e. Calculate CE, ECE, weight of substance deposited or liberated, time in the given numerical.	2.1 Definition of electrolyte, electrolysis, ionization, Arrhenius theory, Difference between atom and ion 2.2 Activity series, mechanism of electrolysis of CuSO4 using Pt electrode and Cu electrode 2.3 Applications of electrolysis: electroplating, electrorefining, 2.4 Faraday's laws of electrolysis and numerical.
UNIT III: Cells and batteries (06hrs,12marks)	
3a. Distinguish between: metallic conductor, electrolytic conductors 3b. Describe the construction and working of cells. 3c. Explain the reactions taking place in given cells. 3d. Explain applications of cells. 3e. Explain the care and maintenance of battery	3.1 Types of conductors: metallic conductor, electrolytic conductors (definition and difference) 3.2 Conductance in metals, conductance in electrolyte, Factors affecting conductance: nature of solute, nature of solvent, temperature, concentration of solution. 3.3 Primary and secondary cell: Difference between primary cell and secondary cell, Construction, working and applications of Daniel cell (porous vessel and salt bridge), Dry cell, lead acid cell, Ni-Cd cell, Lithium ion battery 3.4 Maintenance of battery.
UNIT IV: Metals and alloys (07hrs, 10marks)	
4a. Draw the flow chart showing different processes in metallurgy. 4b. Classify carbon steel giving properties and application of each type. 4c. Explain the purposes of heat treatment methods. 4d. Explain purposes of making alloys. 4e. classify alloys with suitable examples of each. 4f. Write the composition, properties and uses of alloys.	4.1 Occurrence of metals, definitions of mineral, ore, flux, matrix, slag and metallurgy, mechanical properties of metal. 4.2 Flow chart showing different processes in metallurgy, classification, properties and application of carbon steel, heat treatment (definition, purposes and methods) 4.3 Definition of alloy, purposes of making alloys with examples, classification of alloys (ferrous and non-ferrous), 4.4 Composition, properties application of Copper zinc alloy, Cadmium copper alloy, Chromium copper alloy, Brass, Bronze, Duralumin, Wood's metal, Babbitt metal

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
UNIT V: Insulating materials:(10hrs,16marks)	
5a. Describe the formation of a given polymer. 5b. Distinguish between thermosoftening and thermosetting plastics. 5c. Explain the applications of Plastic based on its properties. 5d. Explain the vulcanization process of natural rubber. 5e. Distinguish between synthetic and natural rubber. 5f. Distinguish between natural and synthetic rubber. 5g. Explain the preparation, properties and application reaction of given synthetic rubber 5h. Explain the properties and application of thermal insulators. 5i. Explain the properties and application of electrical insulators.	**Plastic** 5.1 Definition of monomer and polymer, polymerization, classification of plastic on the basis of monomer, on basis of thermal behavior, on basis of monomer structure, 5.2 Types of polymerization (Addition, and Condensation) applications of Plastic based on its properties. 5.3 synthesis, properties and applications of- Polythene, PVC, Teflon, Bakelite, Polystyrene. **Rubber** 5.4 Types of rubber, processing of natural rubber, properties of rubber, drawbacks of natural rubber, vulcanization of rubber. 5.5 synthetic rubber – preparation, properties and application of BUNA-S, BUNA-N, neoprene, Thiokol. **Thermal insulators:** 5.6 Properties and application of thermocol and glasswool. Electrical insulators: 5.7 Properties and applications of Ceramics, silicon fluid, nitrogen gas.
UNIT VI: Corrosion (06hrs, 08marks**)**	
6a. Explain different types of oxide films. 6b. Explain the mechanism of electrochemical corrosion. 6c. Explain the factors affecting rate of atmospheric corrosion and electrochemical corrosion. 6d. Describe the galvanization process of protection of metal from corrosion. 6e. Distinguish between galvanization and tinning. 6f. Describe the given process of protection of metal from corrosion.	6.1 Definition, causes of corrosion types of corrosion-definition (atmospheric and electrochemical) Types of oxide films 6.2 Mechanism of atmospheric and electrochemical corrosion (evolution of hydrogen, absorption of oxygen). 6.3 Factors affecting rate of atmospheric corrosion and electrochemical corrosion. 6.4 Protection Methods-anodic and cathodic protection, Galvanization and tinning processes, sherardizing.

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
UNIT VII: Engineering materials (08hrs,14marks)	
7a. Explain the properties and application of nano materials. 7b. Explain the properties and application of magnetic materials. 7c. Distinguish between diamagnetic and paramagnetic materials. 7d. Explain the applications of Semiconducting materials. 7e. Difference between N-type and P- type semiconductors. 7f. Describe the properties of three groups of resistor materials. 7g. Explain the properties and applications of resistor materials.	7.1 **Nano materials-** properties and application of fullerene, graphene. 7.2 **Magnetic Material:** properties and applications of – diamagnetic materials, paramagnetic material and ferromagnetic materials. 7.3 **Semiconducting materials:** Definition, Applications of Semiconducting materials, Examples of Semiconductors commonly used, Intrinsic and extrinsic semiconductors, N-type and P- type semiconductors, Difference between N-type and P-type semiconductors, 7.4 **Resistor material:** Definition, Properties of three groups of resistor materials, Properties and applications of resistor materials: Tungsten, Carbon, Nichrome, Manganin, Eureka, Platinum.

8 SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
01	Atomic structure	05	02	04	04	10
02	Electrochemistry	06	02	04	04	10
03	Cells and batteries	06	02	02	08	12
04	Metals and alloys	07	02	02	06	10
05	Insulating materials	10	04	08	04	16
06	Corrosion	06	04	00	04	08
07	Engineering Materials	08	04	06	04	14
Total		**48**	**20**	**26**	**34**	**80**

9 SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a. Prepare a journal based on practical performed in a Chemistry laboratory. Journal consists of drawing, observations, required equipment, date of performance with teacher signature.

10 SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/subtopics.
b. About ***15-20% of the topics/sub-topics*** which are relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
c. With respect to item No.8, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
d. Use Flash/Animations to explain various components, operation and
e. Teacher should ask the students to go through instruction and Technical manuals

11 SUGGESTED MICRO-PROJECTS

Only **one micro- project** is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.*** S/he ought to submit it by the end of the semester to develop the industry oriented COs .Each micro project should encompass two or more COs which are in fact, an integration of PrOs .UOs and ADOs .(Affective Domain Outcomes) .The micro project could be application based, internet based, workshop based ,laboratory based or field based. Each student will have to maintain a dated work diary consisting of individual contributions in the project work.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

a. Types of bonds: Prepare a chart and models displaying different types of bonds with examples.

b. Battery and Cell: collect waste material from the lab and household and prepare a working model of cell.

c. Metals and Alloys: Prepare a chart showing Composition, properties application of Non Ferrous Alloys.

d. Insulating materials: Prepare a chart including different synthetic Plastic and Rubber and list their uses.

e. Engineering materials: Prepare a chart Nano materials/ Magnetic Materials/ Semiconducting materials/ Resistor materials and list their uses**.**

12 SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publisher, Edition and Year of publication and ,ISBN
1	Polytechnic Chemistry	V.P.Mehta	Jain brothers, New Delhi.2012818360093X
2	Engineering Chemistry	P.C.Jain and Monica Jain,	DhanpatRai and sons, New Delhi.20169352161319
3	Engineering Chemistry	Dara S.S. Umare SChand	S Chand 9788121903592
4	Engineering Chemistry	Jain and Jain	Dhanpat Rai and Sons, New Delhi,2015, ISBN: 9352160002
5	Engineering Chemistry	Vairam. S	Wiley Indian Pvt. Ltd, New Delhi, 2013 ISBN: 9788126543342
6	Chemistry for Engineers	Agnihotri,Rajesh	Wiley Indian Ptd.Ltd, New Delhi, 2014, ISBN: 9788126550784
7	Engineering Chemistry	Agrawal Shikha	Cambridge University press, New Delhi, 2015 ISBN: 97811074764

13 SOFTWARE/LEARNING WEBSITES

a. **www.chemistrytesching.com**
b. **www.visionlearning.com**
c. **www.chem1.com**
d. **www.onlinelibrary.wiley.com**
e. **www.rsc.org**
f. **www.chemcollective.org**
g. **www.wqa.org**

14 PO - COMPETENCY- CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	-	-	2	1	-	2
CO2	3	2	-	2	1	-	2
CO3	3	-	-	2	1	1	1
CO4	3	2	-	1	1	1	2

CO- PSO MAPPING

	ELECTRICAL				ELECTRONICS AND TELECOMMUNICATION		
	PSO 1	PSO 2	PSO 3	PSO 4	PSO1	PSO2	PSO3
CO1	1	1	1	-	2	-	-
CO2	1	1	1	1	2	-	-
CO3	2	1	2	1	1	-	-
CO4	1	1	1	1	-	1	-

Sign Name: Smt. S. A. Kakade (Course Experts) Smt. G. M. Patel (Course Expert)	Sign: Name: Mrs. N. S. Kadam (Head of Department)
Sign: Name: Shri R. N. Shikari (Programme Head)	Sign: Name: Shri. A. S. Zanpure (CDC In-Charge)

Level 2 Curriculum

Government Polytechnic, Pune

'180OB' – Scheme

Programme	**Diploma in CE/EE/ET/ME/MT/CM/IT/DDGM**
Programme code	**01/02/03/04/05/06/07/08/15/16/17/18/19/21/22/23/24/26**
Name of Course	**Fundamentals of ICT**
Course Code	**CM2102**
Prerequisite course code and name	**NA**
Class Declaration	**NO**

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)		Examination Scheme				
					Theory		Practical		Total Marks
L	T	P	C		ESE	PA	*ESE	PA	
01	00	02	03	Marks	-	-	25	25	50
				Exam Duration	-	-	-	-	

Legends: L- Lecture, P-Practical, T-Tutorial, C-Credits, ESE-End semester examination, PA- Progressive Assessment(Test I,II/Term work), *-Practical examination, $-Oral Examination, #-Online Examination, Each Lecture/Practical period is of one clock hour.

2. RATIONALE

In any typical business setup, in order to carry out routine tasks related to create business documents, perform data analysis and its graphical representations and making electronic slide show presentations, the student need to learn various software as office automation tools like word processing applications, spreadsheets and presentation tools. They also need to use these tools for making their project reports and presentations. The objective of Information and Communication Technology course is to develop the basic competency in students for using these office automation tools to accomplish the job.

3. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Use Computers for electronic documentation, data analysis, slide presentations and use of various internet services.**

4. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency**:**

1. Connect Computer System and its peripherals.
2. Prepare document using word processing tool.
3. Create and design spreadsheets and data tables.
4. Prepare professional presentations.
5. Use various web services.

5. SUGGESTED PRACTICALS/ EXERCISES

Sr. No.	Unit No.	Practical Exercises (Learning Outcomes in Psychomotor Domain)	Relevant CO	Approximate Hours Required.
1	1	i) Identify various Input/output devices, connections and peripherals of computer system ii) Demonstration of Front Panel View ,Rear Panel View, I/O Serial and Parallel Ports iii)Demonstration of opening and closing of the Computer	1	1
2	1	i) Connections inside CPU and its demonstration ii) Setting up the Cabinet. iii) Identification and Demonstration of different slots on motherboard. Mounting and Un mounting of RAM, Graphics card and Network card	1	1
3	1	i) Connecting various I/O Devices such as Mouse, Keyboards, Monitors, Printers, Web Cameras, Speakers, Scanners and External Hard disks etc. ii)Demonstration of RJ45 connector and its use and Bluetooth as an external interface	1	2
4	1	Functions and working of Secondary Storage devices i) Study of various types of Secondary Storage devices. ii) BIOS Settings for Primary and secondary Memory. iii) Installation, Configuration and Setting of Hard Disks and working of CD-ROM/DVD-ROM/ DVD-Combo/ DVD- Writer (Internal and External).	1	1
5	1	Execution of basic commands in command window: Ex: dir, md, copy, cd, move, rmdir, rd etc.	1	1
6	1	Various operations on Window based operating system part I: i) Windows Operations: Minimizing, Maximizing, Resizing. ii) Managing files and folders: Create, copy, rename, delete, move file and folder, Creating shortcuts.	1	1
7	1	Various operations on Window based operating system part II: i) Creating and Removing/Deleting User Accounts. ii) Using Add /Remove Programs and Hardware Utility. iii)Adding Fonts and Viewing Computer Configuration iv)Desktop settings: Display properties, Time and Date setting, Screen Saver , Appearance	1	2

8	2	i) Create, edit and save document : apply formatting features on the text - line, paragraph ii) Use bullets, numbering, page formatting iii) Insert and edit images and shapes, sizing, cropping, color, background, group/ungroup	2	2
9	2	i) Insert and apply various table formatting features on it. ii) Use mail merge with options.	2	1
10	2	Apply page layout features i)Themes, page background, paragraph, page setup ii)Create multicolumn page iii)Use different options to print the documents	2	2
11	3	Create, open and edit worksheet i)Enter data and format it, adjust row height and column width ii)Insert and delete cells, rows and columns iii) Apply wrap text, orientation feature on cell.	3	2
12	3	i) Insert formulas, “IF” conditions, functions and named ranges in worksheet. ii) Apply data Sort Filter and Data Validation features.	3	3
13	3	Create charts to apply various chart options.	3	2
14	3	Apply Page setup and print options for worksheet to print the worksheet.	3	1
15	3	Perform following in GUI based database software using GUI like MS-Access i) Create Database ii) Create tables and assign primary key. iii) Modify the table structure-add column, change the data type of column, delete the column from table. iv) Insert, update and delete the record from table. v) Retrieve data from the table according to condition given.	3	2
16	4	i)Create slide presentation ii)Apply design themes to the given presentation iii) Add new slides and insert pictures/images, shapes, apply animation effects to the text and slides. iv)Add tables and charts in the slides. v) Run slide presentation in different modes and Print it.	4	2
17	5	Configure Internet connection	5	1
18	5	Use internet for different web services.	5	2
19	5	Configure browser settings and use browsers.	5	1
20	All	Micro-project (Refer point 11 for micro project list)	All COs	2
		Total		**32**

Sr.No.	Performance Indicators	Weightage in %
a.	Use of Appropriate tool to solve the problem (Process)	40
b.	Quality of output achieved (Product)	30
c.	Complete the practical in stipulated time	10
d.	Observations and Recording	10
e.	Answer to sample questions	10
Total		**100**

6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practicals, as well as aid to procure equipment by authorities concerned.

Sr. No.	Major Equipment/ Instruments Required	Experiment Sr. No.
1	Computer system with all necessary components like; motherboard, random access memory (RAM), read-only memory (ROM), Graphics cards, sound cards, internal hard disk drives, DVD drive, Network interface card, Mouse, Keyboard, Monitors, Printers, Web Cameras, Speakers, Scanners and External Hard disks etc.	1 to 7
2	Laser printer	1,14,16
3	Hard Disks, CD-ROM/DVD-ROM/ DVD-Combo/ DVD-Writer (Internal and External).	3,4
4	Hubs, Switches, Modems.	18,19
5	Any operating system.	5 to 20
6	Any Office Software.	8,9,10, 11, 12, 13, 15,16,17
7	Any browser.	18,19,20

7. THEORY COMPONENTS

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit -1 Introduction to Computer System (Hours- 04)	
1a.Explain the given block diagram of computer system. 1b. Classify the given types of software. 1c.Explain characteristics of the specified type of network. 1d.Describe Procedure to manage file/folders. 1e.Describe application of the specified type of network connecting device.	1.1 Basics of Computer System: Overview of Hardware and Software ,block diagram of Computer System, Input /Output unit, CPU, Control unit, Arithmetic logic unit(ALU), Memory Unit 1.2 Internal Components: Processor, Motherboards, random access memory(RAM), read-only memory(ROM), Video cards, Sound cards and internal hard disk drives 1.3 External Devices: Types of Input/ Output Devices, Types of monitors, Keyboards, Mouse, Printers: Dot Matrix, Inkjet and LaserJet, Plotter and scanner, external storage devices CD/DVD , Hard disk and pen drive 1.4 Basic Commands in command window: Ex: dir, md, copy, cd, move, rmdir, rd etc. 1.5 Application Software: Word processing , Spreadsheet, database management systems, Control software, measuring

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	software, photo editing software , video editing software, graphics manipulation software system software compilers, linkers, device drivers, operating systems and utilities 1.6 Network environments: Network interface cards, hubs, switches, routers and modems, concept of LAN, MAN, WAN, WLAN, Wi-Fi and Bluetooth 1.7 Working With Operating Systems: Create and manage file and folders, Copy a file, renaming and deleting files and folders, searching files and folders, application installation , creating shortcut of application on the desktop
Unit - 2 Word Processing (Hours- 03)	
2a.Write steps to create the given text document. 2b.Explain the specified feature for document editing. 2c.Explain the given page setup features of a document. 2d.Write the specified table formatting feature	2.1 Word Processing: Overview of Word processor, Basics of Font type, size, color, Effects like Bold, italic, underline, subscript and superscript, Case changing options, Previewing a document, Saving a document, Closing a document and exiting application. 2.2 Editing a Document: Navigate through a document, Scroll through text, Insert and delete text, Select text, Undo and redo commands, Use drag and drop to move text, Copy, cut and paste, Use the clipboard, Clear formatting, Format and align text, Formatting Paragraphs, Line and paragraph spacing, using FIND and REPLACE, Setting line spacing ,add bullet and numbers in lists, add borders and shading, document views, Page settings and margins, Spelling and Grammatical checks 2.3 Changing the Layout of a Document: Adjust page margins, Change page orientation, Create headers and footers, Set and change indentations, Insert and clear tabs 2.4 Inserting Elements to Word Documents: Insert and delete a page break, Insert page numbers, Insert the date and time, Insert special characters(symbols),Insert a picture from a file, Resize and reposition a picture 2.5 Working with Tables: Insert a table, Convert a table to text, Navigate and select text in a table, Resize table cells, Align text in a table, Format a table, Insert and delete columns and rows, Borders and shading, Repeat table headings on subsequent pages, Merge and split cells. 2.6 Working with Columned Layouts and Section Breaks: Add Columns, Section breaks, Creating columns, Newsletter style columns, Changing part of a document layout or formatting, Remove section break, Add columns to remainder of a document, Column widths, Adjust column spacing, Insert manual column breaks
Unit -3 Spreadsheets and Database (Hours- 04)	

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
3a. Write steps to create the given spreadsheet. 3b. Explain the specified formatting feature of a worksheet. 3c. Write steps to insert formula and functions in the given worksheet. 3d. Write steps to create charts for the specified data set. 3e. Explain steps to perform advance operation on the given dataset	3.1 Working with Spreadsheets: Overview of workbook and worksheet, Create Worksheet Entering sample data, Save, Copy Worksheet, Delete Worksheet, and Open & Close Workbook. 3.2 Editing Worksheet: Insert and select data, adjust row height and column width, delete, move data, insert rows and columns, Copy and Paste, Find and Replace, Spell Check, Zoom In-Out, Special Symbols, Insert Comments, Add Text Box, Undo Changes,- Freeze Panes, hiding/un hiding rows and columns. 3.3 Formatting Cells and sheet: Setting Cell Type, Setting Fonts, Text options, Rotate Cells, Setting Colors, Text Alignments, Merge and Wrap, apply Borders and Shades, Sheet Options, Adjust Margins, Page Orientation, Header and Footer, Insert Page Breaks, Set Background. 3.4 Working with Formula: Creating Formulas, Copying Formulas, Common spreadsheet Functions such as sum, average, min, max, date, In, And, or, mathematical functions such as sqrt, power, applying conditions using IF. 3.5 Working with Charts: Introduction to charts, overview of different types of charts, Bar, Pie, Line charts, creating and editing charts. Using chart options: chart title, axis title, legend, data labels, Axes, grid lines, moving chart in a separate sheet. 3.6 Advanced Operations: Conditional Formatting, Data Filtering, Data Sorting, Using Ranges, Data Validation, Adding Graphics, Printing Worksheets, print area, margins, header, footer and other page setup options 3.7 Introduction to Database Management System: Meaning of Data, Database, DBMS, GUI based database software Creating tables and assign primary key, Modifying the table structure-add column, change the data type of column, and delete the column from table. And Insert, update and delete the record from table.
Unit – 4 Presentation Tool (Hours- 03)	
4a. Write the steps to create the specified slide presentation. 4b. Write the steps to insert multiple media in the given presentation. 4c. Write steps to apply table features in the given presentation 4d. Write steps to manage	4.1 Creating a Presentation: Outline of an effective presentation, Identify the elements of the User Interface, Starting a New Presentation Files, Creating a Basic Presentation, Working with text boxes, Apply Character Formats, Format Paragraphs, View a Presentation, Saving work, creating new Slides, Changing a slide Layout, Applying a theme, Changing Colors, fonts and effects, apply custom Color and font theme, changing the background, Arrange Slide sequence, 4.2 Inserting Media elements: Adding and Modifying

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
charts in the given presentation	Graphical Objects to a Presentation - Insert Images into a Presentation, insert audio clips, video/animation, Add Shapes, Add Visual Styles to Text in a Presentation, Edit Graphical Objects on a Slide, Format Graphical Objects on a Slide, Group Graphical Objects on a Slide, Apply an Animation Effect to a Graphical Object, Add 4.3 Working with Tables: Insert a Table in a Slide, Format Tables, and Import Tables from Other Office Applications. 4.4 Working with Charts: Insert Charts in a Slide, Modify a Chart, Import Charts from Other Office Applications
Unit - 5 Basics of Internet (Hours- 02)	
5a. Explain use of the given setting option in browsers. 5b.Explain features of the specified web service. 5c.Describe the given characteristic of cloud. 5d.Explain the specified option used for effective searching in search engine	5.1 World Wide Web: Introduction, Internet, Intranet, Cloud, Web Sites, Web Pages, URL, web servers, basic settings of web browsers-history, extension, default page, default search engine, creating and retrieving bookmarks, use search engines effectively for searching the content. 5.2 Web Services: e-Mail, Chat, Video Conferencing, e-learning, e-shopping, e-Reservation, e-Groups, Social Networking.

Transitions, Add Speaker Notes, Print a Presentation.

8. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction to Computer System	4	--	--	--	--
II	Word Processing	3	--	--	--	--
III	Spreadsheets and Database	4	--	--	--	--
IV	Presentation Tool	3	--	--	--	--
V	Basics of Internet	2	--	--	--	--
Total		**16**	--	--	--	--

9. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a. Prepare journal of practicals performed in laboratory
b. Prepare a sample document with all word processing features.(Course teacher shall allot appropriate document type to each students)

c. Prepare PowerPoint Presentation with all the presentation features.(Course teacher shall allot various topics to the groups of students)
d. Prepare Database/spreadsheets in groups, related to various Fields/Organizations
e. Undertake micro projects

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
c. With respect to item No.9, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
d. Guide student(s) in undertaking micro-projects.
e. Correlate subtopics with power plant system and equipments.
f. Use proper equivalent analogy to explain different concepts.
g. Use Flash/Animations to explain various components, operation and
h. Teacher should ask the students to go through instruction and Technical manuals

11. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. (Affective Domain Outcomes). Each student will have to maintain activity chart consisting of individual contribution in the project work and give a seminar presentation of it before submission. The student ought to submit micro-project by the end of the semester to develop the industry-oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

a. Word documents: Prepare Time Table, Application Notes, Reports(Subject teacher shall assign a document to be prepared by the each students)
b. Slide Presentations: Prepare slides with all Presentation of reports (Subject teacher shall assign a presentation to be prepared by each student.
c. Spreadsheets: Prepare pay bills, tax statement, student's assessment record using spreadsheets (Teacher shall assign a spreadsheets to be prepared by each student
d. Web Browser/ Email : Create Email ID using any web browser and E-mail service and explore all the options available in Email e.g. drive, forms etc.

12. SUGGESTED LEARNING RESOURCES

S.N.	Title	Author	Publisher, Edition, Year of publication ,ISBN Number
1	Computer Fundamentals	Goel, Anita	Pearson Education, New Delhi, 2014 • ISBN-13: 978-8131733097
2	Computer Basics Absolute Beginner's Guide, Windows 10	Miller, Michael	QUE Publishing; 8th edition August 2015 • ISBN: 978-0789754516
3	Microsoft Office 2010 for Windows: Visual Quick Start	Schwartz, Steve	Pearson Education, New Delhi India, 2012 • ISBN:9788131766613
4	OpenOffice.org for Dummies	Leete, Gurdy, Finkelstein Ellen, Mary Leete	Wiley Publishing, New Delhi 2003 • ISBN : 978-0764542220
5	Microsoft Office 2010: On Demand	Johnson, Steve	Pearson Education, New Delhi India, 2010. • ISBN : 9788131770641

13. SOFTWARE/LEARNING WEBSITES

a. http://www.nptel.ac.in
b. https://www.microsoft.com/en-in/learning/office-training.aspx
c. http://www.tutorialsforopenoffice.org
d. https://s3-ap-southeast-1.amazonaws.com/r4ltue295xy0d

14. PO - COMPETENCY- CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2	-	-	2	1	-	2
CO2	-	-	-	2	2	2	2
CO3	3	2	2	2	2	2	2
CO4	-	-	-	2	2	2	2
CO5	1	-	-	-	1	-	1

	PSO1	PSO2	PSO3
CO1	2	-	-
CO2	-	1	-
CO3	-	1	-
CO4	-	1	-
CO5	2	1	-

Sign: Name: Smt. A. D. Kshirsagar Smt. K. S. Sathawane Smt. P.L. Sonwane (Course Experts)	Sign: Name: Shri. U. V. Kokate Dr. S. B. Nikam (Head of Department) (Department of Computer Engineering)
Sign: Name: Shri. R. N. Shikari (Programme Head) (E & TC Department)	Sign: Name: Shri A. S. Zanpure (CDC Incharge)

Government Polytechnic, Pune

'180OB' – Scheme

Programme	**Diploma in Electronics and Telecommunication Engineering**
Programme code	01/02/**03**/04/05/06/07/08/15/16/**17**/18/19/21/22/**23**/24/26
Name of Course	**Fundamentals Electrical Engineering**
Course Code	**EE 2103**
Prerequisite	**NA**
Class Declaration	**No**

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)		Examination Scheme				
					Theory		Practical		Total Marks
L	T	P	C		ESE	PA	$ESE	PA	
03	00	02	05	Marks	80	20	25	25	150
				Exam Duration	3 Hrs	1 Hr	-	-	

(Legends: L- Lecture, P-Practical, T-Tutorial, C-Credits, ESE-End semester examination, PA- Progressive Assessment(Test I,II/Term work), *-Practical examination, $-Oral Examination, #-Online Examination, Each Lecture/Practical period is of one clock hour.

2. RATIONALE

Technicians from Electronics discipline are required to operate and maintain the electrical machines, electrical installations and control panels. So, it is highly essential to know basic principles of Electrical Engg.

3. COMPETENCY

The aim of this course is to attend following industry identified competency through various teaching learning experiences:

- **To operate and control various parameters of electrical machines.**
- **To maintain various electrical installations in industry.**
-

4. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency**:**

1. To understand the principals related with magnetic circuits and electromagnetic Induction.
2. To understand terms related to ac supply also able to analyze ac circuits and 3 ph Circuits.
3. To know the construction, working principal, characteristics and application of ac And dc machines.
4. To select and use appropriate L.T. Switch gears for electrical distribution system And also able to select proper type of earthing.

5. SUGGESTED PRACTICALS/ EXERCISES

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Relevant CO	Approximate Hours Required.
1.	1	Verification of Faradays laws of Electromagnetic induction	1	2
2.	1	To plot B-H curve of a magnetic material	1	2
3.	2	To verify the relation between line & phase value of current & voltage in balanced star circuit.	2	4
4.	2	To verify the relation between line & phase value of current & voltage in balanced delta circuit	2	4
5.	2	To determine voltage & current ratio of single phase transformer and determine efficiency and voltage regulation of single phase.	2	4
6.	3	Verification of reversal of rotation of following motor i) DC motor ii) 3PH Induction motor	3	2
7.	6	Demonstration of use & tripping of MCB against overload	6	2
8.	2	Study of R-L series circuit	2	2
9.	2	Study of R-C series circuit	2	2
10.	3	Study of 3 point starter.	3	2
11.	6	Indian Electricity Rulesfor electrical safety	6	4
12.	All	Complete a microproject based on guidelines provided in sr.no.11	All	4
		Total Hrs	1	**32**

S.No.	Performance Indicators	Weightage in %
a.	Arrangement of available equipment / test rig or model	20
b.	Setting and operation	20
c.	Safety measures	10
d.	Observations and Recording	10
e.	Interpretation of result and Conclusion	20
f.	Answer to sample questions	10
g.	Submission of report in time	10
Total		**100**

6. MAJOR EQUIPMENT/ INSTRUMENTSREQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practical, as well as aid to procure equipment by authorities concerned**.**

Sr.No.	Major Equipment/ Instruments Required	Experiment Sr. No.
1	Single phase Transformer ,50Hz,1KVA, 1phase,230/115 Volts	5
2	Dc shunt Motor,110 V DC, 1HP	6
3	3 phase Induction Motor 440 V	6
4	A.C./D.C. Ammeters	2,3,4,5,8,9
5	A.C./D.C. Voltmeters	2, 3,4,5,8,9
6.	3 Phase RAM Bank	3,4
7	Galvanometer(30-0-30)	1
8	MCB 44V,4pole,3phase,16A,50 Hz	7

7. THEORY COMPONENTS :

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
UNIT 1 : Magnetic & Electromagnetic Circuits (Weightage- 16, Hrs- 12)	
1a.Describe the various parameters of magnetic circuits 1b.Describe the significance of magnetization curve and hysteresis loop 1c. State and explain faraday's laws. Lenz law, Fleming's right and left hand rule. 1d. Differentiate between self and mutual inductance. 1e. Differentiate between statically &Dynamically Induced emf	1.1 Definition-M.M. F,Permeability,Magnetic Flux,Reluctance,Flux Density,Magnetising force 1.2 Relation between Magnetizing Force & Flux density. 1.3Magnetising Curve of Different magnetic Material. (B-H Curve). 1.4.Concept of Hysteresis & Hysteresis loop 1.5. Comparison between Magnetic circuit & Electrical Circuit. 1.6 Definitions & Explanation of a. Faraday's first & second Law b.Lenz's Law c. Fleming's Left- and Right-hand rule. 1.7 Concept of self & Mutual Inductance. 1.8 Concept of self & Mutual induced emf.

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	1.9 Concept of statically &Dynamically Induced emf, simple numerical(1.7 to 1.9)
UNIT 2 :A.C.Fundamentals& Series Circuits(Weightage- 16, Hrs- 08)	
2a.Explain generation of alternating emf. 2b.Define the various terms related to ac supply 2c. Explain the behavior of ac voltage and ac currents for different circuits.	2.1Graphical Representation of one phase Supply.(Sinusoidal) 2.2 Definition-Instantaneous Value,Cycle,Frequency,Amplitude,Time Period, Peak value ,Average Value,RMS Value, Peak factor& Form factor 2.3Concept of Phaser and phasor difference-leggings and leading 2.4 Study of following circuits w.r.to circuit diagram,waveform,phasor diagram & mathematical expression for a.Purely resistive b.Purely Inductive c.Purely Capacitive d.R-L Series. e.R-C Series 2.5 simple numerical from 2.1 to 2.4
UNIT 3 : Three Phase Circuits(Weightage- 10 , Hrs- 06**)**	
3a. Explain the generation of three phase supply. &States its advantages 3b.Explain types of connections of load for 3 phsystem. 3c.state relation between line voltage & phase current.and line current & phase current for delta and star conetion load	3.1Generation of 3 phase voltage and its waveforms. 3.2 Advantages of 3 ph system over 1ph system. 3.3 Phase sequence, star & delta connection. 3.4 Concept of balanced load & balanced supply 3.5 Voltage ,current, power relation in star & delta connected system, simple numerical on 3.5
UNIT 4:Transformer and D.C motors(Weightage- 14,Hrs- 08)	
4a. Explain the function of various part and working principal of single-phase transformer. 4b.Derive emf equation of transformer. And understand voltage ratio and current ratio of transformer. 4c.Describe the construction and working of dc motor 4d.State the types of dc motor 4e.Select the dc motor depending upon application f selection of necessary starter.	4.1Definition and working principal, construction of transformer 4.2 EMF Equation, voltage and current ratio. Concept of F.L.KVA of transformer. 4.3 losses of transformer and regulation of transformer (no numerical) 4.4construction and working principal of D.C.motor 4.5 Types of D.C. motor 4.6 Characteristics and application of dc motor 4.7 study of 3-point starter 4.8 simple numerical on 4.2
UNIT 5 : Induction Motor(Weightage- 14 , Hrs- 08)	

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
5a. Describe the construction and working of 3ph & 1 phInduction motor. 5b.State the types of Inductions motor. 5c.Select the Induction motor depending upon application.	5.1 Construction and working principal of three phase induction motor. Types of 3 phInduction motor. 5.2 synchronous speed, slip 5.3 D.O.L. Starter 5.4 construction,working principal, application of i.split phase ii. capacitor start, capacitor run iii. shaded pole
UNIT 6:L.T.Switchgear & earthing(Weightage- 10 , Hrs- 06)	
6a. Select proper L.T.switchgear as per requirement. 6b.Understand the importance of earthing 6c.Select type of earthing asper requirement.	6.1 Fuse: operation and types 6.2switch fuse unit and fuse switch unit difference 6.3MCB,MCCB,ELCB; operation, General specifications 6.4 import ants of earthing and factors affecting on earthing 6.5 Explain pipe earthing and Plate earthing with suitable diagram

8. SUGGESTED SPECIFICATION TABLE FORQUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	**Magnetic & Electromagnetic Circuits**	12	**8**	**4**	**4**	16
II	**A.C.Fundamentals& Series Circuits**	8	**8**	**4**	**4**	16
III	**Three Phase Circuits**	6	**4**	**2**	**4**	10
IV	**Transformer and D.C motors**	8	**4**	**4**	**6**	14
V	**Induction motor**	8	**4**	**4**	**6**	14
VI	**L.T Sweachgear& earthing**	6	**2**	**4**	**4**	10
Total		48	**34**	**20**	**26**	**80**

9. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a. Market survey regarding commonly used electrical equipment which are not covered in the curriculum.
b. Undertake microprojects.(Under PP1)
c. Search information about Ratings and specifications of voltage Regulator ICs, power amplifier ICs and electronic components.
d. Undertake market survey of different domestic electrical appliances based on the following points:
    i. Manufacturing
    ii. Specifications /Ratings

iii. Salient Features
iv. Apllications

e. Prepare power point presentation showing working 1 phase transfprmer.
f. Prepare power point presentation showing working of AC and DC motors.

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
c. With respect to item No.9, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
d. Guide student(s) in undertaking micro-projects.
e. Guide student(s) for using data sheets/manuals.
f. Use proper equivalent analogy to explain different concepts.
g. Use Flash/Animations to explain operation and working of various instruments, transformer, motors,
h. Use PPTs to explain different circuits.

11. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs.(Affective Domain Outcomes) .Each student will have to maintain activity chart consisting of individual contribution in the project work and give a seminar presentation of it before submission.. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

a. Collect the photographs of different types fuses
b. Collect the coloured photographs of various types of electric motors
c. Prepare a chart of Plate Earting
d. Prepare a chart of Pipe Earthing
e. Prepare a chart of MCB and ELCB
f. Prepare a chart of different types transformers

12. SUGGESTED LEARNING RESOURCES

S.N.	Title	Author,	Publisher, Edition, Year of publication and ISBN Number
1	Electrical Technology-Vol.1	B.L.Therja,	S.Chand& co., New DelhiISBN: 9788121927833
2	Electrical Technology-Vol.2	B.L.Therja,	S.Chand& co., New DelhiISBN10:1259200116 ISBN13:9781259200113
3	Basic Electrical Engg.	Mittal and Mittal	Tata Mcgraw Hill ,New DelhiISBN 10: 8121925568 ISBN 13: 9788121925563

13. SOFTWARE/LEARNING WEBSITES

1. www.nptel.com
2. SCILAB
3. SIMULINK
4. PSIM
5. PSPICE
6. ELECTRONIC WORKBENCH
7. www.nptel.iitm.ac.in
8. www.onlinelibrary.willy.com

14. PO - COMPETENCY- CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	1	1	3	-	-	3
CO2	3	2	-	1	-	-	3
CO3	3	2	1	3	--		3
CO4	3	-	1	3	3	-	3

	PSO1	PSO2	PSO3
CO1	**3**	**2**	-
CO2	3	2	-
CO3	3	2	**3**
CO4	3	2	-

Sign: Name:Smt.R.T.Patil Shri S.B.Kale (Course Expert /s)	Sign: Name:Dr.S.S.Bharatkar (Head of Department)
Sign: Name: Shri.R.N.Shikari (Head of Program)	Sign: Name: Shri A.S.Zanpure (CDC I/C)

Government Polytechnic, Pune

'180OB' – Scheme

Programme	Diploma in **Electronics &Telecommunication Engineering**
Programme code	01/02/**03**/04/05/06/07/08/15/16/**17**/18/19/21/22/**23**/24/26
Name of Course	**Basic Electronic Engineering**
Course Code	**ET2101**
Prerequisite course code and name	**NA**
Class Declaration	**NO**

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)		Examination Scheme				
					Theory		Practical		Total Marks
L	T	P	C		ESE	PA	*ESE	PA	
04	00	02	06	Marks	80	20	25	50	175
				Exam Duration	3 Hrs	1 Hr	-	-	

(*):POE (Practical & Oral Examination)
Legends: L-lecture, T-Tutorial/teacher guided theory practice, P-practical, ESE-End semester examination, PA- Progressive Assessment, # - Online theory exam

2. RATIONALE

Diploma engineers have to deal with the various electronic components while maintaining various electronics equipment. The study of basic operating principles and handling of various electronics devices will help them to troubleshoot electronics equipment. This course is developed in such a way that, students will be able to apply the knowledge to solve broad electronic engineering application problems.

3. COMPETENCY

The aim of this course is to attend following industry identified competency through various teaching learning experiences:

- **Maintain electronic circuits comprising of discrete electronic components.**

4. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency**:**

1.Use relevant passive components in electronic circuits.
2. Use relevant diode in different electronics circuits.
3. Maintain rectifiers comprising of diodes.
4.Use BJT in electronics circuits.
5.Maintain DC regulated power supply

5. SUGGESTED PRACTICALS/ EXERCISES

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Relevant CO	Approximate Hours Required.
1	**2**	Test the performance of PN Junction diode	2	**02**
2		Test the performance ofzener diode.	2	02
3		Test the performance of photo diode by varying the light intensity as well as the distance of the light source.	2	02
4	3	Build/ Test the half wave rectifier on bread board	3	02
5		Build/ Test the half wave rectifier on bread board with LC filter/ π filter.	3	02
6		Build/ Test the full wave rectifier on bread board using two diodes	3	02
7		Use LC/ π filter with full wave rectifier to measure ripple factor	3	02
8		Assemble positive clipper circuit on breadboard and test the performance	3	02
9		Assemble negative clipper circuit on breadboard and test the performance	3	02
10.		Build the combinational clipper on breadboard and test the performance.	3	04
11		Build positive clamper on breadboard and test the performance	3	02
12		Build negative clamper on breadboard and test the performance	3	02
13	4	Identify the terminals of the PNP and NPN transistor using different methods.	4	02
14		Find specifications of a given transistor using data sheets.	4	02
15		Test the performance of BJT working	4	02

		in CB/CE mode		
16		Test the assembled BJT voltage divider bias circuit for given input	4	02
17	5	Test the performance of transistorized series voltage regulator for the given load regulation.	5	02
18		Test the performance of transistorized shunt voltage regulator for the given load regulation	5	02
19		Test the various blocks of regulated dc power supply .	5	02
20		Find out faults at different stages of regulated dc power supply.	5	02
21		Trouble shoot given DC regulated power supply	5	02
22	All	Complete a Micro- project based on guidelines provided in sr.no. 11.	All	04
		Total Hrs		**32**

Note: Any 12 practicals from sr. no. 1 – 21 can be performed and 22 is compulsory.

Sr.No.	Performance Indicators	Weightage in %
a.	Preparation of experimental setup	20
b.	Setting and operation	20
c.	Safety measures	10
d.	Observations and Recording	10
e.	Interpretation of result and Conclusion	20
f.	Answer to sample questions	10
g.	Submission of report in time	10
Total		**100**

6. MAJOR EQUIPMENT/ INSTRUMENTSREQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practical, as well as aid to procure equipment by authorities concerned**.**

Sr.No.	Major Equipment/ Instruments Required	Experiment Sr. No.
1	Analog multimeter& Digital multimeter	ALL
2	CRO	4,5,6,7,8,9,10,11,15,16,
3	Function Generator	4,5,6,7,8,9,10,11
4	Different types of cables and connectors	ALL
5	Variable DC Power supply 0-30V with display for voltage and current	1,2,3,8,9,10,11,12,13

7. THEORY COMPONENTS

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
UNIT 1 : Passive Components(Weightage-14, Hrs- 12)	
1a.Indentify different types of Resistors to know its specification 1b. Identify different types of Capacitors to know its specification. 1c. Differentiate between different type of Resistors. 1d. Differentiate between different type ofCapacitors.	1.1 Resistors: Classification of Resistors, Colour coding: with three, four, five Bands 1.2 Fixed value resistor:Specification, constructional diagram, application: Carbon composition resistor, Carbon film resistor, Metal oxide film resistor, Wire wound resistors. 1.3 Variable value resistor : Specification, constructional diagram, application: linear and logarithmicPotentiometer 1.4 Classification of Capacitors, Dielectric material used in capacitor, Capacitor Specification: working voltage, capacitive reactance, frequency characteristics 1.5 Fixed capacitor: Specification & application, Electrolytic capacitor: Constructional diagram & working, variable capacitor: Air gang, PVC gang capacitor, trimmer capacitor. 1.6 Coding of capacitor using numerals, colour band system.
UNIT 2 : Semiconductor Diode(Weightage- 18 , Hrs-12)	
2a. Describe the construction & working of principal of semiconductor diode 2b. Differentiate between conductor, Insulator, Semiconductor. . 2c Describe working principle, characteristics, and application of the given type of diode. 2d. Describe effect of temperature on the given type of diode	2.1Difference between conductor, insulator, , semiconductor 2.2 N type material, P type material 2.3 Different types of Semiconductor 2.4 Diodes and their materials 2.5 Energy band theory and effect of Temperature 2.6 Construction, Symbol, working principle, applications, Forward & reverse biasing& V-I characteristics of following diodes: P-N junction diode, Zener diode, LED, Photo diode, LDR, Schottky diode, PIN diode, Tunnel Diode.
UNIT 3 : Application of Diodes(Weightage- 18 , Hrs- 14)	

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
3a. Describe working of given type of rectifier. 3b. Calculate ripple factor, PIV, and efficiency of the given type of filter. 3c. Describe the need and working of rectifier filter circuit. 3d. Select clipper or clamper for obtaining the given waveform.	3.1Types of Rectifier : Half wave, Full wave (bridge rectifier and center tapped): circuit operation, Input- output waveform for voltage & current. 3.2 Parameters of rectifier: Average DC value, value of current & voltage, ripple factor, ripple frequency, PIV of diode, TUF, efficiency of rectifier 3.3 Types of Filters: Shunt capacitor, Series inductor , LC and CLC filter. 3.4 Clipper & Clamper circuits.
UNIT 4: Bipolar Junction Transistor(Weightage- 18 , Hrs- 14)	
4a.Describe the working principle of the given type of transistor. 4b.Compare configuration of transistors. 4c. Justify the need of biasing method. 4d. Describe the procedure to minimize the thermal runaway effect for the given type of transistor biasing circuit.	4.1 Current operating device 4.2 Different types of transistors: PNP, NPN 4.3 Transistor configurations: CB, CE, CC Transistor characteristics (input,output) in different transistor configuration. Relation between α, β, γ, Comparison between CB, CC & CE. 4.4 BJT biasing: Need,DC load Line,Operating point, stabilization, thermal runaway.Types of biasing: fixed biasing, basebias with emitter feedback, voltage divider
UNIT 5 : Regulators and Power supply(Weightage- 12 , Hrs- 12)	
5a. Describe working of the given transistorized regulator. 5b. Describe the working of the given block of the DC regulated power supply in the block diagram. 5c. Calculate output voltage of the	5.1 Basic block diagram of DC regulated power supply 5.2 Load and Line regulation 5.3 Zener diode voltage regulator 5.4 Transistorized series and shunt regulator:

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
given Zener voltage regulator circuit. 5d. Calculate load and line regulation of the given transistorized regulator .	Circuit diagram and working

8. SUGGESTED SPECIFICATION TABLE FORQUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Passive Components	12	04	06	04	14
II	Semiconductor Diode	12	04	06	08	18
III	Application of Diodes	14	04	06	08	18
IV	Bipolar Junction Transistor	14	04	06	08	18
V	Regulators and Power supply	12	02	04	06	12
Total		**64**	**18**	**28**	**34**	**80**

9. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a. Prepare journals based on practical performed inlaboratory.
b. Test different diode using CRO.
c. Give seminar on any relevant topic.
d. Library survey regarding different data books and manuals.
e. Collect information of passive component and prepare charts of the same.
f. Undertake a market survey of different semiconductor components.

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the

development of the COs through classroom presentations (see implementation guideline for details).

c. With respect to item No.9, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
d. Guide student(s) in undertaking micro-projects.
e. Correlate subtopics with power plant system and equipments.
f. Use proper equivalent analogy to explain different concepts.
g. Use Flash/Animations to explain various components, operation and
h. Teacher should ask the students to go through instruction and Technical manuals

11. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs.(Affective Domain Outcomes) .Each student will have to maintain activity chart consisting of individual contribution in the project work and give a seminar presentation of it before submission.. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

a. Prepare a chart of different types of Resistors showing their specifications and applications
b. Prepare chart of different types of Capacitors showing their specifications and Applications
c. Prepare a chart of different types of Diodes showing their specifications and Applications
d. Prepare a chart of different types of Rectifiers showing their specifications and applications
e. **Diode:** Build a circuit on general purpose PCB to clip a positive half cycle at 1.5V of a waveform with input signal 5Vpp and prepare the report.
f. **Diode :**Build a circuit on general purpose PCB to clamp a waveform at 3V using diode and passive component.
g. **Rectifier :** Build a half wave rectifier for 6V,500mA output current on general purpose PCB.
h. **Rectifier :**Build a full wave rectifier with capacitor filter for 6V,500mA output current on general purpose PCB.
i. **BJT** : Build a circuit to switch on and off the LED by using BJT as a switching component.

J.**Voltage Regulator** : Build a circuit of DC regulated power supply on general purpose PCB for 12V and 500mA output.

12. SUGGESTED LEARNING RESOURCES

S.N.	Title	Author	Publisher, Edition ,Year of publication and ISBN Number
1	Basic Electronics.	Albert Malvino	8th Edition,Tata McGraw Hill ,2015ISBN10:1259200116 ISBN13:9781259200113
2	Basic Electronics.	J.S.Katre. 2017, Techmax Publishers	Edition2017, Techmax PublishersISBN-10: 9350779641 ISBN-13: 978-9350779644
3	Basic Electronics.	B.L.Theraja, S Chand	Publishing, 2007, ISBN 10: 8121925568ISBN 13: 9788121925563
4	Applied Electronics	R.S.Sedha	S.Chand&company Ltd., New Delhi,ISBN:8121927833
5	Electronics Device andCircuits	P.Ramesh Babu	Scitech PublicationPvt.Ltd 2009 ,ISBN:8183711723
6	Electronics Circuit and Circuit theory	RoberrL.Boylestead	Louis Neshelsky,PearsonISBN 13: 978-0132622264

13. SOFTWARE/LEARNING WEBSITES

1. www.nptel.com
2. http://www.electronics-tutorials
3. https://en.wikipedia.org/wiki/P%E2%80%93n_junction
4. https://learn.sparkfun.com/tutorials/transistors
5. http://www.pitt.edu/~qiw4/Academic/ME2082/Transistor%20Basics.pdf
6. http://faculty.cord.edu/luther/physics225/Handouts/transistors_handout.pdf
7. http://www.technologystudent.com/elec1
8. www.slideshare.net/manash234/classification-of-transducers
9. http://www.electrical4u.com/linear-variable-differential-transformer/

14. PO - COMPETENCY- CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	-	1	3	-	-	2
CO2	3	-	3	2	-	2	2
CO3	3	3	3	2	-	2	2
CO4	2	2	2	3	-	2	2
CO5	3	2	3	3	-	2	3

	PSO1	PSO2	PSO3
CO1	3	-	3
CO2	3	-	3
CO3	3	-	3
CO4	3	-	3
CO5	3	-	3

Sign: Name: Smt. S.S.Chhatwani Smt. P.M.Zilpe (Course Experts)	Sign: Name: Shri.R.N.Shikari (Head of Department)
Sign: Name: Shri.R.N.Shikari (Program Head) (E & TC Department)	Sign: Name: Shri A.S.Zanpure (CDC)

Government Polytechnic, Pune

'180OB' – Scheme

Programme	Diploma in **Electronics&Telecommunication Engineering**
Programme code	01/02/**03**/04/05/06/07/08/15/16/**17**/18/19/21/22/**23**/24/26
Name of Course	**C language Programing**
Course Code	**ET2102**
Prerequisite course code and name	**NA**
Class Declaration	**NO**

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)		Examination Scheme				
					Theory		Practical		Total Marks
L	T	P	C		ESE	PA	*ESE	PA	
03	01	02	06	Marks	80	20	25	50	175
				Exam Duration	3 Hrs	1 Hr	-	-	

(*):POE(Practical & Oral Examination)

Legends: L-lecture, T-Tutorial/teacher guided theory practice, P-practical, ESE-End semester examination, PA- Progressive Assessment, # - Online theory exam

2. RATIONALE

Programming language C is a versatile language used in many microcontroller based applications. This course deals with concepts of programing to enhance programming skills of diploma students. This course will enable the student to inculcate programming concepts and methodology to solve engineering problems.

3. COMPETENCY

The aim of this course is to attend following industry identified competency through various teaching learning experiences:

- **Develop 'C' program to solve broad based electronic engineering related problems.**

4. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency**:**

1. Interpret the basic code of „C'.
2. Implement decision making in 'C' programming.
3. Use Arrays and string in 'C' programming.
4. Use function in 'C' programs for modular programming approach.
5. Use pointer to increase efficiency of programs.
6. Implement basic concept of structure in 'C'.

5. SUGGESTED PRACTICALS/ EXERCISES

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Relevant CO	Approximate Hours Required.
1	1	Write algorithm and draw flow chart for following programs : A) Addition/Subtraction of Two numbers B) Exchange value of Two variables	1	02
2		Write the Program to display the message "Hello GPP", name, address, date of birth and email id using printf() function.	1	02
3		Write a program to demonstrate use of Logical Operators.	1	02
4		Write a program to demonstrate use of Arithmetic operators.	1	02
5		Write a program to check whether entered year is leap or not.	1	02
6		Write a program to demonstrate use of Conditional operator.	1	02
7	2	Write a program to demonstrate use of if, if-else, nested if-else statements.	2	02
8		Write a program to demonstrate the use of switch case statements.	2	02
9		Write a program to demonstrate the use of for loop.	2	02
10.		Write a program to demonstrate the use of while, do while .	2	02
11	3	Write a program to declare , modify and print elements of a given data array.	3	02
12		Write a program to copy one array into second array for given data elements.	3	02
13		Write a program to sort numbers in ascending and descending in a given array.	3	02
14		Write a program to accept a string from user and print that string	3	02

15		Write a program to demonstrate the use of all string handling functions.	3	02
16	4	Write the program to add two numbers using function.	4	02
17	5	Write a program to use address operator(&) and pointer operator(*)for given data.	5	02
18		Write a program to access the array elements using pointer.	5	02
19		Write a program to exchange given values of two variables using pointer.	5	02
20	6	Create structure DATA using „C' having members day, month, year and assign initial values to that structure	6	02
21	All	Complete a micro project based on guidelines provided in Sr. No. 11	All	04
		Total Hrs		**32**

Note: Any 12 practicals from sr. no. 1 – 20 can be performed and 21 is compulsory.

S.No.	Performance Indicators	Weightage in %
a.	Write algorithm and draw flow chart	20
b.	Use C software tool for programming	20
c.	Debug, test and execute the program	10
d.	Observations and Recording	10
e.	Interpretation of result and Conclusion	20
f.	Answer to sample questions	10
g.	Submission of report in time	10
Total		**100**

6. MAJOR EQUIPMENT/ INSTRUMENTSREQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practical, as well as aid to procure equipment by authorities concerned**.**

Sr.No.	Major Equipment/ Instruments Required	Experiment Sr. No.
1	Hardware: Personal computer	For all Experiments
2	Operating system: Windows XP/Windows 7	
3	Software: Turbo C	

7. THEORY COMPONENTS

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
UNIT 1. OVERVIEW OF 'C' Programing (Weightage-14 , Hrs-08)	
1a.Comprehend the basic structure of C programming language. 1b. Differentiate between keywords and identifiers 1c. Describe the given data types. 1d. Construct algorithm ,flow chart for given program 1e. Manage input and output operations 1f. Use pre-increment and post-increment operators in given situation. 1g. Use bitwise operators in the given situation.	1.1 Introduction: Development of „C' language, Importance of „C' 1.2 Basic structure of 'C' program, programming style, Sample 'C' programs, Execution process of 'C' program. 1.3 'C' Character set- Keywords, Identifiers, types of constants (Integer, single character, string and real) variables, concept of ASCII 1.4 Data types: integer–unsigned, signed ,long, float, double, character, string, octal, hexadecimal. 1.5 Algorithm and flow chart 1.6 Formatted input and output statements .Input and output function. 1.7 Operators and expressions: i. Operators in 'C': Arithmetic, Conditional, Increment and decrement, bit wise ,special operator ii Expressions- Arithmetic expressions, Evaluation of expressions, Operators precedence and associativity
UNIT 2DECISION CONTROL & LOOP CONTROL (Weightage-16 , Hrs-10)	
2a. Write a „C' program using the decision making structure for two way branching. 2b. Write a „C' program using the decision making structure for multi way branching. 2c. Write a „C' program using loop statements to solve the given problem. 2d. Use related statements to alter the program flow in the given loop.	2.1 Introduction to decision making and branching. 2.2 Decision making with simple if statement, if...else statement, Nested if...else statement, switch statement, ? : Conditional operator, go to statement 2.3 Introduction to Loop control statement: while statement, do-while statement, for statement, break and continue statements ,nested loops
UNIT 3 Array and String (Weightage- 16 , Hrs- 10)	

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
3a. Write steps to access elements of given array. 3b. Write steps to perform operation on the given array. 3c.Write steps to initialization and declaration of given string. 3d.Apply relevant control statement on the given strings to manipulate its elements.	3.1 Introduction to array and its types 3.2 Declaration, initialization of array, accessing elements of an array, adding, deleting, sorting and searching. 3.3 Introduction to String initialization, declaring and display of string. 3.4 String handling functions- strcat(), strcmp(), strcpy(), strlen(),strlwr(),strupr()
UNIT 4 FUNCTIONS(Weightage- 14 , Hrs-08)	
4a. use inbuilt function for the given program. 4b. Develop relevant user defined function for given program. 4c. Create programs based on categories of user defined functions. 4d.Write recursion function for the given problem.	4.1 Concept and need of Function. 4.2 Library function :Math function ,string handling function ,other miscellaneous function. 4.3 Elements of user defined functions, Calling a user defined function, Categories of user defined functions- No argument- No return value, Argument- No return value, No argument- Return value, Argument- Return value. 4.4 Recursion function
UNIT 5 Pointers (Weightage- 10, Hrs-06)	
5a. Use pointer for address access to manipulate the given data. 5b. Use pointer to access memory location to solve the given problem. 5c. Recognize the importance of Pointers.	5.1 Pointer concept 5.2 & (Address) and * (Indirection) operators 5.3 Declaration and Initialization of pointer variables ,Accessing a variable through its pointer 5.4 Conceptual knowledge of Handling arrays and function using Pointers (No programs)
UNIT 6 Structures (Weightage- 10 , Hrs-06)	
6a. Create a structure for given data. 6b. Develop a program to access elements of structure	6.1 Introduction and features and syntax of structure. 6.2 Declaring and Initialization of structure 6.3 Initialization, Accessing structure members using pointer 6.4 Type def, Enumerated data types ,using structures in C program.

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
using pointers. 6c. Use the enumerated data type in structure to solve the given program.	

8. SUGGESTED SPECIFICATION TABLE FORQUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Overviewof 'C' Programing	08	02	06	06	14
II	Decision Control & Loop Control	10	04	06	06	16
III	Array and String	10	04	06	06	16
IV	Functions	08	02	06	06	14
V	Pointers	06	02	04	04	10
VI	Structures	06	02	04	04	10
Total		48	**16**	**32**	**32**	**80**

9. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a. Prepare journals based on practical performed in laboratory.
b. Give seminar on relevant topic.
c. E book survey regarding 'C' used in electronic industries
d. Prepare PPT for showing different types of „C' applications
e. Find and utilize android application related to „C,
f. Undertake a market survey of different 'C' application sensors in remote controls.

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
c. With respect to item No.9, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.

d. Guide student(s) in undertaking micro-projects.
e. Correlate subtopics with power plant system and equipment.
f. Use proper equivalent analogy to explain different concepts.
g. Use Flash/Animations to explain various components, operation and
h. Teacher should ask the students to go through instruction and Technical manuals

11. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***
The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs.(Affective Domain Outcomes) .Each student will have to maintain activity chart consisting of individual contribution in the project work and give a seminar presentation of it before submission.. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.
A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

a. Simple Calculator: driven program to perform any four mathematical operation Each group will prepare a menu
b. Modern Periodic Table Using 'C': Each group will prepare a periodic table using functions „Void add()' and „Void show() „.
c. Digital Clock Using „C'
d. Employee Record System : Each group will prepare a menu driven program to perform following operation
   1.Add Record
   2.List Record
e. String Manipulation Project : Each group will prepare a menu driven program to perform following operation. (Any two)
   1. Sub Strings
   2.Reverse String
   3.String Integer
   4.Sort a string

f. Matrix operations :Each group will prepare a menu driven program to perform following operation. (Any two)
   1. Matrix addition
   2. Matrix Multiplication
   3. Matrix Transpose
   4. Sum of Diagonal of Matrix

g . Patterns: Each group will prepare a menu driven program to perform following operation. (Any two)

1	1	*	1
121	12	**	22
12321	123	***	333
1234321	1234	**	4444
123454321	12345	*	55555

12. SUGGESTED LEARNING RESOURCES

S.N.	Title	Author	Publisher, Edition , Year of publication and ISBN Number
1	Programming in 'C'	Balguruswamy,	Tata McGraw Hill,2012ISBN :978-1-25-9000461-2
2	Let us „C'	Kanetkar	Edition 2017, BPB Publications 2016 , ISBN : 9788183331630

13. SOFTWARE/LEARNING WEBSITES

1. Turbo C editor
2. Dosbox
3. www.tutorialspoint.com/c programming
4. www.c programming.com
5. http://www.c4learn.com/c-programs/

14. PO - COMPETENCY- CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	-	2	2	-	-	2
CO2	3	-	2	2	-	-	2
CO3	3	3	2	2	-	-	2
CO4	1	-	-	3	-	-	2
CO5	3	2	2	2	1	-	3
CO6	2	2	2	2	-	-	3

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-
CO6	3	-	-

Sign: Name: Smt. S.S.Chhatwani Smt. P.M.Zilpe (Course Experts)	Sign: Name: Shri.R.N.Shikari (Head of Department)
Sign: Name: Shri.R.N.Shikari (Program Head) (E & TC Engg Dept.)	Sign: Name: ShriA.S.Zanpure (CDC)

Government Polytechnic, Pune

'180OB' – Scheme

Programme	Diploma in **Electronics&Telecommunication Engineering**
Programme code	01/02/**03**/04/05/06/07/08/15/16/**17**/18/19/21/22/**23**/24/26
Name of Course	**Electronic Workshop**
Course Code	**ET2103**
Prerequisite course code and name	**NA**
Class Declaration	**NO**

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)		Examination Scheme				
					Theory		Practical		Total Marks
L	T	P	C		ESE	PA	*ESE	PA	
01	00	04	05	Marks			25	50	75
				Exam Duration	NA	NA	-	-	

(*):POE (Practical & Oral Examination mention whichever is applicable)
Legends: L-lecture, T-Tutorial/teacher guided theory practice, P-practical, ESE-End semester examination, PA- Progressive Assessment, # - Online theory exam

2. RATIONALE

This course of 'Electronics Workshop Practice' is aimed to provide the students with more hands-on experience and also enable them to test different types of electronics components, different basic electrical instruments, cables/wires used in electrical & electronics circuit and develop simple PCB circuits. Selection of components, wiring, soldering, de-soldering, testing and troubleshooting, are some of the basic skills required by industry from any electronics engineering diploma holder.

3. COMPETENCY

The aim of this course is to attend following industry identified competency through various teaching learning experiences:

- **Build /test simple electronic circuit on breadboard and PCBs**.

4. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency**:**

1. Identify the different types of electronics components and equipment.
2. Identify the colour coding and calculate values of resistor, capacitor &inductor
3. Test and observe different types of electronics component response.
4. Design and test PCB circuit.

5. SUGGESTED PRACTICALS/ EXERCISES

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Relevant CO	Approximate Hours Required.
1	ALL	Identify the different controls of electronic lab. equipment's (Analogmultimeter, Digital multimeter, CRO, Function generator and IC Tester)	1	02
2	ALL	Observe the square wave, triangular wave and sine wave generated by function generator and measure their amplitude and frequencies	2	02
3	ALL	Identify various electronics components by physical observation	1	02
4	1	Test resistor, capacitors, inductor and diodes using CRO	3	02
5	1	Verify values of resistors and capacitors by colour codes and compare with actual values.	2	02
6	1	Study specification of R, L and C from data manual	3	02
7	ALL	Test various components by analog/digital multimeter	3	02
8	ALL	Identify various semiconductor devices by physical observation.	1	02
9	ALL	Write specification of components from data books	3	02
10.	2	Test various switches and relays.	3	02
11	3	Identify various cable and connectors by physical Observation.	1	02
12	3	Test various cable and connectors.	3	02
13	4	Identify various transformers.	1	02
14	4	Test various transformers.	3	02
15	5	Identify various display devices by physical observation.	1	02
16	5	Test various display devices.	3	02
17	5	Identify various microphones and speakers by physical observation.	1	02
18	ALL	Test various types of ICs by IC tester.	3	02
19	1-6	Prepare charts related to symbol and application of all components (unit1 to unit6) by group of	1,2,3	02

		maximum 3 students.		
20	**7**	Introduction and use of any one electronic circuit design software	4	04
21	**7**	Practice of PCB layout drawing using software and manually.	4	04
22	**7**	Practice of etching.	4	04
23	**7**	Practice of drilling.	4	04
24	**7**	Practice of soldering.	4	04
25	**7**	Continuity testing.	4	02
26	**7**	Prepare Presentation (PPT) on their project work	4	04
27	All	Complete a Micro- project based on guidelines provided in sr.no. 11.	All	04
		Total Hrs		**64**

Note: Any 20 practicals from sr. no. 1 – 26 can be performed and 27 is compulsory.

S.No.	Performance Indicators	Weightage in %
a.	Arrangement of available equipment / test rig or model	20
b.	Setting and operation	20
c.	Safety measures	10
d.	Observations and Recording	10
e.	Interpretation of result and Conclusion	20
f.	Answer to sample questions	10
g.	Submission of report in time	10
Total		**100**

6. MAJOR EQUIPMENT/ INSTRUMENTSREQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practical, as well as aid to procure equipment by authorities concerned**.**

S. No.	Equipment Name with Broad Specifications	Experiment Sr. No.
1	Analogmultimeter& Digital multimeter	ALL
2	CRO	1,2,4
3	Function Generator	1,2
4	Different types of cables and connectors	ALL
5	Different resistor, capacitors, inductor, diodes, switches, transformers, display and relays, IC.	4,5,7,12,14,16,18
6	(Open source)electronic circuit design software, computer	20,21

7. THEORY COMPONENTS

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit-I Active and Passive Component (Weightage-14, Hrs- 12)	
1a.Identify different types of passive components. 1b. Differentiate between resistor, capacitor and inductor. 1c. Find the values of resistor, capacitor and inductor using color code. 1d. Identify different types of active components. 1e. Differentiate between passive and active components.	1.1 Passive components: Introduction to Resisters, Capacitors & Inductors, Types of Resisters, Capacitors & Inductors, color codes, Specifications, testing. 1.2 Active components : Testing of semiconductor diode, zener diode, LED, BJT,FET, UJT,SCR by multimeter
Unit-II Switches and Relays	
2a. List the different types of switches and relays. 2b. write specification of switches and relays. 2c. write application of switches and relays. 2d. Test switches and relays.	2.1Types of Switches & Relays, specifications, applications, testing
Unit-III Cable & connectors	
3a. Identify different types of cables and connectors. 3b. List applications of cables and connectors. 3c.List specification of cables and connectors. 3d.Test cables and connectors.	3.1Types of Cable & connectors, applications, specification, testing.
Unit-IV Transformer	
4a. Identify different types of transformer. 4b. List applications of transformer 4c.List specification of transformer 4d.Test different types of transformer	4.1Types of Transformer, applications, specification , testing

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit-V IC and Display Devices	
5a.Identify different types of display devices. 5b. List applications of display devices 5c.List specification of display devices 5d.Test different types of display devices	5.1Introduction of IC.Types of Display Devices, applications, specification, testing.
Unit-VI Microphones & Speakers	
6a. Identify different types of Microphones & Speaker 6b. List applications of Microphones & Speaker 6c. List specification of Microphones & Speaker 6d.Test different types of Microphones & Speaker	6.1Types of Microphones & Speaker, applications, specification, and testing.
Unit-VII Introduction to PCB manufacturing	
7a. List the rules of layout of circuit 7b. Explain the process of etching. 7c.Explain the types of soldering	7.1 PCB layout drawing, etching, drilling, soldering. Latest design software Specification and Use any one design software like Kicad, circuit maker. I

8. SUGGESTED SPECIFICATION TABLE FORQUESTION PAPER DESIGN

NA

9. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a. Prepare journal based on practical performed in laboratory.
b. Search & collect Data sheet of different component

c. Study various knobs functions & use of different electronic instrument used inlaboratory
d. Identify & test R,L,C,RELAY,SWITCHES,TRANSFORMERS,CABLES components with the help of instruments.
e. Prepare charts of electronics symbol & Applications.
f. Search, download & use one open source electronic circuit design software.
g. Search & Select one micro project.
h. Build & test micro project.
i. Prepare PPT & make Presentation on micro project.

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
c. With respect to item No.9, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
d. Guide student(s) in undertaking micro-projects.
e. Use Flash/Animations to explain various components, operation and
f. Teacher should ask the students to go through instruction and Technical manuals

11. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs.(Affective Domain Outcomes) .Each student will have to maintain activity chart consisting of individual contribution in the project work and give a seminar presentation of it before submission.. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

a. Prepare chart showing comparison of various types of resistors used in the electronics industry.
b. Prepare a chart showingtypes of Switches & Relays, specifications, applications.
c. Build heat sink for the given specifications.
d. Build a cabinet for the given circuit/ equipment/ instrument.
e. Solder components on PCB and check the continuity.
f. Test the active and passive components connected in the given electronic equipment.

g. Prepare small report on market survey on diodes used in the small electronics industry.
h. Prepare the specifications of active and passive components and their manufacturers with addresses.
i. Prepare the specifications of CRO and function generator of any one manufacturer.
j. Prepare brief report on various display devices with their applications.

12. SUGGESTED LEARNING RESOURCES

Sr.no	Tittle of book	Author	Publisher, Edition ,Year of publication and ISBN Number
1	Printed Circuit Boards: Design and Technology	Bossart	TMH, 2008 or latest edition ISBN-10:0776602373
2	Build Your Own Printed Circuit Board	Al Williams	McGrawHill, 2003 or latest edition ISBN-10:1098078047
3	Electronics Material & components	Mrs. Madhuri Joshi	3/Ed 3rd Edition ISBN-10:1649516991

13. SOFTWARE/LEARNING WEBSITES

1. http://circuiteasy.com
2. www.expresspcb.com/expresspcbhtm/download.htm
3. www.freepcb.com
4. http://www.circuitstoday.com/simple-electronics-projects-and-circuits
5. http://www.buildcircuit.com/5-beginners-projects-that-work-in-the-first-attempt

14. PO - COMPETENCY- CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2	3	-			2	1
CO2	-			2		2	1
CO3	-		3	3		2	
CO4			3	3		3	3

Course Outcomes	**Program Outcomes (PSOs)**		
	1	**2**	**3**
1	3	--	--
2	3	1	--
3	3	2	2
4	3	2	3

Sign: Name: Smt. N.S.Bakde Smt.A.M.Kulkarni (Course Experts)	Sign: Name:Shri.R.N.Shikari (Head of Department)
Sign: Name: Shri.R.N.Shikari (Program Head) (E & TC Department)	Sign: Name: Shri. A. S. Zanpure (CDC)

Government Polytechnic, Pune

'180OB' – Scheme

Programme	Diploma in **Electronics&Telecommunication Engineering**
Programme code	01/02/03/04/05/06/07/08/15/16/**17**/18/19/21/22/23/24/26
Name of Course	**Industrial Measurement**
Course Code	**ET2104**
Prerequisite course code and name	**NA**
Class Declaration	**NO**

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)		Examination Scheme				
					Theory		Practical		Total Marks
L	T	P	C		ESE	PA	*ESE	PA	
04	-	02	06	Marks	80	20	25	25	150
				Exam Duration	3 Hrs	1 Hr	-	-	

(*):POE (Practical & Oral Examination)

Legends: L-lecture, T-Tutorial/teacher guided theory practice, P-practical, ESE-End semester examination, PA- Progressive Assessment, # - Online theory exam

2. RATIONALE

The science of instrumentation system plays vital role in the development of technology. Different types of transducers used for measurement of different physical quantities with their construction, working principle, advantages, and disadvantages are studied through this subject.

3. COMPETENCY

The aim of this course is to attend following industry identified competency through various teaching learning experiences:

- Maintain Industrial instruments and Measurements.

4. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

1. Use various type of transducer to measure the quantities.
2. Select the relevant transducer for given range of pressure measurement with justification.

3. Select the relevant transducer for given range of flow measurement with justification.
4. Explain the working principle of various type of transducer for level measurement.
5. Explain the working principle of various type of transducer for measurement of temperature.
6. Select the relevant transducer for given range of humidity measurement with justification.

5. SUGGESTED PRACTICALS/ EXERCISES

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Relevant CO	Approximate Hours Required.
01	01	Identify different type of Sensors or Transducer	1	02
02	02	Measurement of Pressure by using Pressure measuring devices :U tube.	2	02
03	02	Measurement of Pressure by using Pressure measuring devices : Inclined Tube	2	02
04	02	Measure the Electronic pressure by usingDiaphragm with Strain gauge	2	02
05	03	Measurement of flow using rotameter.	3	02
06	03	Measurement of Flow Using orifice plate meter	3	04
07	04	Measurement of Water Level using Capacitance type of Level Sensor .	4	02
08	04	Measure the Water level by using potentiometer	4	02
09	05	Measurement and control of temperature using Resistance Temperature Detector(RTD.)	5	02
10	05	Measurement and control of Temperature using Thermocouple.	5	04
11	05	Measurement and control of Temperature using Thermister.	5	02
12	06	Measurement of Humidity by using Hygrometer.	6	02
13	All	Complete a Micro- project based on guidelines provided in sr.no. 11.	All	04
		Total Hrs		**32**

Note: All practicals are compulsory.

Sr.No.	Performance Indicators	Weightage in %
a.	Arrangement of available equipment / test rig or model	20
b.	Setting and operation	20
c.	Safety measures	10
d.	Observations and Recording	10
e.	Interpretation of result and Conclusion	20
f.	Answer to sample questions	10
g.	Submission of report in time	10
Total		100

6. MAJOR EQUIPMENT/ INSTRUMENTSREQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practical, as well as aid to procure equipment by authorities concerned.

Sr.No.	Major Equipment/ Instruments Required	Experiment Sr. No.
01	Different type of Sensors	01
02	U tube , Inclined Tube, Well type manometer. Bourdon tube with LVDT Diaphragm with Strain gauge	02 ,03,04
03	RotameterOrifice plate meter …	05,06
04	Capacitance type of Level Sensor ,Linear & rotary Potentiometer	07 ,08
05	RTD ,Thermocouple, Thermister .	09,10,11
06	Hygrometer	12

7. THEORY COMPONENTS

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
UNIT 1. Transducers (Weightage- 14 , Hrs-12)	
1a.classify different type of transducer. 1b.describe the function of the given block of instrumentation system with the help of suitable block diagram. 1c.select the relevant transducer for given application with justification. 1d.select the relevant transducer for the given range of displacement measurement with justification	1.1 Instrumentation System: Block diagram of Instrumentation system: Function of each block, Explanation of basic instrumentation systems 1.2 Transducer: Need of Transducer: Classification of transducers: Active and Passive, Analog and Digital, Primary and Secondary. 1.3 Electrical Transducers: Resistive transducers- Linear & Angular potentiometers Capacitive transducer Inductive transducer –LVDT, RVDT (As a displacement transducer) Piezoelectric transducer (Principle of operation and applications of above) 1.4 Selection criterion of transducers.
UNIT 2. Pressure measurement(Weightage-12 , Hrs-10)	
2a.Define pressure and state its type. 2b.Classify the different pressure measuring devices. 2c.Explain Inclined Tube Well type manometer with diagram 2.d Differentiate between elastic pressure transducer and Non elastic pressure transducer	2.1 Pressure: Definition Types - Absolute, Gauge, Atmospheric, Vacuum(Definition, Units) 2.2 Classification of Pressure measuring devices 2.3 Non elastic pressure transducer: U tube ,Inclined Tube, Well type manometer. 2.4 Elastic pressure transducer: Bourdon Tube Bellows Diaphragm 2.5 Electronic pressure transducers: Bourdon tube with LVDT Diaphragm with Strain gauge

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
UNIT 3 Flow measurement : (Weightage- 16 , Hrs- 12)	
3.a Define flow and explain different type of flow. 3.b classify different flow measuring transducer 3.cdiscribe the working principle of variable head flow meter. 3.d. Differentiate between – Rota meter Electromagnetic Flow meter.	3.1 Flow: Definition Types of Flow –Laminar, turbulent, Reynolds number 3.2 Classification of flow measuring transducers : Variable head flow meter- Venturi meter, orifice plate meter 3.3 Variable area flow meter – Rota meter Electromagnetic Flow meter.
UNIT 4. Level measurement: (Weightage- 16 , Hrs-12)	
4.a State the need of Level measurement. 4.b Classify the different type of level measurement. 4.c.Enlist different float type measurement explain the working of rotary potentiometer. 4.d.Explain the working principle of ultrasonic type and Radiation measurement.	4.1 Level: Definition Need of level measurement 4.2 Classification of level measurement methods: Float type – linear & rotary potentiometer (Contact type) Capacitive type (Contact type) Ultrasonic type (Non-contact type) Radiation type (Non-contact type)
UNIT 5 Temperature Measurement (Weightage- 14 , Hrs-10)	
5.a Define Temperature, state Different temperature scales & their conversions 5.b Classify temperature measuring transducer. 5.c Explain the working principle of Gas filled thermometer and Bimetallic thermometer 5.d.draw the circuit diagram of two wire system 5.e discuss the Seeback&Peltier effect of thermocouple	5.1 Temperature : Definition and units Different temperature scales & their conversions 5.2 Classification of temperature measuring transducers: Gas Filled thermometer. Bimetallic thermometer Thermistor, RTD – (PT-100) , wire systems (circuit diagram only) Thermocouple – See back &Peltier effect , Types J, K, R , S, T (Based on material, temperature ranges) Pyrometer - Optical, Radiation
UNIT 6 : Humidity Measurement (Weightage- 08 ,Hrs- 08)	
6.a Define humidity ,enlist different type of humidity. 6.b Describe the working principle of dry and wet Bulb . 6.c. Classify the speed measurement methods. 6.d Explain the working principle of photoelectric Pick-up.	6.1 Humidity: Definition Types - Absolute, relative . 6.2 Humidity measurement devices: Psychrometer- Dry & wet Bulb thermometer type Hygrometer- hair type 6.3 Speed Definition , Classification of speed measurement methods - Photoelectric pick-up (Non contact type) ,Magnetic pick up.

8. SUGGESTED SPECIFICATION TABLE FORQUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Transducers	12	06	04	04	14
II	Pressure measurement	10	04	04	04	12
III	Flow measurement :	12	06	06	04	16
IV	Level measurement	12	06	06	04	16
V	Temperature Measurement	10	06	04	04	14
VI	Humidity Measurement	08	04	02	02	08
Total		64	32	26	22	80

9. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related *co-curricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a. Prepare journals based on practical performed inlaboratory.
b. Download the datasheet of different type of sensors, and study it.
c. Prepare the documentation of all the component /Sensor along with their Specification
d. Deliver the Seminar on relevant Topic.
e. Collect information of passive transducers and prepare charts of the same.
f. Library /Web Survey regarding the different data books & Manual.
g. Undertake the survey of different type of sensors.
h. Use the Safety Precautions.

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (*MOOCs*) may be used to teach various topics/sub topics.
b. About *15-20% of the topics/sub-topics* which is relatively simpler or descriptive in nature is to be given to the students for *self-directed learning* and assess the development of the COs through classroom presentations (see implementation guideline for details).
c. With respect to item No.9, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
d. Guide student(s) in undertaking micro-projects.
e. Correlate subtopics with automation.
f. Use proper equivalent analogy to explain different concepts.
g. Use Flash/Animations to explain various components, operation and
h. Teacher should ask the students to go through instruction and Technical manuals

11. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs.(Affective Domain Outcomes) .Each student will have to maintain activity chart consisting of individual contribution in the project work and give a seminar presentation of it before submission.. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

a. Prepare a report on various types of transducers with examples
b. Use thermistor for indication of temperature
c. Use level transducer for indicating and controlling of water tank
d. Use pressure transducer for indicating and controlling the compressor utility system
e. Use strain gauge for weight measurement in simple platform.
f. Prepare a report on selection criteria of transducers
g. Use RTD for indication of temperature

12. SUGGESTED LEARNING RESOURCES:

Sr.No.	Title	Author	Publisher, Edition ,Year of publication and ISBN Number
01	Instrumentation Measurement and Analysis	B.C.Nakra , K. K.Chaudhary	Tata McGraw Hill Publishing, Co.Ltd ;N.Delhi. ISBN 13: 978-0070151277
02	Instrumentation Devicesand System.	C.S.Rangan,V.SV.Mani, G.R.Sarma	McGraw Hill Publishing**ISBN-13**-9780074633502
03	Industrial Instrumentation & Control	S.K.Singh	McGraw Hill Publishing **ISBN-13:** 978-0070678200
04	Electrical and Electronic Measurements and Instrumentation	A.K.Sawhney	DhanpatRai& Sons. ISBN :9788177001006
05	Principles of Industrial Instrumentation	D. Patranabis	Tata McGraw Hill PublishingCo. Ltd; N. Delhi **ISBN :** 1283187051, 9781283187053

13. SOFTWARE/LEARNING WEBSITES

1. Active and Passive Transducer : https://circuitglobe.com/difference-between-active-and-passive-transducer.html
2. LVDT and RVDT Transducer : https://www.elprocus.com/differences-between-lvdt-and-rvdt/

3. Selection criterion of transducers. : https://www.polytechnichub.com/selection-criteria-transducer/
4. Classification of Pressure measuring devices : https://www.hkdivedi.com/2017/12/classification-of-pressure-measuring.html
5. Non elastic pressure transducer: Inclined Tube : https://www.slideshare.net/BRIJ10PATEL/pressure-measurement-93860446
6. Elastic pressure transducer: Bourdon Tube http://www.instrumentationtoday.com/bourdon-tube/2011/09
7. Classification of flow measuring transducers : https://instrumentationtools.com/classification-of-flow
8. Variable head flow meter- Venturimeter, orifice plate meterhttps://nptel.ac.in/content/storage2/courses/108105063/pdf/L-07(SS)(IA&C)%20((EE)NPTEL).pdf
9. Classification of level measurement methods:https://automationforum.in/t/basics-of-level-measurement-working-principle-and-types-of-level-measurement/495
10. Difference Between RTD & Thermistor. https://circuitglobe.com/difference-between-rtd-and-thermistor.html
11. Humidity measurement devices: https://automationforum.co/humidity-measuring-devices/

14. PO - COMPETENCY- CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	03	02	02	03	01	-	-
CO2	03	02	02	03	01	-	01
CO3	03	02	02	03	01	-	01
CO4	03	02	02	03	01	-	01
CO5	03	02	02	03	01	-	01

	PSO1	PSO2	PSO3
CO1	03	-	-
CO2	03	01	-
CO3	03	01	-
CO4	03	01	-
CO5	03	01	-

Sign: Name: Shri. G.W.Sonone Smt.P.P. Rajhans Smt. R.P.More (Course Experts)	Sign: Name: Shri.R.N.Shikari (Head of Department)
Sign: Name: Shri.R.N.Shikari (Program Head) (E & TC Department)	Sign: Name: Shri. A.S.Zanpure (CDC)

Government Polytechnic, Pune

'180 OB' – Scheme

Programme	Diploma in CE/**EE**/**ET**/ME/MT/CM/IT/DDGM
Programme code	01/**02**/**03**/04/05/06/07/08/15/**16**/**17**/18/21/**22**/**23**/24/26
Name of Course	Engineering Graphics
Course Code	ME2104
Prerequisite course code and name	NA
Class declaration course	NO

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)		Examination Scheme				
					Theory		Practical		Total Marks
L	T	P	C		ESE	PA	*ESE	PA	
02	00	02	04	Marks	00	00	00	50	50
				Exam Duration	--	--	--	--	--

Legends: L- Lecture, P-Practical, T-Tutorial, C-Credits, ESE-End semester examination, PA- Progressive Assessment(Test I,II/Term work), *-Practical examination, $-Oral Examination, #-Online Examination, Each Lecture/Practical period is of one clock hour.

2. RATIONALE:

Engineering drawing is the graphical language. It is used by engineers, designers, planners, supervisors and also the workers to express their thoughts, ideas and concepts. The expression by drawing is very accurate precise and brief. At a glance one can understand detailed description of any part to be manufactured or a dam to be built or an electric circuit to be used. For all technicians through understanding of principles of engineering drawing (Graphic Skills) is essential.

3. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

Interpret understand and prepare orthographic and isometric drawing of given component and prepare sectional mechanical working drawing /production drawing of given component and also draw projections of lines planes solids and free hand sketches

4. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs**:**

After studying this course, the student will be able to
1. Draw geometrical figures and Engineering Curves
2. Draw views of given object using principles of orthographic projections
3. Draw isometric view of a given object from orthographic projections
4. Draw free hand sketches of given engineering elements

5. SUGGESTED PRACTICALS/ EXERCISES

Sr. No.	Unit No.	Sheet No.	Practical Exercises (Learning Outcomes in Psychomotor Domain)	Relevant CO	Approx. Hrs. required
1	01	--	Draw horizontal, vertical, 30 degree, 45 degree, 60 and 75 degrees lines, different types of lines, dimensioning styles using Set squares/ drafter. (do this exercise in sketch book)	--	01
2	01	1	Line letters and numbers. Dimensioning technique. One problem on Redraw the figure (Sheet No.1).	--	02
3	02	2	Engineering curves --Three problems (Sheet No.2)	1	05
4	03	3	Draw a problem on orthographic projections using first angle method of projection having slanting surfaces, cylindrical surfaces, ribs.(Sheet No-3-Problem-1)	2	03
5	03	3	Draw a problem on orthographic projections using Third angle method of projection having slanting surfaces, cylindrical surfaces, ribs.(Sheet No-3-Problem-2)	2	03
6	04	4	Draw a problem on sectional orthographic projections using first angle method of projection having slanting surfaces, cylindrical surfaces, ribs.(Sheet No-4-Problem-1)	2	02
7	04	4	Draw a problem on sectional orthographic projections using Third angle method of projection having slanting surfaces, cylindrical surfaces, ribs.(Sheet No-4-Problem-2)	2	02
8	05	5	Draw one problems on Isometric view of simple objects having plain and slanting and cylindrical surfaces by using natural scale.(Sheet No.5-Problem-1)	3	04
9	05	5	Draw one problems on Isometric projection of simple objects having plain and slanting and cylindrical surfaces by using isometric scale. (Sheet No.5-Problem-2)	3	03
10	06	6	Draw neat and proportionate free hand sketches. Any six elements (Sheet No.6)	4	03

11	All	--	Complete a micro project based on guidelines provided in Sr. no. 11	1 to 4	04
			Total		**32**

S.No.	Performance Indicators	Weightage in %
1	Neatness, Cleanliness on drawing sheet	10
2	Uniformity in drawing and line work	10
3	Creating given drawing	40
4	Dimensioning the given drawing and writing text	20
5	Answer to sample questions	10
6	Submission of drawing in time	10
Total		**100**

6. MAJOR EQUIPMENT/ INSTRUMENTSREQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practicals, as well as aid to procure equipment by authorities concerned**.**

Sr. No.	Equipment Name with Broad Specifications	Experiment Sr. No.
1	Drawing Table with Drawing Board of Full Imperial/ A1 size.	All
2	Models of objects for orthographic / isometric projections	3,4,5,6
3	Models/ Charts of objects mentioned in unit no. 7	-
4	Set of various industrial drawings being used by industries.	All
5	Drawing equipment's and instruments for class room teaching-large size: a. T-square or drafter (Drafting Machine) b. Set squares (45^0 and 30^0- 60^0) c. Protractor d. Drawing instrument box (containing set of compasses and dividers)	All
6	Interactive board with LCD overhead projector	All

7. THEORY COMPONENTS

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit-I Introduction of Drawing Instruments, Lines, Letters etc.(Weightage00 , Hrs- 04)	
1a. Prepare drawing using drawing instruments. **1b.** Use IS SP-46 for dimensioning. **1c.** Use different types of lines. **1d.** Draw regular geometrical figures. **1e.** Draw figures having tangency constructions.	**1.1** Drawing Instruments and supporting material: method to use them with applications. **1.2** Standard sizes of drawing sheets (ISO-A series). I.S. codes for planning and layout. Letters and numbers (single stroke vertical) **1.3** Conventions of lines and their applications. Scale - reduced, enlarged and full size **1.4** Dimensioning techniques as per SP-46(Latest edition) – types and applications of chain, parallel and coordinate dimensioning.
UNIT -IIEngineering Curve and Tangential Exercises (Weightage00 , Hrs- 06)	
2a. Explain different engineering curves with areas of application. **2b.** Draw different conic sections based on given situation.	**2.1** Concept of focus, directrix, vertex and eccentricity. Conic sections. **2.2** To draw an ellipse by concentric circle method and Directrix focus method. **2.3** To draw a parabola by :- 1) Directrix focus method. **2.4** To draw a hyperbola by :- 1) Directrix focus method.
UNIT-IIIOrthographic Projections (Weightage00 , Hrs- 06)	
3a. Explain methods of Orthographic Projections. **3b.** Draw orthographic views of given simple 2D entities containing lines, circles and arcs only. **3c.** Draw the orthographic views from given pictorial views.	**3.1** Projections-orthographic, perspective, isometric and oblique: concept and applications.(No question to be asked in examination). **3.2** Orthographic projection, First angle and Third angle method, their symbols. **3.3** Conversion of pictorial view into Orthographic Views – object containing plain surfaces, slanting surfaces, slots, ribs, cylindrical surfaces. (use First Angle and Third Angle Projection Method.)
Unit– IV Sectional orthographic views (Weightage00 , Hrs- 04)	
4a. Classify various types of sectional views. **4b.** Explain sectioning and hatching conventions. **4c.** Convert pictorial views of given object into sectional orthographic views. **4d.** Interpret the given Drawing	**4.1** Cutting plane line **4.2** Types of sectional views: Full section, Half section, Partial or broken section, Revolved section, Removed section, offset section, Aligned section. **4.3** Sectioning conventions

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	4.4 Hatching or section lines **4.5** Conversion of pictorial views into sectional orthographic views
UNIT-VIsometric Projections (Weightage00 , Hrs- 08)	
5a. Prepare isometric scale. **5b.** Draw isometric views of given simple 2D entities containing lines, circles and arcs only. **5c.** Interpret the given orthographic views. **5d.** Draw Isometric views from given orthographic views.	**5.1** Isometric view **5.2** Isometric projection. **5.3** Isometric scale and Natural Scale. **5.4** Illustrative problems related to simple objects having plain, slanting, cylindrical surfaces and slots on slanting surfaces. **5.5** Conversion of orthographic views into Isometric view/Projection.
UNIT-VIFree Hand Sketches (Weightage00 , Hrs- 04)	
6a. Sketch proportionate freehand sketches of given machine elements. **6b.** Select proper fasteners and locking arrangement for given situation.	**6.1** Free hand sketches of machine elements: Thread profiles, nuts, bolts, studs, set screws, washers, Locking arrangements.

8. SUGGESTED SPECIFICATION TABLE FORQUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction to Drawing instruments lines letters etc.	04	--	--	--	--
II	Curve and Tangential exercises	06	--	--	--	--
III	Orthographic Projection	06	--	--	--	--
IV	Sectional orthographic views	04	--	--	--	--
V	Isometric Views	08	--	--	--	--
VI	Free hand sketches	04	--	--	--	--
Total		32	**--**	--	--	--

9. SUGGESTED STUDENT ACTIVITIES

Following is the list of proposed student activities like:

i. Student should maintain a separate A3 size sketch book which will be the part of term work and submit it along with drawing sheets.

ii. Students should collect Maps, Production drawings, Building Drawings, Layouts from nearby workshops/industries/builders/contractors and try to list
   a. types of lines used
   b. lettering styles used
   c. dimension styles used
   d. IS code referred

iii. List the shapes and curves you are observing around you in real life with name of place and item. (For Ex.ellipse, parabola, hyperbola, cycloid, epicycloids, hypocycloid, involute, spiral helix).

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.

a. Guide student(s) in fixing the sheet and mini drafter on drawing board.
b. Show video/animation films to explain orthographic and Isometric projection.
c. Demonstrate engineering curves through actual cut sections of cone, pyramid, etc.
d. Demonstrate first and third angle method using model.
e. Use charts and industrial drawing to teach standard symbolsTeacher should ask the students to go through instruction and Technical manuals
f. Encourage students to refer different websites to have deeper understanding of the subject.

11. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs (Affective Domain Outcomes). Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

a. Helical springs: Each batch will collect 5 open coil and closed coil helical springs of various sizes. Each student will measure the significant parameters of one spring and draw corresponding helix curve in his sketch book.
b. Flat coil or spiral springs: Each batch will collect 10 spiral springs of varioussizes. Each student will measure the significant parameters of one spring and draw corresponding helix curve in his sketch book.
c. Isometric views: Each student of the batch will try to collect at least one production drawings/ construction drawings/plumbing drawings from local workshops/builders /electrical and mechanical contractors and try to generateisometric views from the orthographic views given in the drawings.
d. Isometric views: Each student of a batch will select a household/industrial real item and will draw its isometric view in the sketch book.
e. Isometric and orthographic views: Each batch will collect a single point cuttingtool from workshop and draw its Isometric and orthographic views with a tentimes enlarged scale. In carpentry shop each batch will try to make woodenmodel from these views.

f. Isometric views: The teacher will assign one set of orthographic projections andask the student to develop 3D thermocol models of the same.
g. Conic curves: Each batch will go to institute's playground and one studentstanding on the boundary throws a ball to the wicket keeper who is 30 metersaway from the thrower and the ball has reached a maximum height of 20meters from the ground, draw the path of the ball and identify the type ofconic curve it has traced in air.

12. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publisher, Edition and Year of Publication, ISBN Number
1	Engineering Drawing	N.D. Bhatt	Charotar Publication, Anand. ISBN:9380358172
2	Engineering Graphics	R.V.Mali, Chaudhary	Vrinda Prakashan, Jalgaon ISBN: 9789389251012
3	--	I.S. 696 Latest version	B.I.S.
4	Engineering Drawing Practice for Schools and Colleges IS: SP-46	Bureau of Indian Standards.	Third Reprint, October 1998 ISBN. 81-7061-091-2
5	Engineering Drawing and Graphics + AutoCAD K.	Venugopal	New Age International Publishers. ISBN: -10 8122431453
6	Engineering Drawing	D.A. Jolhe	Tata McGraw Hill Edu. New Delhi, 2010, ISBN No. 978-0-07-064837-1
7	Engineering Drawing	R. K. Dhawan	S. Chand and Company New Delhi, ISBN . 81-219-1431-0

13. SOFTWARE/LEARNING WEBSITES

i. https://www.youtube.com/watch?v=TJ4jGyD-WCw
ii. https://www.youtube.com/watch?v=dmt6_n7Sgcg
iii. https://www.youtube.com/watch?v=_MQScnLXL0M
iv. https://www.youtube.com/watch?v=3WXPanCq9LI
v. https://www.youtube.com/watch?v=fvjk7PlxAuo
vi. http://www.me.umn.edu/courses/me2011/handouts/engg%20graphics.pdf

14. PO - COMPETENCY- CO MAPPING (ELECTRICAL ENGINEERING)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	2	2	1	1	2
CO2	3	3	2	2	1	1	2
CO3	3	3	2	2	1	1	2
CO4	3	3	2	2	1	1	2
CO5	3	3	2	2	1	1	2

	PSO1	PSO2	PSO3	PSO3
CO1	2	3	2	2
CO2	2	3	2	2
CO3	2	3	2	2
CO4	2	3	2	2
CO5	2	3	2	2

15. PO - COMPETENCY- CO MAPPING (E&TC ENGINEERING)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	2	2	1	1	2
CO2	3	3	2	2	1	1	2
CO3	3	3	2	2	1	1	2
CO4	3	3	2	2	1	1	2
CO5	3	3	2	2	1	1	2

	PSO1	PSO2	PSO3
CO1	2	1	1
CO2	2	1	1
CO3	2	1	1
CO4	2	1	1
CO5	2	1	1

Sign: Name: M.R.Mundhe. M. W. Giridhar (Course Expert)	Sign: Name: Dr.N.G.Kulkarni. (Head of Department) (Mechanical Engg Dept.)
Sign: Name: Shri.R.N.Shikari (Program Head) (E&TC Dept.)	Sign: Name: Shri A.S.Zanpure. (CDC I/C)

GOVERNMENT POLYTECHNIC, PUNE

'180 OB' – Scheme

Programme	**Diploma in ET**/CE/EE//ME/MT/CM/IT/DDGM
Programme code	01/02/**03**/04/05/06/07/08/16/**17**/21/22/**23**/24/26
Name of Course	**ADVANCED MATHEMATICS III**
Course Code	**SC2104**
Prerequisite	**SC1102 – Applied Mathematics II**
Class Declaration	**NO**

1. **TEACHING AND EXAMINATION SCHEME**

Teaching Scheme (In Hours)			Total Credits (L+T+P)		Examination Scheme				
					Theory		Tutorials		Total Marks
L	**T**	**P**	**C**		**ESE**	**PA**	**ESE**	**PA**	
02	01	00	03	**Marks**	40	10	–	25	75
				Exam Duration	2 Hrs	30 min.	–	--	—

Legends : L- Lecture, P- Practical, T- Tutorial, C- Credits ,ESE-End Semester Examination, PA- Progressive Assessment (Test I,II/TermWork) , *- Practical Exam, $- Oral Exam, #- Online Examination each Lecture/Practical period is of one clock hour;

2. RATIONALE

The student shall learn various techniques in integration and use these techniques to their related Engineering problems.

3. COMPETENCY

The aim of this course is to help the student to attain the following industry identified Competency through various teaching learning experiences:

- **Solve various engineering related problems using the principles of advanced mathematics**

4. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency**:**

1. Solve the given problems of integration using suitable methods.
2. Apply the concept of integration to find Mean and Root Mean Square value.
3. Using the general form of Complex number find the all roots of complex number

5. SUGGESTED PRACTICALS/ EXERCISES

Sr. No.	Unit No.	Practical Exercises (Learning Outcomes in Psychomotor Domain)	Relevant COs	Approx. Hrs. required
1	1	Integration by substitution method	1	2
2	1	*Integration on the type $1/ax^2+bx+c$, $1/\sqrt{ax^2}+bx+c$,$1/(asinx+bcosx+c)$, $1/(asin^2 x+bcos^2 x+c)$.	1	2
3	1	*Integration using By Part Rule	1	2
4	2	Integration by partial fraction method.	2	2
5	2	*Examples on Definite integral and its properties	2	2
6	2	*Examples on Mean and R.M.S. value	2	2
7	3	Modulus and Amplitude of complex number and Solve examples on complex numbers using De Moivre's theorem.	3	2
8	3	Find roots of complex number.	3	2
9	All	*Complete a Micro- project as per the guidelines in point no. 11 towards the fulfillment of the COs of the course.	All	4
		Total		16

***Experiment No. 9 compulsory, perform experiment 2 or 3 and experiment 5 or 6.**

Sr.No.	Performance Indicators	Weightage in %
a.	Prepare experimental set up	-
b.	Handling of instruments during performing practical.	-
c.	Follow Safety measures	-
d.	Accuracy in calculation	20
e.	Answers to questions related with performed practices.	40
f.	Submit journal report on time	20
g.	Follow Housekeeping	10
h.	Attendance and punctuality	10
Total		**100**

6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practicals, as well as aid to procure equipment by authorities concerned**.**

S. No.	Equipment Name with Broad Specifications	Experiment Sr. No.
1	LCD Projector	1-8
2	Interactive Classroom	1-8

7. THEORY COMPONENTS

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Units I : Integration (09 hrs, 16 marks)	
1a. Obtain the given simple integral(s) using a substitution method. 1b. Integrate given simple functions using the integration by parts. 1c. Evaluate the given simple integral by partial fractions.	1.1 Methods of Integration: a. Integration by substitution. b. Integration by parts c. Integration by partial fractions.
Unit II: Definite Integrals (09 hrs, 12 marks)	
2a. Solve given simple problems based on properties of definite integration. 2b. Utilize the concept of definite integration to find mean value of the function. 2c. Invoke the concept of definite integration to find root mean square value of function.	2.1 Definite Integration: a. Simple examples b. Properties of definite integral (without proof) and simple examples. 2.2 Applications of integration : a. Mean Value. b. Root Mean Square Value.
Unit III: Complex Number (14 hrs, 12 marks)	
3a. Solve given problems based on complex number. 3b. Solve examples on complex number using De Moivre's theorem 3c. Find roots of complex numbers.	3.1 Cartesian, polar and exponential form of a complex number. 3.2 Algebra of complex numbers. 3.3 De Moivre's theorem 3.4 General form of complex number

8. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Integration	09	02	08	06	16
II	Definite Integrals	09	02	04	06	12
III	Complex number	14	04	04	04	12
Total		**32**	**08**	**16**	**16**	**40**

9. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

a. Identify engineering problems based on real world problems and solve them with the use of free tutorials available on the internet.
b. Use graphical software's: EXCEL, DPLOT and GRAPH for related topics.
c. Use Math CAD as a Mathematical Tool and solve the problems on Calculus.
d. Identify problems based on applications of differential equations and solve these problems.

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/subtopics.
b. About ***15-20% of the topics/subtopics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the details development of the COs through classroom presentations (see implementation guideline for.)
c. Use Flash/Animations to explain various components, operation
d. Teachers should ask the students to go through instruction and Technical manuals.

11. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***
The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs.(Affective Domain Outcomes) .Each student will have to maintain activity chart consisting of individual contribution in the project work and give a seminar presentation of it before submission.. The student ought to submit a micro-project by the end of the semester to develop the industry oriented COs.
A suggested list is given here. Similar micro-project could be added by the concerned faculty.

a. Prepare charts displaying the area of irregular shapes using the concept of integration.
b. Prepare charts displaying the volume of irregular shapes using the concept of integration.
c. Prepare charts displaying formulae of complex numbers.

12. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publisher, Edition Year of publication and ISBN Number
1.	Higher Engineering Mathematics	Grewal B. S.	Khanna publication New Delhi , 2013 ISBN: 8174091955
2.	A text book of Engineering Mathematics	Dutta. D	New age publication New Delhi, 2006 ISBN: 978-81-224-1689-3
3.	Advance Engineering Mathematics	Kreysizg, Ervin	Wiley publication New Delhi 2016 ISBN: 978-81-265-5423-2
4.	Advance Engineering Mathematics	Das H.K.	S Chand publication New Delhi 2008 ISBN: 9788121903455
5.	Engineering Mathematics Volume I (4^{th} edition)	Sastry S.S.	PHI Learning, New Delhi, 2009 ISBN: 978-81-203-3616-2

13. SOFTWARE/LEARNING WEBSITES

a. *www.scilab.org/ -SCI Lab*
b. *www.mathworks.com/product/matlab/ -MATLAB*
c. *Spreadsheet Applications*
d. *www.dplot.com*
e. *https://www.khanacademy.org/math?gclid=CNqHuabCys4CFdOJaddHoPig*

14. PO - COMPETENCY- CO MAPPING

CO-PO Mapping of course

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
1	2	2	1	-	-	-	1
2	3	3	1	-	-	1	2
3	3	3	-	1	-	-	1

CO-PSO Mapping of course

CO	PSO1	PSO2	PSO3
1	1	-	-
2	2	-	-
3	2	-	-

1)Sign: Name: Shri. S. B. Yede 2)Sign: Name: Shri. V. B. Shinde 3)Sign: Name : Smt. P. R. Nemade (Course Experts)	Sign: Name: Smt. N. S. Kadam (Head of Department)
Sign: Name: Shri R.N. Shikari (Head of Program)	Sign: Name: Shri. A. S. Zanpure (CDC)

GOVERNMENT POLYTECHNIC, PUNE

'180 OB' – Scheme

Programme	**Diploma in ET**/CE/EE//ME/MT/CM/IT/DDGM
Programme code	01/02/**03**/04/05/06/07/08/16/**17**/21/22/**23**/24/26
Name of Course	**ADVANCED MATHEMATICS IV**
Course Code	**SC2105**
Prerequisite	**SC1102 – Applied Mathematics II**
Class Declaration	**NO**

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)		Examination Scheme				
					Theory		Tutorials		Total Marks
L	T	P	C		ESE	PA	ESE	PA	
02	01	00	03	Marks	40	10	–	25	75
				Exam Duration	2 Hrs	30 min	–	--	—

Legends : L- Lecture, P- Practical, T- Tutorial, C- Credits , ESE-End Semester examination, PA- Progressive Assessment (Test I,II/ TermWork) , *- Practical Exam, $- Oral Exam, #- Online Examination each Lecture/Practical period is of one clock hour;

2. RATIONALE

The student shall learn various techniques in differential equations and use these techniques to their related Engineering problems.

3. COMPETENCY

The aim of this course is to help the student to attain the following industry identified Competency through various teaching learning experiences:

- **Solve various engineering related problems using the principles of advanced mathematics**.

4. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency**:**

1. Solve the differential equation of first order and first degree using suitable methods.
2. Use Laplace transform to solve first order first degree differential equations.
3. Use Fourier Transform to solve engineering problems.

5. SUGGESTED PRACTICALS/ EXERCISES

Sr. No.	Unit No.	Practical Exercises (Learning Outcomes in Psychomotor Domain)	Relevant COs	Approx. Hrs. required
1	1	Examples on order, degree and formation of differential equation.	1	2
2	1	*Solution of first order first degree D.E. using various methods.	1	2
3	1	*Make use of applications of D.E.	1	2
4	2	Find Laplace transform and inverse Laplace transform using related properties	2	2
5	2	*Find inverse Laplace transform using related properties	2	2
6	2	*Make use of concept of Laplace transform to solve first order first degree differential equation	2	2
7	3	Fourier Sine Transforms	3	2
8	3	Fourier Cosine Transforms	3	2
9	ALL	*Complete a Micro- project as per the guidelines in point no. 11 towards the fulfillment of the COs of the course.	ALL	4
		Total		16

***Experiment No. 9 compulsory, perform experiment 2 or 3 and experiment 5 or 6.**

Sr. No.	Performance Indicators	Weightage in %
a.	Prepare experimental set up	-
b.	Handling of instruments during performing practical.	-
c.	Follow Safety measures	-
d.	Accuracy in calculation	20
e.	Answers to questions related with performed practices.	40
f.	Submit journal report on time	20
g.	Follow Housekeeping	10
h.	Attendance and punctuality	10
Total		**100**

6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practicals, as well as aid to procure equipment by authorities concerned**.**

S. No.	Equipment Name with Broad Specifications	Experiment Sr. No.
1	LCD Projector	1-8
2	Interactive Classroom	1-8

7. THEORY COMPONENTS

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit I: Differential Equations (12 hrs, 16 marks)	
1a. Find the order and degree of given differential equations 1b. Form simple differential equation for given simple engineering problems. 1c. Solve given differential equations using the method of variable separable 1d. Solve the given simple problems based on linear differential equations	1.1 Concept of differential equation. 1.2 Order, degree and formation of. Differential equations 1.3 Solution of differential equation Equations a. Variable separable form. b. Linear differential equation. c. Homogeneous differential equation 1.4 Application of differential equations and related engineering problem(s).
Unit II:Laplace Transform (10 hrs, 12 marks)	
2a. Solve the given problems based on Properties on Laplace Transform. 2b. Solve the given problems based on Properties on Inverse Laplace Transform. 2c. Invoke the concept of Laplace transform to solve first order first degree differential equations	2.1 Laplace Transform of standard functions (without proof). 2.2 Properties of Laplace Transform such as linearity, first and second shifting properties(without proof) 2.3 Inverse Laplace Transform using partial fraction method, first and second shifting properties (without proof). 2.4 Laplace transform of derivatives and solution of first order first degree differential equation
Unit III:Fourier Transforms (10 hrs, 12 marks)	
3a. Find Fourier Sine and Cosine Transforms 3b. Properties of Fourier Transforms	3.1 Fourier Sine and Cosine Transforms with examples 3.2 Properties of Fourier Transforms without proof: a. Linear Property b. Change of scale property c. Shifting property

8. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Differential Equation	12	04	08	04	16
II	Laplace transform	10	04	04	04	12
III	Fourier Transforms	10	04	04	04	12
	Total	**32**	**12**	**16**	**12**	**40**

9. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

a. Identify engineering problems based on real world problems and solve them with the use of free tutorials available on the internet.
b. Use graphical software's: EXCEL, DPLOT and GRAPH for related topics.
c. Use Mathcad as a Mathematical Tool and solve the problems on Calculus.
d. Identify problems based on applications of differential equations and solve these problems.

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/subtopics.
b. About ***15-20% of the topics/subtopics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
c. Use Flash/Animations to explain various components, operation and
d. Teacher should ask the students to go through instruction and Technical manuals

11. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs.(Affective Domain Outcomes) .Each student will have to maintain activity chart consisting of individual contribution in the project work and give a seminar presentation of it before submission.. The student ought to submit a micro-project by the end of the semester to develop the industry oriented COs.

A suggested list is given here. Similar micro-project could be added by the concerned faculty.

a. Prepare models using the concept of differential equations for radiocarbon decay.
b. Prepare models using the concept of differential equations for population growth.
c. Prepare models using the concept of differential equations for thermal cooling.
d. Prepare models using the concept of Laplace transform to solve engineering problems.
e. Prepare models using the concept of Fourier transform to solve engineering problems.

12. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publisher, Edition Year of publication and ISBN Number
1.	Higher Engineering Mathematics	Grewal B. S.	Khanna publication New Delhi , 2013 ISBN: 8174091955
2.	A text book of Engineering Mathematics	Dutta. D	New age publication New Delhi, 2006 ISBN: 978-81-224-1689-3
3.	Advance Engineering Mathematics	Kreysizg, Ervin	Wiley publication New Delhi 2016 ISBN: 978-81-265-5423-2
4.	Advance Engineering Mathematics	Das H.K.	S Chand publication New Delhi 2008 ISBN: 9788121903455
5.	Engineering Mathematics Volume I (4^{th} edition)	Sastry S.S.	PHI Learning, New Delhi, 2009 ISBN: 978-81-203-3616-2

13. SOFTWARE/LEARNING WEBSITES

a. *www.scilab.org/ -SCI Lab*
b. *www.mathworks.com/product/matlab/ -MATLAB*
c. *Spreadsheet Applications*
d. *www.dplot.com*
e. *https://www.khanacademy.org/math?gclid=CNqHuabCys4CFdOJaddHoPig*

14. PO - COMPETENCY- CO MAPPING

CO-PO Mapping of course

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
1	2	2	1	-	-	-	1
2	3	3	1	-	-	1	2
3	3	3	-	1	-	-	1

CO-PSO Mapping of course

CO	PSO1	PSO2	PSO3
1	2	-	-
2	2	-	-
3	2	-	-

1)Sign: Name: Shri. S. B. Yede 2)Sign: Name: Shri. V. B. Shinde 3)Sign: Name : Smt. P. R. Nemade (Course Experts)	Sign: Name: Smt. N. S. Kadam (Head of Department)
Sign: Name: (Head of Program)	Sign: Name: Shri A. S. Zanpure (CDC)

Level 3 Curriculum

Government Polytechnic, Pune

'180OB'– Scheme

Programme	Diploma in **Electronics&Telecommunication Engineering**
Programme code	01/02/**03**/04/05/06/07/08/15/16/**17**/18/19/21/22/**23**/24/26
Name of Course	**Electronic Circuit and Network**
Course Code	**ET3102**
Prerequisite course code and name	**NA**
Class Declaration	**NO**

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)		Examination Scheme				
					Theory		Practical		Total Marks
L	T	P	C		ESE	PA	*ESE	PA	
03	01	02	06	Marks	80	20	25	50	175
				Exam Duration	3 Hrs.	1 Hr.	-	--	

(*):POE (Practical &Oral Examination mention whichever is applicable)

Legends: L-lecture, T-Tutorial/teacher guided theory practice, P-practical, ESE-End semester examination, PA- Progressive Assessment, # - Online theory exam

2. RATIONALE

In industry, to build and test electronic/electrical circuits in different situation knowledge of electric circuits and network is very important. This course is intended to develop the skills to diagnose and rectify the electric network and circuits related problems in the industry. the concept and principles of circuit analysis lays the foundation to understand courses of higher level.

3. COMPETENCY

The aim of this course is to attend following industry identified competency through various teaching learning experiences:

- **Diagnose the electrical and electronic circuits problem.**

4. COURSE OUTCOMES (COs)

The theory practical experiences and relevant soft skill associated with this course are to be taught and implemented, so that the students demonstrate the following industry orientated Cos associated with the above mentioned competency.

1. Check the functionality using the principle of circuit analysis .
2. Apply the nodal & mesh method of circuit analysis
3. Use network theorems to determine the various parameters in circuits.
4. Use Two port networks to determine circuits parameters .
5. Check the resonance condition of electric/electronics circuit.
6. Design and analyze filter, attenuators and equalizer.

5. SUGGESTED PRACTICALS/ EXERCISES

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Relevant CO	Approximate Hours Required.
1	1	Verification of KCL	1	02
2		Verification of KVL	1	02
3	2	Measurement of Node voltages	2	02
4		Measurement of loop currents.	2	02
5	3	To verify Super position theorem	3	02
6		To verify The venin's Theorem	3	02
7		To verify Maximum Power Transfer theorem	3	02
8	4	Calculate Z Parameters of two ports Network	4	02
9		Calculate Y Parameters of two ports Network	4	02
10		Calculate ABCD Parameters of two ports Network	4	04
11	5.	To plot frequency response of Series resonance circuit.	5	02
12		To plot frequency response of parallel resonance circuit.	5	02
13	6.	Study of Low pass filter Characteristic	6	04
14		Study of High pass filter Characteristic	6	02
15	All	Complete a Micro- project based on guidelines provided in sr.no. 11.	All	04
		Total Hrs		**32**

Note: Any 12 practicals from sr. no. 1 – 14 can be performed and 15 is compulsory.

Sr.No.	Performance Indicators	Weightage in %
a.	Arrangement of available equipment / test rig or model	20
b.	Setting and operation	20
c.	Safety measures	10
d.	Observations and Recording	10
e.	Interpretation of result and Conclusion	20
f.	Answer to sample questions	10
g.	Submission of report in time	10
Total		**100**

6. MAJOR EQUIPMENT/ INSTRUMENTSREQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practical, as well as aid to procure equipment by authorities concerned**.**

Sr.No.	Major Equipment/ Instruments Required	Experiment Sr. No.
1	Variable DC Power supply 0-30V with display for voltage and current	1 TO 10
2	Digital Multimeter	All
3	CRO	11,12,13,14
4	Function Generator	11,12,13,14
5	Different types of cables and connectors	All
6	Ammeters	All
7	Voltmeter	All

7. THEORY COMPONENTS

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
UNIT 1. LAWS AND DEFINATION(Weightage-10 , Hrs.- 08)	
1a. Use Kirchhoff'slaw to solve the given network. 1b.ApplyVoltage divider rule & current divider rule. 1c.Use source transformation techniques for the given circuit. 1d.Convert given star connection to delta connection and vice-versa.	1.1 Kirchhoff's current and voltage Law. 1.2 Calculation of Voltage, Current & Power in Series & Parallel components, Types of Sources,V-I relations of R, L & C. 1.3 Voltage divider rule &current divider rule 1.4 Star to delta & delta to star Transformations. 1.5 Source Transformations. 1.6Types of Network Elements - (Only Definitions) Active / Passive, Unilateral / Bilateral, Lumped / Distributed, Linear / Nonlinear Elements.
UNIT 2. MESH AND NODAL ANALYSIS(Weightage-14 , Hrs.- 08)	
2a.Use mesh analysis to solve the given network. 2b.Solve the given network using nodal analysis. 2c.Diagnose the fault in the given circuit using the relevant techniques.	2.1 Mesh analysis 2.2 Nodal analysis 2.3 Duality-concept

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
UNIT 3. NETWORK THEOREMS(Weightage- 16, Hrs.- 10)	
3a.Use Superposition theorem to calculate the given parameter in the given circuit. 3b.Apply The venin's theorem to calculate the given parameter in the given circuit. 3c.Use Norton's theorem to calculate the given parameter in the given circuit. 3d.Calculate load impedance using maximum power transfer theorem For the given circuit. . 3e.Use Reciprocity theorem to analyze given circuit.	3.1 Superposition Theorem 3.2 Thevenin's Theorem 3.3 Norton's Theorem 3.4 Maximum PowerTransfer Theorem 3.5 Reciprocity Theorem 3.6 Millman's Theorem
UNIT 4. TWO PORT NETWORK(Weightage- 14, Hrs.- 08)	
4a.Calculate Z,Y and H Parameters for the given circuit. 4b.Find ABCD Parameters for the given circuit. 4c. Find Inter-relationship between Z and Y parameters	4.1 Impedance (Z) parameter 4.2 Admittance (Y) parameters 4.3 Hybrid parameters 4.4 Transmission (ABCD) parameters 4.5 Inter-relationship between Z and Y parameters
UNIT 5. RESONANT CIRCUIT (Weight age- 14 , Hrs.- 08)	
5a.Find Expression for the resonant frequency of Series resonant circuits. 5b.Determine bandwidth and quality factor for given series and parallel resonant circuit 5c. Find Expression for the resonant frequency of parallel resonant circuits.	5.1 Series A.C Circuits:R-L,R-C and R-L-C circuits, impedance, reactance, phasor diagram, power factor, apparent power, reactive power. 5.2: Series resonant circuits: Expression for the resonant frequency, effect of Q on bandwidth, relation between Frequency (Fr), Q factor and BW. 5.3 Parallel A.C Circuits: Resistance in parallel with pure inductance andcapacitance, series combination of resistance and inductance in parallel with capacitance. 5.4 Parallel resonant circuits- Expression for the resonant frequency, effect of Q on bandwidth, relation between frequency (Fr), Q and BW. Voltage magnification factor, Q- factor, Bandwidth.

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
UNIT 6. FILTER AND ATTENUATORS (Weightage-12 , Hrs.- 06)	
6a.State need of filter and attenuator. 6b.Construct all the types of filter for the given network	6.1Definition, Types,need, and applications of filter, Constant-K type High pass,Constant-K type low pass, Constant-K type band pass,Constant-K type Band rejects filters. 6.2 Attenuators Equalizers: Definition, Types, applications (numericals based on it)

8. SUGGESTED SPECIFICATION TABLE FORQUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Laws And Defination	08	04	04	02	10
II	Mesh And Nodal Analysis	08	04	04	06	14
III	Network Theorems	10	04	04	08	16
IV	Two Port Network	08	04	04	06	14
V	Resonant Circuits	08	04	04	06	14
VI	Filter And Attenuators	06	02	04	06	12
Total		48	**22**	**24**	**34**	**80**

9. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a. Prepare journals based on practical performed inlaboratory.
b. Follow the safety precautions.
c. Use various meters to test electrical /electronic equipment and component.
d. Library/internet survey of electrical circuits and network.
e. Prepare power point presentation or animation for understanding different circuits behavior.

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b. 'L' in item No.1 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
c. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).

d. With respect to item No.9, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
e. Guide student(s) in undertaking micro-projects.
f. Use Flash/Animations to explain various components, operation and

11. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs.(Affective Domain Outcomes) .Each student will have to maintain activity chart consisting of individual contribution in the project work and give a seminar presentation of it before submission.. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

a. Select suitable components for the given circuit and prepare same on the bread board. Verify Kirchoff's Voltage Law and Kirchoff's Current Law theoretically and practically
b. Select suitable components for the given circuit and prepare same on the bread board. Verify current and voltage in each component theoretically and practically
c. Select suitable components for the given circuit and prepare same on the bread board. Verify voltage divider rule and current divider rule theoretically and practically
d. Prepare power point presentation on source transformation, star delta transformation, mesh analysis, and nodal analysis and give presentation in classroom.
e. Select suitable components for the given circuit and prepare same on the bread board. Verify following network theorems theoretically and practically.i)Superposition theorem ii)Thevenin's theorem ii)Norton's theorem iv)Maximum power transfer theorem
f. Design and prepare two port network on bread board for given values of open circuit Z parameter.
g. Design and prepare two port network on bread board for given values of short circuit Y parameter.
h. Prepare series RL C circuit using variable R,L and C combination on the bread board. Tune the circuit for resonance condition.Measure the response,calculate the bandwidth and Q factor for the circuit.

12. SUGGESTED LEARNING RESOURCES

S.N.	Title	Author	Publisher, Edition ,Year of publication and ISBN Number
1	Basic Electrical Engineering.	Mittal V.N;Arvind	McGraw Hill Education,Noida,2005 ISBN:9780070593572
2	Circuit and Network	Sudhakar, A;.PalliShyammohan S,	McGraw Hill New Delhi,2006. ISBN-978-0-07-340458-5
3	A Textbook of Electrical Technology vol.1.	B.L.Theraja,	S Chand and CO, New Delhi,2006. ISBN :978-81-219-2440-5
4	Fundamental of Electrical Networks	Gupta B.R; Singhal, Vandana	S Chand and CO, New Delhi,2005 ISBN :978-81-219-2318-7
5	Electric Circuit Analysis	ParanjothiS.R	New age Publisher , New Delhi , 2011 ISBN :978-81-224-3154-4

13. SOFTWARE/LEARNING WEBSITES

1. www.cesim.com/simulations
2. www.scilab.org/scilab
3. www.ni.com/multisim
4. www.youtube.com/electric circuits
5. www.dreamtechpress.com/ebooks
6. www.nptelvideos.in/electrical engineering/circuit theory
7. www.learnerstv.com/free-engineering
8. electricalforu.com/category/electronics-project

14. PO - COMPETENCY- CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	2	2	-	-	2
CO2	3	3	2	2	-	-	2
CO3	3	3	2	2	-	-	2
CO4	3	3	-	3	-	-	2
CO5	3	2	2	2	1	-	3
CO6	3	3	2	1	2	2	3

	PSO1	PSO2	PSO3
CO1	3	2	3
CO2	3	1	3
CO3	3	1	2
CO4	3	-	3
CO5	3	2	2
CO6	2	1	-

Sign: Name: Smt. P.V. Lengare Smt.R.S.Deulkar Smt. P.C.Mitkari (Course Experts)	Sign: Name:Shri.R.N.Shikari (Head of Department)
Sign: Name:Shri.R.N.Shikari (Program Head) (E & TC Engg Dept.)	Sign: Name: Shri. A.S.Zanpure (CDC)

Government Polytechnic, Pune

'180OB'– Scheme

Programme	Diploma in **Electronics&Telecommunication Engineering**
Programme code	01/02/**03**/04/05/06/07/08/15/16/**17**/18/19/21/22/**23**/24/26
Name of Course	**Applied Electronics**
Course Code	**ET3103**
Prerequisite	Basic Electronics(ET2101)
Class Declaration	**YES**

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)		Examination Scheme				
					Theory		Practical		Total Marks
L	T	P	C		ESE	PA	*ESE	PA	
04	00	04	08	Marks	80	20	50	25	175
				Exam Duration	3 Hrs	1 Hr	2 Hr	-	

(*):POE (Practical&Oral Examination)

Legends: L-lecture, T-Tutorial/teacher guided theory practice, P-practical, ESE-End semester examination, PA- Progressive Assessment, # - Online theory exam

2. RATIONALE

To make the students familiar with basic facts, concepts, principles, characteristics and applications of electronic devices used in industry. For effective operation and maintenance of electronic devices used in industry technician should have sound knowledge of electronic circuits. Understanding of the subject will provide skill to the students for trouble shooting & testing of some of circuits & devices.

3. COMPETENCY

The aim of this course is to attend following industry identified competency through various teaching learning experiences:

- **Apply principles of basics of electronics for developing and troubleshooting of various systems**

4. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency**:**

1. Plot V-I Characteristics of FET and MOSFET
2. Use BJT as low power amplifier.
3.Use BJT as high power amplifier
4. Interpret working of oscillators and feedback amplifier
5. Use BJT as waveform Generator.
6. Maintain IC voltage Regulators and SMPS.

5. SUGGESTED PRACTICALS/ EXERCISES

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Relevant CO	Approximate Hours Required.
1.	1	Build n plot Input output characteristics of common Drain configuration of FET	1	04
2.		Build n plot Input output characteristics of common emitter configuration of BJT.	1	02
3.	2	Build and Plot Frequency response of common emitter **BJT** amplifier Determine gain and BW.	2	04
4.		Build n Plot Frequency response of RC Coupled **BJT** amplifier.	2	04
5.		Simulate Frequency response of FET amplifier.	2	04
6.	3	Build / test the performance of single tuned **BJT** amplifier.	2	04
7.		Simulate the performance of double Tuned **BJT** amplifier.	2	04
8.	4	Build / test the performance of Class A power amplifier.	3	04
9.		Build / test the performance of Class B push pull power amplifier.	3	04
10.	5	Build n test / Simulate the performance of positive and negative feedback on the given amplifier.	4	04
11.		Observe/ Simulate waveform and measure frequency response of RC phase shift Oscillator.	4	04
12.		Observe /simulate Wein-bridge Oscillator and measure frequency response of Wein bridge Oscillator.	4	04
13.		Observe waveform and measure frequency response of Heartley Oscillator.	4	04
14.		Observe waveform and measure frequency response of Colpitts Oscillator.	4	04
15.		Observe waveform and measure frequency response of Crysal Oscillator.	4	02

16.		Build/ test Switching characteristics of BJT.	5	02
17.	6	Build n test performance of Astable Multivibrators.	5	04
18.		Build n test (or Simulate) performance of Monostable Multivibrators.	5	04
19.		Study function of Bistable Multivibrators.	5	02
20.		Study function of Schmitt's Trigger circuit.	5	04
21.	7	Study of VI characteristics of UJT.	5	02
22.		Study function of UJT relaxation oscillator	5	04
23.	8	Build dual voltage regulator using 78xx and 79xx for specified output voltage.	6	04
24.		Build low voltage regulator using 723 for specified output voltage(2v to 7v)	6	04
25.		Build high voltage regulator using 723 for specified output voltage(7v to 37v)	6	04
26	All	Complete a Micro- project based on guidelines provided in sr.no. 11.	All	04
		Total Hrs		**64**

Note: Any 20 practicals from sr. no. 1 – 25 can be performed and 26 is compulsory.

S.No.	Performance Indicators	Weightage in %
a.	Arrangement of available equipment / test rig or model	20
b.	Setting and operation	20
c.	Safety measures	10
d.	Observations and Recording	10
e.	Interpretation of result and Conclusion	20
f.	Answer to sample questions	10
g.	Submission of report in time	10
Total		**100**

6. MAJOR EQUIPMENT/ INSTRUMENTSREQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practical, as well as aid to procure equipment by authorities concerned**.**

Sr.No.	Major Equipment/ Instruments Required	Experiment Sr. No.
1	Variable DC Power supply 0-30V with display for voltage and current	For all except simulation Practicals
2	Digital Multimeter	For all except simulation Practicals, 23,24,25
3	CRO	For all except simulation Practicals
4	Function Generator	For all except simulation Practicals,23,24,25
5	Different types of cables and connectors	For all except simulation Practicals

7. THEORY COMPONENTS

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Section I	
UNIT 1 : FET and MOSFET(Weightage- 08, Hrs- 08)	
1a.Explain with sketches the working principle of the given Field Effect transistor 1b.Determine the FET parameters from the given FET characteristics curve. 1c. Describe the specified JFET parameter. 1d. Describe the specified MOSFET parameter.	1.1 **Field Effect Transistors (FET):** Construction of JFET, (n-channel & p-channel),Working, principle & characteristics(Drain characteristics & Transfer characteristics) **1.2 FET biasing:** Source self bias, Drain to source bias , Applications of FET **1.3 MOSFET**: Introduction, types, construction, working& Applications.
UNIT 2 :LOW POWER AMPLIFIER(Weightage- 14, Hrs- 10)	
2a. Explain with sketches the working principle of type of amplifier. 2b. calculate gain and bandwidth of given low power amplifier. 2c. compare performance parameters of given types of amplifier coupling. 2d. Explain with sketches the working principle of FET amplifier	**1.1**. Classification of amplifiers, BJT as an amplifier. 1.2 Single stage CE amplifier, frequency response, gain, bandwidth 1.2. Multistage amplifier: General BJT based multistage amplifier. 1.3 Types of BJT amplifier coupling: Circuit diagram, operation, frequency response and applications of RC, Transformer and Direct coupling. 1.4 FET amplifier: Common Source amplifier, working principal and applications.
UNIT 3 : TUNED AMPLIFIER (Weightage- 06 , Hrs- 06)	
3a. Explain with sketches working principle of basic tuned circuit. 3b. Compare performance of different types of tuned Amplifier.	**Tuned Amplifier** 3.1. Introduction & necessity of tuned amplifier , Basic tuned circuit 3.2 Circuit diagram & operating principle of single & double tuned Amplifiers, Stager tuned Amplifier, Applications of all three types.
UNIT 4:Power Amplifiers(Weightage- 12 , Hrs- 08)	

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
4a.Explain with sketches the working of given type of power amplifier. 4b.Calculate the efficiency of given Power amplifier. 4c. Compare performance parameters of given types of Amplifier. 4d. Select the relevant power amplifier for the given application.	4.1. Introduction, Comparison between small signal amplifier and power amplifier, Performance parameters 4.2 Classification: Class A, Class B, Class AB &Class C. with respect to operating point on load line, efficiency,. 4.3. Operating point on load line, Circuit Operation, input/output waveform, efficiency and Power equations of Single stage class A, Class B push-pull amplifier, Class C . 4.4. Advantages & disadvantages, applications of power amplifier.
Section II	
UNIT 5 : FEEDBACK AMPLIFIERS AND OSCILLATORS: (Weightage- 12 , Hrs- 08)	
5a. Explain effect of negative feedback on the given type of amplifier. 5b.Compare the performance of given type of negative feedback amplifier. 5c. Explain with sketches the working of given type of Oscillators. 5d.Calculate the frequency of oscillations for given type of Oscillators.	**5.1. Feedback Amplifiers:** Concept of Feedback series & current shunt. Types of feedback: negative and positive feedback Types of feedback connections, voltage shunt, voltage series, current series & current shunt. **5.2 Introduction to Oscillators:** Need and condition for oscillators ,Barkhausen's criteria Type of oscillator: LC Oscillators-Hartley Oscillator, Colpitts Oscillators, RC phase shift oscillator and crystal oscillator-Concept, working and applications
UNIT 6:MULTIVIBRATORS.(Weightage- 12 , Hrs- 08)	
6a. Explain with sketches the working of given type of multivibrator. 6b. Calculate the frequency of output waveform of multivibrator. 6c. Explain with sketch the working of Schmitt trigger.	6.1 Transistor as a Switch 6.2 Classification multivibrator 6.3AMVcircuit working ,waveforms & frequency, 6.4BMV circuit working ,waveforms & frequency, 6.5MMVcircuit working ,waveforms & frequency, 6.6Applications of multivibrator 6.7 Schmitt trigger
UNIT 7: TIME BASE GENERATORS(Weightage- 08 , Hrs.- 08)	
7a. Plot characteristics of UJT. 7b. Explain with sketches the working of given type of base generators. 7c. Choose the relevant sweep generator to obtain the specified sawtooth waveform.	**7.1** Unijunction Transistor (UJT): Construction, Working principle & characteristics **7.2 Types of Time Base Generators:** Free running time base generator, working principle of UJT as time base generators, (Relaxation oscillator). Circuit diagram and working of i. Voltage time base generator, ii. Current time base generator,

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	iii. Bootstrap time base generator, iv. Miller's sweep generator & its applications.
UNIT 8: IC VOLTAGE REGULATORS(Weightage- 08 , Hrs- 08)	
8a.Explain with sketches the working of given voltage regulator 8b. Compare the performance of types voltage regulator 8c. Design voltage regulator for specified value. 8d. Interprete the working of given blocks of SMPS.	8.1 Types of IC voltage regulator: fixed & variable 8.2 Line & Load regulation. 8.3 78XX & 79XX series, LM723, LM 317- Pin Diagram Working, line & load regulation, specifcations. 8.4 SMPS: Block diagram, Working Principal, Specification, Special features, Advantages, Disadvantages, Applications.

8. SUGGESTED SPECIFICATION TABLE FORQUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
Section I						
I	FET and MOSFET	08	04	02	02	08
II	Low Power Amplifier	10	04	08	02	14
III	Tuned Amplifier	06	02	02	02	06
IV	Power Amplifiers	08	04	04	04	12
	Total	32	14	16	10	40
Section II						
V	Feedback Amplifiers And Oscillators	08	04	04	04	12
VI	Multivibrators.	08	04	04	04	12
VII	Time Base Generators	08	02	04	02	08
VIII	IC Voltage Regulators	08	02	02	04	08
	Total	32	12	14	14	40
	Total	64	**26**	**30**	**24**	**80**

9. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a. Study of datasheet of electronic components.
b. Undertake microprojects.(Under PP2)

c. Search information about Ratings and specifications of voltage Regulator ICs, power amplifier ICs and electronic components.
d. Undertake market survey of electronic components and voltage Regulator ICs
e. Prepare power point presentation on SMPS and comparative statement of different manufacturers.

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
c. With respect to item No.9, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
d. Guide student(s) in undertaking micro-projects.
e. Guide student(s) for using data sheets/manuals.
f. Use proper equivalent analogy to explain different concepts.
g. Use Flash/Animations to explain various components, operation and working
h. Use PPTs to explain different circuits.

11. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs.(Affective Domain Outcomes) .Each student will have to maintain activity chart consisting of individual contribution in the project work and give a seminar presentation of it before submission.. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

a. Design CMOS switch .
b. Build Field Strength Meter Circuit using FET
c. Build Public Address (PA) Amplifier Circuit
d. Drive Build Non Contact AC line Voltage detector/tester using BJT.
e. Build Water level monitoring Using BJT.
f. Build Clap switch using BJT.
g. 4 Ω speaker using direct coupled class A amplifier and test performance.
h. Drive 8 Ω speaker using direct coupled class AB amplifier and test performance.
i. Design Solid-State Single IC 220V Adjustable Power Supply Circuits
j. Build 0-60V LM317HV Variable Power Supply Circuit
k. Build Adjustable 3V, 5V, 6V, 9V,12V,15V Dual Power Supply Circuit

l. Designing a Customized Battery Charger Circuit

m. Build LM317 with Outboard Current Boost Circuit

12. SUGGESTED LEARNING RESOURCES

S.N.	Title	Author, Publisher, Edition and Year of publication	ISBN Number
1	Applied Electronics	R.S.Sedha	S.Chand&Co.NewDelhiISBN: 9788121927833
2	Basic Electronics.	Albert Malvino,	8thEdition,TataMcGrawHill,2015 ISBN10:1259200116 ISBN13:9781259200113
3	Basic Electronics.	B.L.Theraja	S Chand Publishing, 2007 ISBN 10: 8121925568 ISBN 13: 9788121925563
4	Electronics Device and *Circuits*	P.RameshBabu,	Scitech ISBN-10: 8183711723 ISBN-13: 978-8183711722
5	Electronics Circuit and Circuit theory	RoberrL.Boylestead Louis Neshelsky	Pearson ISBN-10: 8131727009 ISBN-13: 978-8131727003

13. SOFTWARE/LEARNING WEBSITES

1. www.nptel.com
2. http://www.electronics-tutorials
3. https://en.wikipedia.org/wiki/P%E2%80%93n_junction
4. https://learn.sparkfun.com/tutorials/transistors
5. http://www.pitt.edu/~qiw4/Academic/ME2082/Transistor%20Basics.pdf
6. http://faculty.cord.edu/luther/physics225/Handouts/transistors_handout.pdf
7. http://www.technologystudent.com/elec1
8. www.slideshare.net/manash234/classification-of-transducers
9. http://www.electrical4u.com/linear-variable-differential-transformer/

14. PO - COMPETENCY- CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	-	2	2	-	-	1
CO2	3	2	3	3	-	-	2
CO3	3	2	3	3	-	-	2
CO4	3	2	2	3	-	-	2
CO5	3	2	3	3	-	-	2
CO6	3	2	2	3	-	-	2

	PSO1	PSO2	PSO3
CO1	3	-	2
CO2	3	-	2
CO3	3	-	2
CO4	3	-	2
CO5	3	-	2
CO6	3	-	2

Sign: Name : Smt. P.M.Zilpe Smt. S.S.Chhatwani (Course Experts)	Sign: Name: Shri.R.N.Shikari (Head of Department)
Sign. Name: Shri.R.N.Shikari (Program Head) (E & TC Department)	Sign: Name: ShriA.S.Zanpure (CDC)

GOVERNMENT POLYTECHNIC, PUNE

'180OB' – Scheme

Programme	Diploma in **Electronics&Telecommunication Engineering**
Programme code	01/02/**03**/04/05/06/07/08/15/16/**17**/21/22/**23**/24/26
Name of Course	**Electronic Instrumentation**
Course Code	**ET3104**
Prerequisite course code and name	**NA**
Class Declaration	**NO**

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)		Examination Scheme				
					Theory		Practical		Total Marks
L	T	P	C		ESE	PA	*ESE	PA	
02	00	02	04	Marks	40	10	25	25	100
				Exam Duration	2Hrs	1/2Hr	-	-	

(*):POE (Practical & Oral Examination)

Legends: L-lecture, T-Tutorial/teacher guided theory practice, P-practical, ESE-End semester examination, PA- Progressive Assessment, # - Online theory exam

2. RATIONALE

Modern automated instrumentation system is an emerging field used for data sensing, acquisition, transmission, analysis and control in various practical applications. Analog and digital instruments are mainly used to measure different process control parameters. Handling test and measuring instrument is the essential activity of diploma engineering pass outs when they work in any electronic automation industry.

3. COMPETENCY

The aim of this course is to attend following industry identified competency through various teaching learning experiences:

- **Ability to work with various electronic instrument like CRO, Function generator, LCR-Q meter etc.**

4. COURSE OUTCOMES (COs)

The theory, practical experiences and behavioral skills associated with this course are to be taught and implemented, so the student will able to exhibit the following CO'S.

1. Interpret the characteristics and working of measuring instrument.
2. Use different AC &DC Bridges for relevant parameter measurement
3. Use the relevant instrument to measure specified parameters.

5. SUGGESTED PRACTICALS/ EXERCISES

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Relevant CO	Approximate Hours Required.
1.	2	Measure DC Voltage & DC Current using PMMC instruments.	1	04
2.	4	Measurement of R.L.C using LCR, Q meter	3	02
3.	4	Study front panel controls &specification of typical CRO.	3	02
4.	4	Measure frequency, voltage, phase difference (by time measurement) using CRO.	3	04
5.	4	Testing of component using CRO.	3	02
6.	4	Generate Lissagous pattern on CRO to find frequency of Unknown signal.	3	02
7.	4	Generate Lissagous pattern on CRO to find phase of Unknown signal.	3	02
8.	4	Study block diagram & front panel controls of Digital Storage Oscilloscope	3	02
9.	4	Measure frequency, voltage, phase difference (by time measurement) using DSO.	3	02
10.	3	Study of whetstone's bridge for measurement of unknown resistance.	2	04
11.	3	Measurement of unknown capacitance&inductance using bridge.	2	04
12.		Measure frequency & voltage of the different o/p waveforms of function generator.	3	02
13	All	Complete a Micro- project based on guidelines provided in sr.no. 11.	All	04
		Total Hrs		**32**

Note: Practical no. 13 is compulsory.

S.No.	Performance Indicators	Weightage in %
a.	Arrangement of available equipment / test rig or model	20
b.	Setting and operation	20
c.	Safety measures	10
d.	Observations and Recording	10
e.	Interpretation of result and Conclusion	20
f.	Answer to sample questions	10
g.	Submission of report in time	10
Total		**100**

6. MAJOR EQUIPMENT/ INSTRUMENTSREQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practical, as well as aid to procure equipment by authorities concerned**.**

Sr.No.	Major Equipment/ Instruments Required	Experiment Sr. No.
1	Analog multimeter &Digital multimeter	1,2
2	CRO,DSO	3,4,5,6,7,8,9,10,12
3	Function Generator	4,6,9,10,12
4	Different types of cables and connectors	All
5	LCR Q METER	2

7. THEORY COMPONENTS

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit-I :Fundamental of electronics measurements(Weightage-08 , Hrs-6)	
1.a. Students can describe the block diagram of instrumentation system. 1.b Students can classify static and dynamic characteristics of instruments. 1.c Students can list the types of instruments. 1.d Students can compare the types of error.	1.1 Introduction to measurement systems. 1.2 Generalized block diagram. Of instrumentation system. 1.3 Classification of Instruments: Absolute , Secondary Instruments 1.4 Definitions of Static characteristics of Instruments: (Accuracy, Precision, Sensitivity, Resolution, Static error, Reproducibility, Drift, Dead Zone) 1.5 Definitions of dynamic characteristics of Instruments: (Speed of response, Lag, fidelity, Dynamic error) 1.6 Types of Errors- Gross, Systemic, Random 1.7 Definition of Standards and their classification: (International, Primary, Secondary) 1.8 Calibration: Definition, Need of calibration.
Unit-IIAnalog and Digital meters (Weightage-08, Hrs-6)	

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
2.a Classify analog ammeters and voltmeters. 2.b. Summaries the working principle and construction of PMMC instrument. 2.c Perform practical related to AC and DC Ammeters and voltmeters.	2.1Classification of analog ammeter and voltmeter. 2.2 Working principle and construction of PMMC instruments. 2.3 Analog DC Ammeter: Shunt resistor type, Ayrton Shunt type. 2.4 Analog DC Voltmeter: Multiplier voltmeter 2.5 Analog AC Voltmeter (No derivation)- Half Wave rectifier type, Full wave rectifier type, Multi range type. 2.6 Analog AC Ammeter.
Unit-IIIAC/DC Bridges (Weightage-12, Hrs-10)	
3.a Classify DC and AC bridges. 3.b Identify different DC and AC bridges. 3.c Implement Wheatstone bridge. 3.d Choose a particular bridge according to application	3.1 Bridge balance condition for DC bridge. 3.2Study of following Dc bridges - a. Whetstone's bridge b. Kelvin's bridge 3.3Bridge balance condition for AC bridge. 3.4 Study of following AC bridges. Hay bridge, Schering's bridge, Wien's bridge.
Unit-IVOscilloscope & Signal Generator (Weightage-12, Hrs10)	
4.aDescribe the Basic block diagram of CRO. 4.bIdentify various parts of CRT. 4.c Demonstrate practical related to applications of CRO. 4.d Operate dual beam , dual trace and CRO 4.e Interpret the need of signal generator. 4.f Use function generator	4.1 CRO: Basic Block diagram and function of each block. 4.2 CRT: Construction and working 4.3 Applications of CRO 4.4 Concept, block diagram and Operation of: Single beam dual trace & Dual beam Dual Trace CRO. 4.5 Definition and need of signal generator 4.6 Block diagram, operation and applications Function generator

8. SUGGESTED SPECIFICATION TABLE FORQUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Fundamental of electronics measurements	06	02	06	00	08
II	Analog and Digital meters	06	02	06	00	08
III	AC/DC Bridges	10	04	06	02	12
IV	Oscilloscope & Signal Generator	10	02	06	04	12
Total		**32**	**10**	**24**	**06**	**40**

9. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a. Prepare journals based on practical performed inlaboratory.
b. Study of datasheet of CRO, DSO, FUNCTION GENERATOR.
c. Search information about front panel controls of CRO, function generator, DSO.
d. Measure various R,L,C components in LCR Q meter.

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
c. With respect to item No.9, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
d. Guide student(s) in undertaking micro-projects.
e. Correlate subtopics with power plant system and equipments.
f. Use proper equivalent analogy to explain different concepts.
g. Use Flash/Animations to explain various components, operation and
h. Teacher should ask the students to go through instruction and Technical manuals

11. SUGGESTED MICRO-PROJECTS:

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***
The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs.(Affective Domain Outcomes) .Each student will have to maintain activity chart consisting of individual contribution in the project work and give a seminar presentation of it before submission.. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.
A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

a. Analog and Digital Meters: Build and Test Voltmeter (0-10V, 1mA, 500 ohms) using PMMC.
b. Analog and Digital Meters: Build and Test Ammeter (0-100mA) using PMMC.
c. Signal Conditioning: Using Wheatstone Bridge design a DC signal conditioning circuit and implement on Breadboard/ PCB.
d. Function Generator: Using IC 8308 (Sine Wave, Square Wave, Triangular Wave up to 100Kz) build and test Function Generator on PCB.
e. Oscilloscope, Function Generator: Prepare a report on survey of Oscilloscope and Function Generator.

12. SUGGESTED LEARNING RESOURCES

S.N.	Title	Author, Publisher, Edition and Year of publication	ISBN Number
1	Instrumentation	A K Sawheny	DhanpatRai Publication, Nineteenth edition, 2017 ISBN : 8177001006
2	Modern Electronic Instrumentation & Measurement Techniques	W.D. Cooper	PearsonEducation, New Delhi, Third edition,1995. ISBN :978054867272 ISBN :0711009147
3	Electronic Instrumentation	H S Kalsi	Tata McGraw Hill, Third Edition,2010. ISBN :9780070702066 ISBN :0070702063

13. SOFTWARE/LEARNING WEBSITES

1. www.nptel.com
2. www.slideshare.net
3. WWW.instrumentationcontrolbox.com
4. www.circuittoday.com

14. PO - COMPETENCY- CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	-	-	-	-	1	-
CO2	-	-	1	3	-	2	2
CO3	3	2	-	3	2	-	2

	PSO1	PSO2	PSO3
CO1	2	1	2
CO2	-	*3*	-
CO3	*2*	*3*	2

Sign: Name: Shri. N. D. Toradmal Smt.V. S. Sabnis Smt. A. M. Kulkarni (Course Experts)	Sign: Name: Shri.R.N.Shikari (Head of Department)
Sign: Name: Shri.R. N. Shikari (Program Head) (E & TC Department)	Sign: Name: Shri. A. S. Zanpure (CDC)

GOVERNMENT POLYTECHNIC, PUNE

'180 OB'– SCHEME

Programme	Diploma in **Electronics & Telecommunication Engineering**
Programme code	01/02/**03**/04/05/06/07/08/15/16/**17**/18/19/21/22/**23**/24/26
Name of Course	**PRINCIPLES OF COMMUNICATION**
Course Code	**ET3105**
Prerequisite course code and name	Level 1 completed
Class Declaration	**YES**

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)		Examination Scheme				
					Theory		Practical		Total Marks
L	T	P	C		ESE	PA	$ ESE	PA	
04	00	02	06	**Marks**	80	20	25	25	150
				Exam Duration	3 Hrs	1 Hr	-	-	

($):OE (Oral Examination)

Legends: L-lecture, T-Tutorial/teacher guided theory practice, P-practical, ESE-End semester examination, PA- Progressive Assessment, # - Online theory exam

2. RATIONALE

Diploma engineers have to deal with the various electronic communication circuit while maintaining various electronics communication system. The study of basic operating principles and handling of various electronics communication system will help them to troubleshoot and maintain electronics communication systems used for various types of communication. This course is developed in such a way that, students will be able to apply the domain knowledge to solve broad communication engineering application problems in electronic communication engineering field..

3. COMPETENCY

The aim of this course is to attend following industry identified competency through various teaching learning experiences:

- **Maintain basic electronic communication system.**

4. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency**:**

1. Use relevant frequency range for different communication system.
2. Use relevant modulation technique for specified application.
3. Maintain transmitter and receiver circuits of AM and FM.
4. Understand the concept of transmission lines and different types of noise.
5. Use relevant media for transmission and reception of signals.
6. Use relevant type of antenna for various applications.

5. SUGGESTED PRACTICALS/ EXERCISES

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Relevant CO	Approximate Hours Required.
1	1	Use simple wires, switches and LEDs to establish simplex and half duplex communication link.	1	02
2		Use simple wires, switches and LEDs to establish full duplex communication link.	1	02
3	2	Observe the AM modulated waveforms generated for different carrier frequencies.	2	02
4		Generate AM wave and measure its modulation index.	2	04
5		Use any simulation software to generate AM wave	2	02
6		Use voltage controlled oscillator to generate FM wave and measure the frequency deviation.	2	04
7		Generate FM wave and measure its modulation index.	2	02
8		Use any simulation software to generate FM wave.	2	02
9	3	Use AM demodulator circuit to detect the received AM signal.	3	02
10.		Use IC 564 / IC 565 for FM demodulation and trace it's input and output waveforms.	3	04
11	5	Use any simulation software to measure 1 MUF for the given critical frequency and incident angle. 2 Radio horizon for given given height of transmitting and receiving antenna.	5	02
12	6	Use field meter to plot the radiation pattern of given dipole antenna.	6	02
13		Use field meter to plot the radiation pattern of given Yagi-Uda antenna.	6	02

14		Use any simulation software to plot radiation pattern of the given type of antenna.	6	02
15	All	Complete a Micro- project based on guidelines provided in sr.no. 11.	All	04
		Total Hrs		**32**

Note: Any 12 practicals from sr. no. 1 – 14 can be performed and 15 is compulsory.

S.No.	Performance Indicators	Weightage in %
a.	Preparation of experimental setup	20
b.	Setting and operation	20
c.	Safety measures	10
d.	Observations and Recording	10
e.	Interpretation of result and Conclusion	20
f.	Answer to sample questions	10
g.	Submission of report in time	10
Total		**100**

6. MAJOR EQUIPMENT/ INSTRUMENTSREQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practical, as well as aid to procure equipment by authorities concerned**.**

Sr.No.	Major Equipment/ Instruments Required	Experiment Sr. No.
1	CRO Dual trace/DSO	3,4,5,6,7,8,9,10
2	RF signal generator	3,4,5,6,7,8,9,10
3	Regulated power supply	1,2,3,4,5,6,7,8,9,10
4	Different types of cables and connectors	1,2,3,4,5,6,7,8,9,10
5	Digital multimeter	3,4,5,6,7,8,9,10
6	AM trainer kit for DSB/SSB AM modulation and Demodulation	3,4,9
7	FM trainer kit for modulation and Demodulation	6,7,10
8	Antenna trainer kit	12,13
9	Software for program: MATLAB, SCILAB	5,8,11,14

7. THEORY COMPONENTS

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Section I	
UNIT 1 : Basics of Electronic Communication(Weightage- 08 , Hrs- 04)	
1a. Interpret the working of each block of basic communication system. 1b.Identify the relevant frequency band of electromagnetic spectrum for specified application. 1c.Compare features of given types of transmission modes.	1.1 The elements of basic electronic communication system 1.2 Electromagnetic spectrum 1.3 Transmission modes: Simplex, half duplex and full duplex, Synchronous and Asynchronous.
UNIT 2 : AM and FM modulation (Weightage- 16 , Hrs-14)	
2a. Interpret the necessity of given type of modulation technique. 2b.Compare the working of given type of AM generation technique. 2c. Describe with sketch the given parameters of AM signal. 2d.Calculate modulation index and power distributions of the given AM signal. 2e. Calculate modulation index and power distributions of the given AM signal. 2f. Describe with sketch the given parameters of FM and PM signal. 2g. Calculate modulation index of FM signal.	2.1 Need for modulation 2.2 Types of modulation techniques Amplitude Modulation: Mathematical representation of amplitude modulated wave, modulation index, bandwidth requirement , Representation of AM signal in time and frequency domain, types of AM with respect to frequency spectrum (DSB, SSB and VSB), Power relations in AM wave. 2.3 Frequency Modulation: Representation of FM signal in time domain and frequency domain , frequency deviation ratio, modulation index(β), mathematical representation of FM, Bandwidth requirements, types of frequency modulation (NB and WBFM) 2.4 Phase Modulation.
UNIT 3 : Transmitters and Receivers (Weightage- 16 , Hrs- 14)	
3a.Explain with sketches the working of given type of AM generation technique. 3b.Explain the function of given block of AM super heterodyne receiver. 3c. Explain with sketches the given type of AM demodulation technique. 3d.Explain with sketches the principle of the given type of FM generation technique. 3e.Compare the working of	3.1 Generation of AM. 3.2 Block diagram of AM super heterodyne receiver and its working with waveforms 3.3 Demodulation of AM signal: Diode detector and practical diode detector 3.4 Automatic gain control and its types. 3.5 Concept of pre-emphasis and De-emphasis 3.6 Generation of FM using direct (varactor diode and reactance modulator) and indirect method (Armstrong method) 3.7 Block diagram of FM receiver and its working with waveforms 3.8 FM detector types: Simple slop detector, Balanced slope

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
given types of FM detector.	detector, Phase Discriminator, Ratio detector and PLL as FM Demodulator.
Section II	
UNIT 4: Noise and transmission lines **(**Weightage- 08 , Hrs- 08)	
4a.List different types of noises. 4b.Differentiate properties of the given types of noises. 4c.Sketch the equivalent circuit of transmission line. 4d.Identify different types of losses in transmission line.	4.1 Noise: Definition, S/N ratio, Sources of noise, Only Types of Noise(External, Internal) 4.2 Transmission Lines :Equivalent circuit of transmission line (general, RF Equivalents.),Characteristics impedance and its method of calculation(Simple Numerical),Losses in transmission line. Baluns, standing wave ratio.
UNIT 5 : Wave Propagation (Weightage- 16 , Hrs- 12)	
5a.Describe the properties of given types of electromagnetic waves. 5b.Describe with sketches the propagation mode of given type of radio wave. 5c.Describe properties of specified Ionospheric layer. 5d.Explain parameters and properties of the given types of wave propagation. 5e.For the given application ,identify the type of wave propagation to be used	**5.1** Concept of propagation of radio waves **5.2** Ground Wave propagation **5.3** Sky wave: Ionospheric layers, Concept of actual height and virtual height, Critical frequency, skip distance , skip zone, concept of fading, maximum usable frequency, multiple hop sky wave propagation **5.4** Space Wave propagation : line of sight, multipath space wave propagation ,optical and radio horizon, shadow zones **5.5** Duct propagation(microwave) **5.6** Troposphere scatter propagation
UNIT 6 :Antennas(Weightage- 16 , Hrs- 12)	
6a.Explain with sketches working principle of the given type of antenna. 6b.Compare the sketches working of the given type of antenna on the basis of radiation pattern. 6c.Explain antenna parameters of the given type of antenna. 6d.Choose type of antenna required with broad specification for the given applications.	6.1 Antenna fundamentals :Resonant antenna and Non-resonant antennas 6.2 Antenna parameters: Radiation pattern ,polarization, bandwidth, beam width, antenna resistance, directivity and power gain, antenna gain 6.3 Dipole antenna :Half wave dipole antenna (Resonant Antenna) & its Radiation pattern. Folded dipole antenna and its radiation pattern. Radiation pattern for Dipole Antenna of different length. 6.3 Loop antenna, Telescopic antenna, Yagi-Uda antenna, Micro wave antenna – Dish antenna, Horn antenna and Micro-strip patch antennae- Rectangular, square and circular (Structure, radiation pattern and application of antennas.)

8. SUGGESTED SPECIFICATION TABLE FORQUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
Section I						
I	Basics of Electronic Communication	04	02	02	04	08
II	AM and FM modulation	14	04	06	06	16
III	Transmitters and Receivers	14	04	06	06	16
	Sub Total	32	10	14	16	40
Section II						
IV	Noise and transmission lines	08	02	02	04	08
V	Wave Propagation	12	04	06	06	16
VI	Antennas	12	04	06	06	16
	Sub Total	32	10	14	16	40
	Total	**64**	**20**	**28**	**32**	**80**

9. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a. Prepare chart for electromagnetic spectrum.
b. Give seminar on any relevant topic.
c. Library survey regarding different communication books and manuals.
d. Prepare PPT for recent communication applications.
e. Visit radio transmitter station.
f. Undertake a market survey of different communication devices.

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
c. With respect to item No.9, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
d. Guide student(s) in undertaking micro-projects.
e. Correlate subtopics with power plant system and equipment's.
f. Use proper equivalent analogy to explain different concepts.

g. Use Flash/Animations to explain various components, operation and
h. Teacher should ask the students to go through instruction and Technical manuals

11. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***
The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs.(Affective Domain Outcomes) .Each student will have to maintain activity chart consisting of individual contribution in the project work and give a seminar presentation of it before submission.. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.
A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

a. Modulation: Build a circuit for Modulation using IC MC1496/8038 on general purpose PCB and prepare a report.
b. FM Transmitter: Build a circuit on general purpose PCB for FM Transmitter using IC 8038/Transistor BF 549 and prepare a report.
c. Channel frequencies: Find different Channel frequencies associated with AM and FM Stations.
d. Antenna: Simulate a Microstrip patch antenna for frequency 2.4 GHz using HFSS (High frequency structure simulator) software.
e. Tuning of IFT: Build a circuit on general purpose PCB for tuning IFT at 455 KHz.
f. Prepare a report based on types, radiation pattern and application of antenna.

12. SUGGESTED LEARNING RESOURCES

S.N.	Title	Author	Publisher, Edition ,Year of publication and ISBN Number
1	Electronics Communication Systems.	Kennedy George, Davis Bernard, Prasanna SRM	Mc-Graw Hill 5th edition,New Delhi,2011 ISBN:9780071077828
2	Principles of Electronics Communication Systems .	Frenzel Louis E.	Mc-Graw Hill 5th edition,New Delhi,2007 ISBN:9780073222783
3	Antenna Theorey: Analysis and Design	Constantine A. Balanis	Wiley-Student edition India,New Delhi 2016 ISBN :9788126524228

13. SOFTWARE/LEARNING WEBSITES

1. www.nptel.com
2. http://www.turbofuture.com/Elements of Electronics Communication system
3. www.antanna-theory.com/basics/main.php
4. www.circuitdiagram.org/am-radio-receiver-with-mk484.html
5. https://www.daenotes.com/electronics/communication-system/modulation-definition-explanation-types
6. www.circuitstoday.com/single-chip-fm-radio-circuit

14. PO - COMPETENCY- CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2	2	3	2	-	2	2
CO2	2	2	2	2	-	2	2
CO3	2	2	3	2	-	2	2
CO4	3	2	2	2	-	2	2
CO5	3	2	2	2	-	2	2
CO6	2	2	2	2	-	2	2

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-
CO6	3	-	-

Sign: Name: Shri. G. W. Sonone Smt. S. S. Chhatwani (Course Experts)	Sign: Name: Shri. R. N. Shikari (Head of Department)
Sign: Name: Shri.R.N.Shikari (Program Head) (E & TC Department)	Sign: Name: Shri A. S. Zanpure (CDC)

Government Polytechnic, Pune

'180OB' – Scheme

Programme	Diploma in **Electronics &Telecommunication Engineering**
Programme code	01/02/**03**/04/05/06/07/08/15/16/**17**/18/19/21/22/**23**/24/26
Name of Course	**Linear Integrated Circuit**
Course Code	**ET3106**
Prerequisite course code and name	ET2101 (Basic of Electronics Engineering)
Class Declaration	**NO**

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)		Examination Scheme				
					Theory		Practical		Total Marks
L	T	P	C		ESE	PA	*ESE	PA	
03	01	02	06	Marks	80	20	25	25	150
				Exam Duration	3 Hrs	1 Hr	-	-	

(*):POE (Practical Examination)

Legends: L-lecture, T-Tutorial/teacher guided theory practice, P-practical, ESE-End semester examination, PA- Progressive Assessment, # - Online theory exam

2. RATIONALE

Operational Amplifier (OP-AMP) is the most versatile Linear Integrated Circuit used to develop various applications in electronic circuits and equipment. Hence this course is intended to develop the skills to build, test, diagnose and rectify the Op-Amp based electronic circuits. This course deals with various aspects of Linear Integrated Circuit used in various industrial, consumer and domestic applications.

3. COMPETENCY

The aim of this course is to attend following industry identified competency through various teaching learning experiences:

- **Maintain electronic circuits consisting of Linear Integrated Circuit.**

4. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency**:**

1. Use Op-Amp in linear electronic circuits

2. Use various configurations of Op-Amp for different applications

3. Troubleshoot various linear applications of Op-Amp for the given specifications

4. Maintain filters used in various electronic circuits

5. Troubleshoot specified applications using various linear ICs

6. Analyze the response of frequency selective circuit such as PLL with respect to the incoming signal

5. SUGGESTED PRACTICALS/ EXERCISES

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Relevant CO	Approximate Hours Required.
1	1	To measure the differential input resistance,input offset voltage, common mode rejection ratio(CMRR) of IC741	1	02
2	2	To assemble inverting and non inverting amplifier and draw input output waveforms.	2	02
3		To assemble adder using OPAMP	2	02
4		To assemble substract or using OPAMP	2	02
5		Observe output of active integrator and active differentiator for different types of input (sine and square)	2	02
6	3	Study of input and output for V to I converter and I to V converter	3	02
7		To assemble sample and hold circuit.	3	02
8		To assemble zero crossing detector	3	02
9	4	Plot the frequency response of first order Butterworth low pass filter.	4	02

10.		Plot the frequency response of first order butterwort band pass filter/ band reject filter.	4	02
11		Plot the frequency response of second order Butterworth high pass filter	4	02
12		Plot the frequency response of second order Butterworth low pass filter	4	02
13	5	Study of astablemultivibrator using IC 555	5	02
14		Study of Monostablemultivibrator using IC 555	5	02
15		Study of Schmitt trigger using IC 555	5	02
16	6	Plot the characteristics of PLL	6	02
17	All	Complete a Micro- project based on guidelines provided in sr.no. 11.	All	04
		Total Hrs		**32**

Note: Any 12 practicals from sr. no. 1 – 16 can be performed and 17 is compulsory.

Sr.No.	Performance Indicators	Weightage in %
a.	Preparation of experimental setup	20
b.	Setting and operation	20
c.	Safety measures	10
d.	Observations and Recording	10
e.	Interpretation of result and Conclusion	20
f.	Answer to sample questions	10
g.	Submission of report in time	10
Total		**100**

6. MAJOR EQUIPMENT/ INSTRUMENTSREQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practical, as well as aid to procure equipment by authorities concerned**.**

Sr.No.	Major Equipment/ Instruments Required	Experiment Sr. No.
1	Variable DC Power supply 0-30V with display for voltage and current	All
2	Digital Multimeter	All

3	CRO	1,2,3,4,5,6,7,8,9,10,11,12,13
4	Function Generator	2,5,6,7,8,9,10,11,12,13,14,15,16
5	Different types of cables and connectors	All
6	Electronic work bench with positive and negative power supply	All

7. THEORY COMPONENTS

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
UNIT 1.Fundamentals of Operational Amplifier (Op-Amp)(Weightage-14 , Hrs.- 8)	
1a.Describe the block diagram of Op-Amp. 1b.Select the parameters to be considered for the given applications of the Op-Amp. 1c.State function of each pin of IC's 741. 1d.Explain the working of the given type of Op-Amp configuration.	1.1 Importance of Op-Amp. 1.2 Block diagram of Op-Amp and function of each block with thecircuit such as balanced, Unbalanced, differential amplifiers with simplecurrent source, level shifter and complementary push-pull amplifier. 1.3 Parameters of Op-Amp:Input offset voltage, Input offset current, Input bias current, differentialinput resistance, Input capacitance, Input voltage range, offset voltageadjustment range, Common Mode Rejection Ratio (CMRR), SupplyVoltage Rejection Ratio(SVRR), large signal voltage gain and transfercharacteristics, supply voltages, supply current, output voltage swing,output resistance, slew rate, gain bandwidth product, output short circuitcurrent. 1.4 Ideal op-amp: electrical characteristics. 1.5 Ideal and practical voltage transfer curve. 1.6 OPAMP IC's: 741 pin diagram and pin function. 1.7 Open loop and closed loop configuration of op-amp, its comparison.
UNIT 2.OP-Amp Basic Circuits(Weightage-14, Hrs.- 8)	
2a.Explain with sketches the working of the given configuration. 2b.Calculate the output voltage of the given arithmetic circuit using Op-Amp. 2c.Select the relevant op-Amp configuration for the given application with justification. 2d.Calculate the given parameter for specified Op-	2.1 Virtual ground concept. 2.2 Open loop configuration – Inverting , Non-inverting. 2.3 Close loop configuration – Inverting, non- inverting, differential amplifier, unity gain amplifier (voltage follower) inverter(sign changer). 2.4 Inverting & non-inverting configuration of Adders (summing amplifier, scaling Amplifier, averaging amplifier), Substractor. 2.5 Basic Integrator. 2.6 Basic Differentiator. 2.7 concept of frequency compensation of op-amp and offset nulling.

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Amp configuration.	
UNIT 3.Linear Applications of Op-Amp(Weightage-16, Hrs.- 12)	
3a.Explain with sketches the working of an Instrumentation amplifier for the given application. 3b.Select the relevant op-Amp converter for the given application with justification. 3c.Select the op-Amp based comparator for the given application with justification. 3d.Explain with sketches the working of an Op-Amp for the given application.	3.1 Instrumentation amplifier using three OPAMP requirements,circuit diagram, circuit operation, derivation of output voltage equation,advantages & applications. Pin diagram pin functions and specificationsof IC LM 324. 3.2Voltage to current converter (with floating load, with grounded load)Current to voltage converter. 3.3 Sample and hold circuit. 3.4Logarithmic and antilogarithmic amplifiers (using Diodes)analogdivider and analog multiplier. 3.5 Concept of comparator: zero crossing detector, Schmitt trigger,window detector, phase detector, active peak detector, peak to peakdetector.
UNIT 4.Filters(Weightage-14, Hrs.- 8)	
4a.Explain working the given type of filter with circuit diagram. 4b.Define different terms related to filters. 4c.Identify the given type of filter base on frequency response. 4d.Calculate the cut of frequency for the given type of filters.	4.1Introduction to filters. 4.2 Classification of filters. 4.3 Merits & demerits of active filters over passive filters. 4.4 Concept of passive & active filters. 4.5Ideal and actual characteristics, terms: - cut off frequency, pass band,stop band, centre frequency, roll off rate, BW, Q-factor, first order &second order Butterworth filters. 4.6 Filter types and it's frequency response Low pass filter, High pass filter, Band pass filter(wideband pass ,narrow band pass filter) Band reject filter(wide band reject, Narrow band reject filter), All pass filter. 4.7 Numerical based on design of different filters.
UNIT 5.Timers (Weightage-14, Hrs.-8)	
5a.Explain the block diagram and pin diagram of IC 555. 5b.Explain with sketches the working of IC 555 for the given	5.1 Introduction to timer IC 555. 5.2 Block diagram of IC 555 and its pin diagram & function of each pin. 5.3 Monostable multivibrator, astable multivibrator, Bistable multivibrator, Schmitt trigger, voltage controlled oscillator.

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
application. 5c.Calculate the duty cycle of the given type of multivibrator. 5d.Describe the pin function and specification of IC 556.	5.4 IC556 features, pin diagram and specifications.
Unit 6.Phase Lock Loop(PLL) (Weightage-08, Hrs- 04)	
6a.Explain the block diagram of PLL. 6b.Calculate the lock range and capture range of the given PLL`. 6c.Explain the block diagram of voltage controlled oscillator.	6.1 Phase lock loop(PLL): block diagram, it's operation, lock range and capture range. 6.2 IC 565: pin diagram and function. 6.3 Application of PLL: PLL as a frequency multiplier and FM demodulator. 6.4 IC566 (voltage controlled oscillator), its block diagram and pin diagram.

8. SUGGESTED SPECIFICATION TABLE FORQUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Fundamentals ofOperational Amplifier (Op-Amp)	08	4	4	6	14
II	OP-Amp Basic Circuits	08	4	4	6	14
III	Applications of Op-Amp	12	4	6	6	16
IV	Filters	08	4	6	4	14
V	Timers	08	4	4	6	14
VI	Phase Lock Loop(PLL)	04	2	2	4	8
	Total	48	22	26	32	80

9. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a. Prepare journals based on practical performed in laboratory.
b. Study of datasheet of different linear ICs.
c. Follow the safety precaution.
d. Refer technical magazine to collect information of the op-Amp based linear circuit and their application
e. Prepare power point presentation for understanding different OP-Amp based circuit behaviour.

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
c. With respect to item No.9, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
d. Guide student(s) in undertaking micro-projects.
e. Correlate subtopics with power plant system and equipments.
f. Use proper equivalent analogy to explain different concepts.
g. Use Flash/Animations to explain various components, operation and
h. Teacher should ask the students to go through instruction and Technical manuals

11. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***
The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs.(Affective Domain Outcomes) .Each student will have to maintain activity chart consisting of individual contribution in the project work and give a seminar presentation of it before submission.. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

a. Build a circuit for op-amp to measure CMRR, input & output offset voltage.
b. Build a differential amplifier circuit using op-amp IC741.
c. Developvoltage follower circuit.
d. Build a practical integrator circuit.
e. Build a practical differentiator circuit.
f. Build Instrumentation Amplifier(ICLM324) for measurement of temperature using thermocouple/RTD/Thermistor.
g. DevelopatemperaturecontroldcfanusingIC741.
h. Develop sequential timer circuit using multiple timers.
i. Develop any one type of filter circuit usingop-amp.
j. Develop water level controller using IC555.
k. DevelopatonegeneratorusingIC555.
l. Develop PWMLED Dimmer/Brightness Controlusing 1C555.
m. Develop FSK modulator and demodulator using PLLIC565.
n. Simulate using software LT spice/ P spice / Scilab, /Matlab /Octave or any other open source software linear IC applications

12. SUGGESTED LEARNING RESOURCES

S.N.	Title	Author	Publisher, Edition ,Year of publication and ISBN Number
1	Op-Amps and Linear Integrated Circuits	Gayakwad,Ramakant	A,PILearning,New Delhi. ISBN:9788120320581
2	Operational Amplifiers and Linear ICs	Bell,David A	Oxford University Press,New Delhi India,2011. ISBN: 9780195696134
3	Operational Amplifiers with and Linear Integrated Circuit	Stanley,WillamD	Pearson Education India, New Delhi 2002. ISBN:9788131708453
4	Design with Operational Amplifiers and Analog Integrated Circuit	Franco,Sergio	McGraw Hill Education.New Delhi,2014. ISBN:9780078028168
5	Linear Integrated Circuits	ShalivahananS	McGraw Hill Education.New Delhi,2008ISBN:9780070648180
6	Linear Integrated Circuits	Shivakumar,Senthil	M,S.Chand publishing .M,New Delhi, 2014ISBN:9788121941136
7	Linear Integrated Circuits	Roy Choudhary,D. Jain	Sail B,New Age International/Publisher,New Delhi,2003.ISBNP:8122414702

13. SOFTWARE/LEARNING WEBSITES

1. Op-Amp:-http://www.jamia-physics.net/lecnotes/lab/opamp.pdf
2. IC555:- http://www.jamia-physics.net/lecnotes/lab/555.pdf
3. IC555data sheet:- http://www.Electroschematics.com/650/lm555-datasheet/
4. Op-Amplifier basics:-http://www.khanacademy.org/science/electrical-engineering/ee-amplifiers
5. Data sheet555:- www.engineersgarge.com/electronic-components /ne555-timer-ic-datasheet
6. Vidéo lecture Op-Amp:-http://freevideolectrures.com/Course/3062/Electronics-1/37
7. Voltage control Oscillator:- http://www.Electronicsshub.org/voltage-controlled-oscillators-vco/
8. Op-Amp:- http://www.Talkingelectronics.com/projects/OP-AMP/OP-AMP-1.html

14. PO - COMPETENCY- CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	2	3	-	-	-
CO2	3	-	2	2	-	-	2
CO3	3	3	2	3	-	-	2
CO4	3	-	-	3	-	-	2
CO5	3	3	2	2	-	-	3
CO6	3	3	-	3	-	-	-

	PSO1	PSO2	PSO3
CO1	3	-	2
CO2	3	-	2
CO3	3	-	-
CO4	3	-	2
CO5	3	-	-
CO6	3	-	3

Sign: Name:Smt.N.S.Bakde Smt.M.V.Saraf Smt. R.S.Deulkar (Course Expert /s)	Sign: Name: Shri.R.N.Shikari (Head of Department)
Sign: Name: Shri.R.N.Shikari (Program Head) (E & TC Department)	Sign: Name: Shri. A.S.Zanpure (CDC)

Government Polytechnic, Pune

'180OB' – Scheme

Programme	Diploma in **Electronics&Telecommunication Engineering**
Programme code	01/02/**03**/04/05/06/07/08/15/16/**17**/18/19/21/22/**23**/24/26
Name of Course	**Power Electronics**
Course Code	**ET3107**
Prerequisite course code and name	**ET2101** (Basic of Electronics Engineering)
Class Declaration	**NO**

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)		Examination Scheme				
					Theory		Practical		Total Marks
L	T	P	C		ESE	PA	$ESE	PA	
03	00	02	05	Marks	80	20	25	25	150
				Exam Duration	3Hrs	1 Hr	-	-	

($):OE (Oral Examination) Legends: L-lecture, T-Tutorial/teacher guided theory practice, P-practical, ESE-End semester examination, PA- Progressive Assessment, # - Online theory exam

2. RATIONALE

Electronic control circuit play major role in industries. In this era of automation industry and manufacturing sector, the mechanical control is largely replaced by power electronics devices. In this context this course aims at acquainting the pass outs with the basic principles and the applications of basics power electronics devices, so that they can maintained the control circuits used in the field. Hence this course has been designed to achieve this aim

3. COMPETENCY

The aim of this course is to attend following industry identified competency through various teaching learning experiences:

- **Maintain power electronic devices in electronic circuits**

4. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency**:**

1. Analyzebasic operation of various power semiconductor devices.
2. Maintain triggering and commutation circuits.
3. Use phase controlled rectifier in different applications.
4. Use choppers and inverters in different applications.
5. Maintain controlled circuits consisting of power electronic devices.

5. SUGGESTED PRACTICALS/ EXERCISES

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Relevant CO	Approximate Hours Required.
1.	1	Plot transfer and output characteristics of Insulated - Gate Bipolar Transistor (IGBT).	1	02
2.	2	Measure holding current and latching current of given SCR from its VI characteristics curve.	1	02
3.		Determine break over voltage of given DIAC from its curve	1	02
4.		Plot output characteristics of TRAIC	1	02
5.	3	Observe the effects of variation of R, C in R and RC triggering circuits on firing angle of SCR.	2	02
6.		Observe the effect of variation of R on firing angle in synchronized UJT triggering circuit.	2	02
7.	4	Test the performance of half wave controlled rectifier with R,RL load and measure load voltage	3	04
8.		Test the performance of full wave controlled rectifier with R,RL load and measure load voltage	3	04
9.	5	Measure output voltages of Step up chopper for different values of duty cycles	4	02
10.		Measure output voltages of Step down chopper for different values of duty cycles	4	02
11.		Test parallel inverter to measure frequency and output voltages.	4	02
12.	6	Light Dimmer	5	02
13.	All	Complete a Micro- project based on guidelines provided in sr.no. 11.	All	04
		Total Hrs		**32**

Note: All Practicals are compulsory.

S.No.	Performance Indicators	Weightage in %
a.	Arrangement of available equipment / test rig or model	20
b.	Setting and operation	20
c.	Safety measures	10
d.	Observations and Recording	10
e.	Interpretation of result and Conclusion	20
f.	Answer to sample questions	10
g.	Submission of report in time	10
Total		**100**

6. MAJOR EQUIPMENT/ INSTRUMENTSREQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practical, as well as aid to procure equipment by authorities concerned**.**

Sr.No.	Major Equipment/ Instruments Required	Experiment Sr. No.
1	Variable DC Power supply 0-30V with display for voltage and current	ALL
2	Digital Multimeter	ALL
3	CRO	7,8,9,10,11
4	Function Generator	1,2,9,10
5	Different types of cables and connectors	All
6	LCR Q METER	1,3,6

7. THEORY COMPONENTS

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Units 1 : Power Electronics(Weightage-8, Hrs- 4)	
1a.Define power electronics 1b. Able to draw V-I characteristics of Power MOSFET. 1c. Describe working principle of IGBT & MOSFET.	1.1 Introduction to power electronics. 1.2 Power MOSFET-Construction, Operating Principle, V-I characteristics and Uses of Depletion and Enhancement type Power MOSFET 1.3 IGBT- Construction, Operating Principle, V-I characteristics and Uses of IGBT.
UNIT 2 Thyristor Family Devices (Weightage-14 , Hrs-10)	

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
2a. Describe operating principle of SCR. 2b. Define different currents related to SCR. 2c. Able to classify thyristor family. 2d. Able to differentiate between devices.	2.1 SCR: Construction, Operating Principle with Two transistor analogy, V-I characteristics, Latching Current (IL) and Holding Current (IH). Applications of SCR, SCR protection circuits, Snubber circuit, gate protection circuit, SCR crowbar circuit, Series & parallel operations of SCRs. 2.2Thyristor family devices LASCR, SCS, GTO and TRIAC: Construction, Operating Principle, V-I characteristic and Applications. 2.3 Triggering Devices- Construction, Operating Principle, V-I characteristics and applications of UJT, PUT, SUS, SBS andDIAC
UNIT 3 Turn ON and Turn OFFmethods of SCR(Weightage-18, Hrs-10)	
3a. Describe Turn ON & turn OFF methods. 3b.Classify turn OFF methods 3c.Explain with sketches the methods of triggering for the given SCR 3d. Explain with sketches the effect of the given firing angle on load voltage. 3e. Explain with sketches the turn OFF methods of the given SCR. 3f. Explain the Pulse transformer used in triggering circuit.	3.1 Concept of Turn ON mechanism of SCR: High Voltage triggering, thermal triggering, Illumination triggering, dv/dt triggering Gate triggering of SCR. 3.2 Gate trigger circuits - Resistance triggering circuit, Resistance Capacitance triggering circuit (Operation, applications and limitations) 3.3 SCR triggering using UJT, PUT-Relaxation Oscillator circuit and Synchronized UJT triggering circuit: (Operation and applications). 3.4 Pulse transformer used in triggering circuit (Operation and Applications). 3.5 Concept of Turn OFF mechanism and methods of - Class A-Series resonant commutation circuit, Class B-Shunt resonant commutation circuit, Class C-Complimentary Symmetry commutation circuit
UNIT 4 Phase controlled Rectifiers (Weightage-16, Hrs-08)	
4a. Define firing angle. 4b. Write equations for controlled rectifiers. 4c. Compare controlled	4.1 Concept of phase control. (Firing Angle **α** and conductionangle **Ø**) 4.2 Circuit diagram, working, equations for and Waveforms of VDC of following rectifiers. 4.3 Single phase half wave controlled rectifier with R, RL

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
rectifiers. 4d.Describe effect of freewheeling diode with waveform. 4e. State need of poly -phase rectifier	load.Effect of freewheeling diode. 4.4 Single phase centre tapped full wave controlled rectifier with R, RL load. Effect of freewheeling diode. 4.5 Single phase Bridge type full wave controlled rectifier with R, RL load. Effect of freewheeling diode. 4.6 Basic three phase half wave uncontrolled and controlledRectifier. 4.7 Need and Uses of Poly-phase rectifier
UNIT 5 Converters (Weightage-12, Hrs-10)	
5a. Define Choppers & inverters. 5b. Classify Choppers & inverters. 5c. State need of inverters. 5d. Define performance parameters of Inverters. 5e.Describe working principle of Choppers & inverters.	5.1 Concept of Choppers 5.2 Chopper: basic circuit and its operation. 5.3 Step Up and Step down Chopper, Jones chopper. 5.4 Inverters-Need of an inverter, Classification of inverters, Basic series & parallel inverter, Important applications of inverter. 5.5 Working principle of single phase half bridge inverter 5.6 Definitions of performance parameters of inverter.
Unit 6: Industrial Control Circuits. (Weightage-12, Hrs-06)	
6a. Describe working principle of solid state batteries. 6b.Describe application of SCR as battery charger. 6c. Describe application of DIAC-TRIAC as Light dimmer circuit 6d. State applications of SMPS & UPS	6.1Solid state batteries: Principle of working, application advantages and disadvantages 6.2 Battery charger using SCR. 6.3Light dimmer circuit using DIAC-TRIAC 6.4Block diagram and Concept of UPS and application 6.5. Block diagram and Concept of SMPSand application

8. SUGGESTED SPECIFICATION TABLE FORQUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Power electronics	04	4	4	-	08
II	Thyristors family devices	10	8	3	3	14
III	Turn ON and Turn OFF methods of SCR	10	10	4	4	18
IV	Phase controlled rectifier	08	8	4	4	16
V	Converters	10	8	2	2	12
VI	Industrial control circuits	06	4	2	6	12
Total		**48**	**42**	**19**	**19**	**80**

9. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a. Prepare journals based on practical performed inlaboratory.
b. Library survey of different data sheet and manuals.
c. Prepare charts of symbols of power electronics devices.
d. To collect the literature related to specification of available power devices used in the market.
e. Refer technical magazine to collect information of the current devices used in power electronic industry
f. Prepare power point presentation for controlled rectifiers.

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.

b. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
c. With respect to item No.9, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
d. Guide student(s) in undertaking micro-projects.
e. Correlate subtopics with power plant system and equipments.
f. Use proper equivalent analogy to explain different concepts.
g. Use Flash/Animations to explain various components, operation and
h. Teacher should ask the students to go through instruction and Technical manuals

11. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***
The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs.(Affective Domain Outcomes) .Each student will have to maintain activity chart consisting of individual contribution in the project work and give a seminar presentation of it before submission.. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.
A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

a. **Controlled Rectifier:** Build a circuit of the Battery charger for charging a battery of 6V, 4AH.
b. **Controlled Rectifier:** Build **fan** speed regulator circuit using DIAL, TRIAC on zero PCB.
c. **Phase controlled Rectifiers:** Build the circuit for Speed control of 12V DC shunt motor using IGBT on zero PCB.
d. **Phase controlled Rectifiers:** Build AC power flasher using two SCRs on zero PCB.
e. **Industrial Applications of power devices:** Build DC time delay relay using PUT on zero PCB.
f. **Turn ON and Turn OFF methods of SCR:** Build Ramp and pedestal synchronized triggering circuit using UJT and pulse transformer on zero PCB.
g. **Industrial Applications of power devices:** Build Emergency light system. For 6V battery on zero PCB.
h. **Choppers and Inverters:** Build Step down chopper using MOSFET/IGBT on zero PCB.
i. **Industrial Applications of power devices:** Simulate control of intensity of light using phase control

12. SUGGESTED LEARNING RESOURCES

Sr.No.	Title	Author	Publisher, Edition ,Year of publication and ISBN Number
1	Power Electronics	Moorthi,V.R.	Oxford University Press,New Delhi 110001,2013 ISBN 0-19-567092-2
2	Fundamentals of Power Electronics	Bhattacharyaa	S.K., ISTE Learning materials centre,2006, ISBN 9788125918530
3	Power ElectronicsEssentials and Applications	Umanand,L,	Wiley India Pvt.Ltd,New Delhi,2011 ISBN:9788126519453
4	Power Electronics	Singh, Khanchandani	ISBN:9781259082429
5	Power Electronics Circuit Devices And Application	Rashid, Muhammad H	Pearson Education India,New Delhi,2012 ISBN:9780137967636

13. SOFTWARE/LEARNING WEBSITES

1. www.nptel.ac.in/courses/108101038
2. https://en.wikipedia.org/wiki/Power_Electronics
3. PSIM software for power electronics
4. www.books.google.co.in/books/about/Power_Electronics
5. https:///www.slideshare.net/mobile/gururajrawoor/allssolid-state-batteries-an-overview-for-bio-applications
6. https://www.futurebridge.com/blog/solid-state-batteries/
7. https://www.google.com/amp/s/www.marketecheasier.com/solid-state-batteries/%3famp

14. PO - COMPETENCY- CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2	3	3	2	1	-	-
CO2	3	-	2	2	-	-	2
CO3	3	3	2	2	-	-	2
CO4	1	-	-	3	-	-	2
CO5	3	2	2	2	1	-	3

	PSO1	PSO2	PSO3
CO1	2	2	3
CO2	-	2	3
CO3	1	3	-
CO4	1	3	-
CO5	-	2	3

Sign: Name: Shri.S.H.Jadhav Smt. A.M.Kulkarni Smt. M.V.Saraf (Course Experts)	Sign: Name: Shri.R.N.Shikari (Head of Department)
Sign: Name: Shri.R.N.Shikari (Program Head) (E & TC Department)	Sign: Name: ShriA.S.Zanpure (CDC)

Government Polytechnic, Pune

'180OB' – Scheme

Programme	Diploma in **Electronics & Telecommunication Engineering**
Programme code	01/02/**03**/04/05/06/07/08/15/16/**17**/18/19/21/22/**23**/24/26
Name of Course	**DIGITAL ELECTRONICS**
Course Code	**ET 3108**
Prerequisite course code and name	**NA**
Class Declaration	**NO**

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)		Examination Scheme				
					Theory		Practical		Total Marks
L	T	P	C		ESE	PA	*ESE	PA	
03	01	02	06	Marks	80	20	25	25	150
				Exam Duration	3 Hrs	1 Hr	-	-	

(*):POE (Practical & Oral Examination)

Legends: L-lecture, T-Tutorial/teacher guided theory practice, P-practical, ESE-End semester examination, PA- Progressive Assessment, # - Online theory exam

2. RATIONALE

In the present scenario most of the electronic equipment like computers, mobiles, music systems, ATM, automation and control circuits and systems are based on digital circuits which the diploma electronic engineering pass outs have to test them .The knowledge of basic logic gates, combinational and sequential logic circuits using gates as well as digital ICS will enable the students to interpret the working of equipment's and maintain them. After completion of the course, students will be able to develop the digital circuits-based applications.

3. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Build/ test digital logic circuits consist of digital ICs.**

4. COURSE OUTCOMES (COs)

The theory practical experiences and relevant soft skill associated with this course are to be taught and implemented, so that the students demonstrate the following industry orientated CO associated with the above mentioned competency:

1. Use number system and codes for interpreting working of digital system.
2. Use Boolean expressions to realize the logic circuits.
3. Build simple combinational circuits.
4. Build simple sequential circuits.
5. Test data converts in digital electronic systems.
6. Know about nomenclature & technology in the area of memory.

5. SUGGESTED PRACTICALS/ EXERCISES

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Relevant CO	Approximate Hours Required.
1.	1.	To check different IC's using IC tester.	1	02
2.	2.	Verify Truth table of basic logic gates, universal gate.	2	02
3.		Verify NAND and NOR gate as universal logic gate.	2	02
4.		Verify De Morgan's Theorem.	2	02
5.	3	Design Half Adder & Full Adder.	2	04
6.		Design Half Subtractor and Full substractor.	2	04
7.		Verify the operation of Multiplexer IC 74151.	3	02
8.		Verify the operation of Demultiplexer IC 74155.	3	02
9.		Verify truth table of Encoder & Decoder.	3	02
10.	4.	Realize and verify RS flip flop using NAND gate and verify master slave JK Flip-Flop.	4	02
11.		Implement 4 bit ripple counter/Decade counter.	4	02
12.		Implement 4 bit universal shift register.	4	02
13.		Realize T and D flip flop and verify its truth table.	4	02
14.	5.	Implement 3 bit R-2R D/A converter	5	02
15	All	Complete a Micro- project based on guidelines provided in sr. no. 11.	All	04
		Total Hrs		**32**

Note: Any 12 practicals from sr. no. 1 – 14 can be performed and 15 is compulsory.

Performance Indicators:

S. No.	Performance Indicators	Weightage in %
a.	Preparation of experimental setup	20
b.	Setting and operation	20
c.	Safety measures	10
d.	Observations and Recording	10
e.	Interpretation of result and Conclusion	20
f.	Answer to sample questions	10
g.	Submission of report in time	10
Total		**100**

6. MAJOR EQUIPMENT/ INSTRUMENTSREQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practical, as well as aid to procure equipment by authorities concerned**.**

Sr. No.	Major Equipment/ Instruments Required	Experiment Sr. No.
1	Variable DC Power supply 0-30V with display for voltage and current	All
2	Digital Multimeter	All
3	CRO	14
4	Pulse Generator	10,11,12,13,14
5	Different types of cables and connectors	All
6	Digital IC Tester	1 to 13

7. THEORY COMPONENTS

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
UNIT 1.NUMBER SYSTEM AND CODES(Weightage-14 , Hrs.- 06)	
1a Recognize and convert the given number into the specified number system. 1b. Perform the binary arithmetic operation on the given binary numbers. 1c. Convert the given coded number into the other specified code. 1d. Find 1's compliments and 2's compliment of given no.	1.1 Analog signal Vs Digital signal Number system: Decimal Binary, octal, hexadecimal conversion of one system into other 1.2 Binary Arithmetic: - Addition, Subtraction(1's and 2's complement) Multiplication, Division, 1.3 BCD Arithmetic: BCD addition and subtraction using 9's and 10' complement 1.4Codes:BCD, Grey Code, Excess-3,ASCII codes.

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
1e Add the given two decimal numbers using BCD code.	
UNIT 2. LOGIC GATES AND LOGIC FAMILIES (Weightage- 12, Hrs- 06)	
2a Design the basic gate using NAND and NOR gate. 2b. Simplify the given expression using Boolean laws. 2c. Design logic circuits using the given Boolean Expression. 2d. Compare the silent characteristics of given digital logic families.	**2**.1 Logic Gates: Symbol, logical expression, truth table, pin diagram of basic logic gates(AND,OR,NOT), Universal gates(NAND and NOR),Special purpose gates(EX-OR,EX-NOR) 2.2Booleanalgebra: of Boolean algebra, Duality Theorem, De Morgan's theorems. 2.3 Logic families: Characteristics of logic families(Noise Margin, power dissipation, figure of merit, Fan-in& fan -out , speed of operation, Comparison between different logic families. TTL NAND gate – Totem pole output CMOS Inverter
UNIT 3 COMBINATIONAL CIRCUITS(Weightage-18 , Hrs- 14)	
3a. Design logic circuits in standard SOP/POS forms for given logical expression. 3b. Minimize the given logic expression using K-map. 3c. Design adder/ subtractor using IC7483. 3d. Draw MUX/DEMUX tree for the given number of input and output lines. 3e. Design code converter using k map	3.1 Standard Boolean representation: Sum of product(SOP) & product of sum(POS),Min term and Maxterm conversion between SOP and POS forms. Realization using NAND /NOR gates 3.2 K-map reduction techniques: minimization of Boolean functions upto 4 variable using SOP & POS Forms 3.3 Design of arithmetic circuits and code converter using K-maps: Half and Full Adder, Half and Full Subtractor. 3.4 Code Converter using K-map: Gray to Binary, Binary to Gray Code (upto 4bit) 3.5 Encoder & Decoder : Priority Encoder , Decimal to BCD Encoder , IC 7447 as BCD to 7 segment decoder, IC 7483 as Adder & subtractor , 1 digit BCD adder. 3.6 ALU (Truth table & Block Diagram) IC 74181 and IC 74183 3.7 Multiplexers(MUX) and Demultiplexers (DEMUX): study of IC 74151,MUX tree, study of IC 74155 as DEMUX ,DEMUX Tree, DEMUX as decoder. 3.8 Buffer: Tristate logic, Unidirectional & bidirectional buffer

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	ICs: IC 74244 and IC 74245
UNIT 4.SEQUENTIAL LOGIC CIRCUIT(Weightage- 18 , Hrs- 12)	
4a. Use relevant triggering technique for the given digital circuit. 4b.Use the given Flip flop to construct the specific type of counter. 4c. Design synchronous and Asynchronous counter using excitation table . 4d.Design ring /twisted ring counter using the given flip-flop. 4e. Design 4 bit shift register using given flip flop.	4.1 Basic memory cell: RS latch – using NAND & NOR. 4.2 Triggring methods: Edge and level trigger. 4.3 S R Flip flop: SR- Flip flop, Clocked SR flip flop with preset and clear, Drawbacks of SR Flip flop. 4.4 JK Flip flops: Clocked JK Flip flop with preset & clear, Race around condition in JK flip-flop, Master slave JK flip flop. D and T type flip flop. Excitation table of flip flops. 4.5 Shift Register: Logic diagram of 4 bit shift registers –Serial input serial output, Serial input parallel output, Parallel input serial output, Parallel input parallel output, 4 Bit Universal Shift registers. 4.6 Counters: Asynchronous counter: 4 bit Ripple counter , 4 bit up/down Counter, modulus of counter, Synchronous counter: Design of 4 bit synchronous up/down counter. 4.7 Applications of Shift Register: Ring counter, Twisted ring counter(Logic Diagram with waveforms)
UNIT 5. DATA CONVERTERS(Weightage- 10 , Hrs- 06)	
5a. Calculate the output voltage of R-2R ladder for the given specified digital input. 5b. Calculate the output voltage of the weighted resistor DAC for the given specified digital input. 5c. Explain with sketches the working principle of the given type of ADC. 5d. Explain with sketches the working principle of the given type of DAC.	5.1 Digital to Analog converter: Types of DAC : Weighted resistor method and R-2R Method (along with Mathematical derivation) 5.2 Analog to Digital converter: Single slope ADC, Dual slope ADC, SAR ADC (Block diagram & working)

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
UNIT 6. MEMORIES(Weightage- 08 , Hrs- 04)	
6a. State classification of Memory. 6b. Explain with sketches the working principle of memories. 6c. Compare different types of memories.	6.1 Classification of memory and Principle of operation: Types of memory RAM (Static, Dynamic), Volatile and Non-Volatile, ROM (PROM, EPROM, EEPROM),Flash memory, 6.2 Comparison: Comparison between RAM (Static, Dynamic), Volatile and Non-Volatile, ROM (PROM, EPROM, EEPROM), Flash memory

8. SUGGESTED SPECIFICATION TABLE FORQUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	**Number System and Codes**	06	04	04	06	14
II	**Logic Gates and Logic Families**	06	02	04	06	12
III	**Combinational Logic Circuits**	14	04	06	08	18
IV	**Sequential Logic circuit**	12	04	06	08	18
V	**Data converter**	06	02	06	02	10
VI	**Memories**	04	02	04	02	08
Total		**48**	**20**	**30**	**30**	**80**

9. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a. Prepare the survey report on the application of different types of number system and code converters used in the design of digital system.
b. Compare technical specifications and applications of various types of memory and prepare report.
c. Test digital ICs using various testing equipment like Digital IC tester, Digital multimeter
d. Present seminar on any course relevant topic.
e. Conduct library / internet survey regarding different data sheets and manuals.
f. Prepare power point presentation on digital circuits and application.
g. Undertake a market survey of different digital ICs required for different applications.
h. Search for video/animations/power point presentation on internet for complex topic related to the course and make a presentation.

10.SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
c. With respect to item No.9, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
d. Guide student(s) in undertaking micro-projects.
e. Correlate subtopics with power plant system and equipments.
f. Use proper equivalent analogy to explain different concepts.
g. Use PPTs/Animations to explain construction and working of electronic circuits.
h. Teacher should ask the students to go through instruction and Technical manuals

11.SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs.(Affective Domain Outcomes) .Each student will have to maintain activity chart consisting of individual contribution in the project work and give a seminar presentation of it before submission.. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

a. Build a Digital IC tester circuit.
b. Build a circuit to implement 4 bit adder.
c. Build a circuit to implement BCD adder.
d. Build a circuit to test 7 segment display.
e. Build a circuit to implement BCD to & 7 segment decoder.
f. Build a 4 bit parity Checker circuit.
g. Build a circuit for LED flasher.
h. Build a circuit to implement 4 bit ripple counter.

12.SUGGESTED LEARNING RESOURCES

S.N.	Title	Author	Publisher, Edition, Year of publication and ISBN Number
1	Modern Digital Electronics	R P Jain	McGraw Hill Education Pvt. Ltd, 4th Edition,2012ISBN 10: 0070669112 ISBN 13: 9780070669116
2	Digital Electronics.	V. K. Puri	McGraw Hill ,New Delhi,2016 ISBN-97800746331751
3	Principles of Digital Electronics	Malvino.A.P, Leach, D.P, SahaG.,	McGraw Hill ,New Delhi,2014. ISBN :9780070141704
4	Digital Design	Mano, Morris,Ciletti,Michael D	Personal Education India,Delhi,2007 ISBN:9780131989245
5	Digital Electronics, Principles and Integrated Circuits	Anil K. Maini	Wiley India,Delhi,2007 ISBN:9780470032145
6	Digital Circuits And Design	Salivahanan S. Arivazhagan S.	Vikas Publishing House,New Delhi,2013 ISBN:9789325960411

13.SOFTWARE/LEARNING WEBSITES

1. www.cse.yorku.ca/~mack/1011/01.NumberSystems.ppt
2. www.people.sju.edu/~ggrevera/arch/slides/binary-arithmetic.ppt
3. www.mathsisfun.com/binary-number-system.html
4. www.codesandtutorials.com/hardware/electronics/digital_codes-types.php
5. www.ee.surrey.ac.uk/Projectys/Labview/gatesfunc/
6. www.ee.surrey.ac.uk/Projectys/Labview/boolalgebra/
7. www.eng.auburn.edu/~strouce/class/elec2200/elec2200-8.pdf
8. www.maxwell.ict.griffith.edu.au/yg/teaching/dns_module3_p3.pdf
9. www.scs.ryerson.ca/~aabhari/cps213Chapter5.ppt
10. www.cs.sjsu.edu/faculty/lee/Ch2Problems2.ppt
11. www.rogtronics.net/files/datasheets/dac/sedraSmith.pdf
12. www.old.me.gatech.edu/mechatronics_course/ADC_F04.ppt
13. www.allaboutcircuits.com/vl_4/chpt_13/3.html
14. www.youtube.com/watch?v=5Wz5f3n5sjs
15. www.eee.metu.edu.tr/~cb/e447/Chapter%209%20-%20v2.0.pdf
16. www.cmc.gcg11.org/attachments/article/95/Memory2.ppt
17. www.cosc.brocku.ca/Offerings/3P92/seminars/Flash.ppt
18. www.webopedia.com/TERM/R/RAM.html

14. PO - COMPETENCY- CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	2	2	-	2	2
CO2	3	2	3	2	-	2	2
CO3	3	2	3	3	-	2	2
CO4	3	2	3	3	-	2	2
CO5	2	2	3	2	-	2	2
CO6	2	1	2	2	-	2	2

	PSO1	PSO2	PSO3
CO1	3	–	2
CO2	3	–	2
CO3	3	–	2
CO4	3	–	2
CO5	3	–	2
CO6	3	–	2

Sign: Name: SmtS.S.Chhatwani Smt. R.S.Deulkar (Course Experts)	Sign: Name: Shri.R.N.Shikari (Head of Department)
Sign: Name: Shri.R.N.Shikari (Program Head) (E & TC Department)	Sign: Name: Shri.A.S.Zanpure (CDC)

Government Polytechnic, Pune

'180OB' – SCHEME

Programme	Diploma in **Electronics&Telecommunication Engineering**
Programme code	01/02/**03**/04/05/06/07/08/15/16/**17**/18/19/21/22/**23**/24/26
Name of Course	**Microcontroller and Application**
Course Code	**ET3109**
Prerequisite course code and name	ET3108(Digital Electronics)& Completed level 1 courses
Class Declaration	**YES**

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)		Examination Scheme				
					Theory		Practical		Total Marks
L	T	P	C		ESE	PA	*ESE	PA	
04	--	04	08	Marks	80	20	50	25	175
				Exam Duration	3 Hrs	1 Hr	-	-	

(*):POE (Practical &Oral Examination mention whichever is applicable)

Legends: L-lecture, T-Tutorial/teacher guided theory practice, P-practical, ESE-End semester examination, PA- Progressive Assessment, # - Online theory exam

2. RATIONALE

Microcontroller is used in almost all the domestic, industrial, consumer goods and other high end products. Automation is used in every field of engineering and microcontroller is inbuilt element of these systems and devices. Diploma engineers have to deal with various microcontroller based systems and maintain them. This course is intended to develop the skills to maintain and solve the application problems related to microcontrollers.

3. COMPETENCY

The aim of this course is to attend following industry identified competency through various teaching learning experiences:

- **Maintain microcontroller based systems.**

4. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency**:**

1. Analyze architecture of microcontroller ICs.
2. Interpret special features of 8051 Microcontroller.
3. Interpret the program for 8051 in assembly language for given operations.
4. Interpret the program by using timer and serial port
5. Interface the memory and IO devices to 8051 Microcontroller.
6. Maintain microcontroller used in different applications.

5. SUGGESTED PRACTICALS/ EXERCISES

S. No.	Unit No.	Practical Exercises (Learning Outcomes in Psychomotor Domain)	Relevant COs	Approx. Hrs. required
1	1	Introduction to keil software	1	04
2	3	Write an assembly language program using various addressing modes and assembler directives.	3	02
3		Data transfer internal memory. a) Write ALP to move the data _____H to internal register R0-R7 of Bank 0. b) Write ALP to move the data _____ H to internal RAM memory location____H -____H.	3	02
4		Data transfer internal& external memory. Write ALP to transfer the content of internal RAM memory location _____ H____H to external RAM memory location_____ H- _____H.	3	02
5		Addition of two (2) 8-bit no. a) Write ALP to add the content of two external RAM memory location ____H & ____H . Store the result at ____H. b) Write ALP to add two 8-bit no. which are stored at internal RAM location __ H & __H. Store the 16-bit result at __ H & __ H.	3	02
6		Subtraction of two 8-bit no. a) Write ALP to subtract the content of two external memory location _____H & _____H. Store the result at _____ H. b) Write ALP to subtract the content of internal RAM of memory location ____H from _____H. Store the result at ___H.	3	02
7		Write a program that multiples data in RAM location put the result in two successive location.	3	02
8		Write a program that divides data in RAM location put the result in two successive location.	3	02
9		a) Write ALP to mask lower 4-bit of on 8-bit number. Data is stored at memory location ___H. Store the result at location __H. b) Write ALP to mask higher 4-bit of an 8-bit number. Data is stored at memory location ___H. Store the result at __H.	3	02

10.	3	Write an ALP to obtain one's complement of an16-bit no. Data is stored at memory location.	3	02
11		Write an ALP to obtain two's complement of an 16-bit no. Data is stored at memory location.	3	02
12		a) Write ALP to find largest (maximum) no. out of two number data is stored at internal RAM memory location. b) Write ALP to find smallest (minimum) no. out of two number data is stored at memory internal RAM location.	3	02
13		Write an 8051 ALP to transfer block of data from internal RAM location ___H - ___H to internal RAM location ___H- ___H.	3	02
14		Write an 8051 based ALP to transfer 10 bytes in external RAM(Data) memory starting from location _____H to memory location starting from _____H.	3	02
15		Write ALP to add ten bytes in internal RAM location. Store the result (8-bit) at ___H.	3	02
16		Write ALP to add ten bytes in internal RAM location. Store the result (16-bit) at ___H (LSB) & ____H (MSB).	3	02
17		Write an assembly language program for arranging numbers in ascending and descending order stored in external memory locations.	3	04
18	3&4	Write an assembly language program to generate delay using resistor.	3&4	02
19	4	Write an assembly language program to transfer 8 bit data serially on serial port.	4	02
20	3&5	Interface a LED with 8051 microcontroller and turn it ON & OFF with some delay.	3& 5	02
21	3&4	Develop an assembly language program to generate a pulse and square wave by using Timer Delay.	3 & 4	02
22	3,5&6	Interface relay with microcontroller and Turn it ON/OFF.	3 ,5&6	02
23	3,5&6	Interface LCD with 8051 microcontroller to display characters and decimal numbers.	3,5 &6	02
24		Interface given keyboard with 8051 and display the key pressed.	3,5 &6	04
25		Interface ADC with 8051 microcontroller and verify input/output.	3,5 &6	04
26		Interface DAC with 8051 microcontroller and observe square, triangular and saw tooth wave.	3,5 &6	04
27		Interface stepper motor to microcontroller and rotate in clockwise and anti-clockwise direction.	3,5 &6	02
28	All	Complete a Micro- project based on guidelines provided in sr.no. 11.	All	04
		Total		**64**

Note: Any 20 practicals from sr. no. 1 – 27 can be performed and 28 is compulsory.

S. No.	Performance Indicators	Weightage in %
a.	Arrangement of available equipment / test rig or model	20
b.	Setting and operation	20
c.	Safety measures	10
d.	Observations and Recording	10
e.	Interpretation of result and Conclusion	20
f.	Answer to sample questions	10
g.	Submission of report in time	10
Total		**100**

6. MAJOR EQUIPMENT/ INSTRUMENTSREQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practical, as well as aid to procure equipment by authorities concerned**.**

S. No.	Equipment Name with Broad Specifications	Experiment Sr.No.
1	Microcontroller kit :- single board systems with 8K RAM, ROM with battery backup, 16*4, 16*2, LCD display, PC keyboard interfacing facility, Hex keypad facility, Single user cross c compiler, RS232, USB interfacing facility with built in power supply or any other equivalent.	All
2	Desktop PC with microcontroller simulation software	All
3	Stepper motor	27
4	CRO- Bandwidth AC 10Hz~20MHz. DC~20MHz(-3dB),X10 Probe	21,26
5	Keyboard 4*4 Trainer Board	24
6	Relay Trainer board suitable to interface with 8051 trainer kit.	22
7	LED RED	20
8	ADC(0808) Trainer board	25
9	DAC(0809) trainer board	26
10	LCD Trainer board	23

7. THEORY COMPONENTS

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
SECTION - I	
1 . Introduction to Microcomputers and Microcontrollers(Weightage-18 , Hrs-16)	

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
1a. Compare salient features of microprocessor, microcomputer and microcontroller for the given parameters. 1b. Distinguish between two types of architecture. 1c. Describe types of Buses. 1d. State selection factors of microcontroller. 1e. Describe with sketches function of specified blocks of the given type of microcontroller architecture. 1f. Explain with sketches memory organization of 8051microcontroller.	1.1 Microprocessor , microcomputers and microcontrollers (Basic Introduction and comparison) 1.2 Different types of buses: address, Data, and control bus. 1.3 Types of architectures - Harvard and Von-Neumann. 1.4 Microcontroller& Microprocessor general block diagram , Comparison 1.5 8051 Microcontroller : Features, Architecture (description of each on chip peripheral, Pin description) stack ,memory organization 1.6 Selection factors of microcontroller (Architecture type, speed, Word size, instruction set, memory, and I/O capability)
2. Special feature of MCS 8051(Weightage-08, Hrs-04)	
2a. Identify Hardware feature and internal registers with their functions 2b. Compare different members of 8051 family. 2c. Interpret need of idle and power down mode. 2d.Explain the function of given software development tools	2.1 Special Features of 8051 Boolean Processor, Power saving options- idle and power down mode, Derivatives of 8051 (8951, 8952, 8031,8751). 2.2 Software development cycle- Editor, Assembler, cross compiler, linker, locater, compiler
3.8051 Instruction set and Programming(Weightage-14, Hrs-12)	
3a. Comprehend addressing modes and instruction set. 3b. Develop and realize assembly language programs. 3c.Explain the use of given assembler directives with examples. 3d.Explain the internal I/O port structure and configuration.	3.1 Addressing modes 3.2 instruction set.(Data moving instructions, logical & arithmetic Instructions, Jump, call instructions, subroutines, Bit related instructions. stack operation) 3.3 Assembly language programming 3.4 I/O port structure and configuration – P0, P1,P2,P3 3.5 Port programming 3.6 Assembler directive- ORG, DB, EQU, END, CODE, DATA
SECTION II	
4. MCS 8051 Timer/counter and serial communication(Weightage-12, Hrs-10)	

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
4a. Describe with sketch operation of timers/counter modes. 4b. Write an ALP to generate a delay for the given crystal frequency for the specified waveform on the given port. 4c. Describe with sketch operation of given mode for serial communication. 4d. Use serial port through programs.	4.1 Timer / Counter logic and modes 4.2 Simple programs on timer to generate time delay using polling and interrupt method 4.3 Serial Communication-SCON, SBUF 4.4 Modes of serial communication (Mode 0 to 3). 4.5 Simple programs for serial communication.
5. MCS 80 51 Interrupts(Weightage-08 , Hrs-06)	
5a. Define interrupts and related SFRS. 5b. Use interrupts through programs. 5c. Compare interrupt and polling method.	5.1 Interrupts and polling. 5.2 Interrupts structure of 8051 SFR - IE, IP 5.3 Simple programs based on interrupts and polling method
6. Memory & IO Device Interfacing(Weightage-20 , Hrs-16)	
6a. Describe with sketch interfacing of the given external memory. 6b. Explain with sketch interfacing of external IO devices. 6c. Write an assembly language program to operate the given IO device. 6d. Generate specified waveform using 8051 by given method. 6e. Program 8051 for given application.	6.1 Memory address decoding & Interfacing : Program and data memory (Interfacing external ROM & RAM memory) 6.2 LED 6.3 Relay 6.4 LCD 6.5 Seven segment Display 6.6 Keyboard 6.7 DAC (0808) & square and triangular waveform generation 6.8 ADC (0809) 6.9 Stepper Motor control for clockwise, anticlockwise rotation. 6.10 Temperature sensor 6.11 DC Motor control

8. SUGGESTED SPECIFICATION TABLE FORQUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
SECTION I						
I	Introduction to Microcomputers and Microcontrollers	16	04	06	08	18
II	Special feature of MCS 8051	04	04	02	02	08
III	8051 instruction set & programming	12	04	04	06	14
	Total	32	12	12	16	40
SECTION II						
IV	8051 timer/counter & serial communication	10	02	04	06	12

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
V	MCS 8051 interrupts	06	02	02	04	08
VI	8051 memory & I/O device interfacing	16	04	04	12	20
	Total	32	08	10	22	40
	Total	64	**20**	**22**	**38**	**80**

9. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a. Prepare journals based on practical performed inlaboratory.
b. Follow safety precautions.
c. Give seminar on relevant topic.
d. Library/Internet survey regarding different data books and manuals.
e. Prepare power point presentation on applications of microcontroller.
f. Undertake a market survey of different microcontrollers.

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
c. With respect to item No.9, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
d. Guide student(s) in undertaking micro-projects.
e. Correlate subtopics with power plant system and equipments.
f. Use proper equivalent analogy to explain different concepts.
g. Use Flash/Animations to explain various components, operation and
h. Teacher should ask the students to go through instruction and Technical manuals

11. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs.(Affective Domain Outcomes) .Each student will have to maintain activity chart consisting of individual contribution in the project work and give a seminar presentation of it before

submission.. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

12.

a. Prepare a chart of features of 8051 microcontroller and its derivative using data sheet.
b. Prepare a chart of various features of stepper motor and diagram of interfacing with 8051 microcontroller
c. Prepare a chart of various features of LCD display and diagram of interfacing with 8051 microcontroller.
d. Prepare a chart of various features of seven segment display and diagram of interfacing with 8051 microcontroller.
e. Prepare a chart of various features of ADC and diagram of interfacing with 8051 microcontroller.
f. Prepare a chart of various features of DAC and diagram of interfacing with 8051 microcontroller.
g. Build a circuit using 8051 microcontroller to blink LED.
h. Build a circuit using 8051 microcontroller to detect temperature.
i. Build a circuit using 8051 microcontroller for class period bell.
j. Build a circuit using 8051 microcontroller to display 0 to 9 with delay.
k. Build a circuit using 8051 microcontroller for traffic light controllers.
l. Prepare a chart of various features of rasberipi and arduino.
m. Build a circuit using 8051 microcontroller for water level controller.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publisher, Edition ,Year of publication and ISBN Number
1	8051 Microcontroller, Architecture, programming and application.	Kenneth J Ayala	PHI learning, New Delhi,July 2004, ISBN: 978-1401861582
2	Microcontroller Theory and Application	Ajay. V. Deshmukh	McGraw Hill ,New Delhi,2011, ISBN-9780070585959
3	Microcontroller Principle and Application	AjitPal	PHI Learning ,New Delhi,2014, ISBN: 978-81-203-4392-4
4	The 8051 Microcontroller and Embedded system Using Assembly and C	Mumhammad Ali Mazidi,JaniceGillispieMazidi,Rolin D. Mackinlay	Pearson/Prentice Hall , 2nd edition ,Delhi,2008, ISBN 9788177589030
5	Microcontroller, Architecture, programming, Interfacing and System	Raj Kamal	Pearson Education, Delhi, 2012. ISBN: 9788131759905

S. No.	Title of Book	Author	Publisher, Edition ,Year of publication and ISBN Number
	Design		
6	Microprocessors and Microcontroller	Sunil Mathur, Jeebananda Panda	PHI Learning ,New Delhi.2016,ISBN:978-81-203-5231-5
7	Microprocessors and Microcontroller Architecture, programming and System Design	Krishan Kant	PHI Learning ,New Delhi.2016,ISBN:978-81-203-185

14. SOFTWARE/LEARNING WEBSITES

1.www.circuitstoday.com/8051-microcontroller
2.www.nptel.com
3.www.8051projects.net/files/public/1252055169_5507_FT25871_l2_timers_and_countersppdf
4.www.circuitstoday.com
5.www.dauniv.ac.in/downloads/MController_PPTs/MicroC2_eCH03L02Memory.pdf
6.www.microdigitaled.com/8051/Software/keil_tutorial_v2.pdf

15. PO - COMPETENCY- CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	1	2	2	-	1	1	1
CO2	-	1	2	3	-	2	2
CO3	-	2	3	3	2	2	2
CO4	-	2	3	3	2	2	2
CO5	-	2	3	3	3	3	3
CO6	2	1	3	3	1	1	2

	PSO1	PSO2	PSO3
CO1	2	1	-
CO2	2	1	1
CO3	2	2	3
CO4	2	2	3
CO5	2	2	3
CO6	2	3	3

Sign: Name: Smt.P.G.Gahukar Smt.P.C.Mitkari Smt.V.S.Sabnis (Course Experts)	Sign: Name: Shri.R.N.Shikari (Head of Department)
Sign: Name: Shri.R.N.Shikari (Program Head) (E & TC Department)	Sign: Name: ShriA.S.Zanpure (CDC)

Level 4 - A Curriculum

Government Polytechnic, Pune

'180OB' – Scheme

Programme	**Diploma in /CE/EE/ ET/ME/MT/CM/IT/DDGM**
Programme code	**01/02/03/04/05/06/07/08/15/16/17/18/19/21/22/23/24/26**
Name of Course	**Environmental science**
Course Code	**AU4101**
Prerequisite course code and name	**NA**
Class Declaration	**No**

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)		Examination Scheme				
					Theory		Practical		Total Marks
L	T	P	C		ESE	PA	ESE	PA	
0	0	02	02	Marks	NA	NA	NA	50	50
				Exam Duration	--	--	--	--	--

Legends : L- Lecture, P- Practical, T- Tutorial, C- Credits, ESE- End Semester Examination, PA- Progressive Assessment (Test I, II / Term Work), * - Practical Exam, $ - Oral Exam, # - Online Examination. Each Lecture/Practical period is of one clock hour.

2. RATIONALE

This is an interdisciplinary course, introduced with an aim to create awareness about environmental issues among the diploma students. The rate of Industrialization and Urbanization is very fast, and the country /world is facing issues like drought, flood, deforestation, increase in earth temperature, pollution and depletion of resources. In view of this the management of resources' and dilution of pollutants is of prime need to keep the environment safe and clean.

3. COMPETENCY

The aim of this course is to attend following industry identified competency through various teaching learning experiences:

- **To create environmental awareness for sustainable development.**

4. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry-oriented COs associated with the above-mentioned competency**:**

1. Create awareness for conservation of natural resources and preserving the Environment.
2. Perform/Contribute in sustainable development.
3. Undertake preventive measures to control different pollution.
4. Differentiate between Conventional and Non-conventional energy sources.
5. Identify the role of SPCB/CPCB and EPA in Environment protection

5. SUGGESTED PRACTICALS/ EXERCISES

Sr. No.	Practical Exercises (Outcomes in Psychomotor Domain)	Relevant CO	Approximate Hours Required.
1.	Visit to "Kachara Depot (dumping yard) and write a report.	1, 3,5	04*
2.	Identify the Environmental issues and group discussion on the efforts made to increase public awareness and prepare a Report.	1,2,3	04*
3.	Assignment/Report on ecosystem and its components.	2	02
4.	Expert lecture on Role of NGOs and Government in Conserving the Environment and writing a report on it.	2,3,5	04
5.	Visit to a local area -Environmental assets such as river /forest / grassland / hill / mountain and writing a report on it.	1,3	04
6.	Activity based on – "Best out of Waste" (use of waste paper, Plastic, glass bottles, clothes, scrap.)	3	02*
7.	Video Demonstration /Expert Lecture Report on Climate Change and Global warming.	1,2,3, 4,5	02
8.	Write a report on E-waste - 1. Describing E-waste and its type. 2. State its impact/hazards on the environment. 3. State importance of E-waste disposal and disposal methods. 4. Comments on how E-waste is handled globally. (Role play can be enacted by each group representing different countries) 5. Description of how India handles e-waste. (Role play can be enacted by a group)	1,2,3	04
9.	Visit to nearby site, using nonconventional energy source (e.g., solar/wind)	4	04
10.	Visit the nearby Poly house and write a report. (Product, financial assistance, limitations, difficulties in operating, any other related information)	2	04
11.	Individual Presentation on Environmental issues and his/her Contribution towards the Environment.	12,3, 4,5	04*
12.	Write an assignment on GreenHouse effect, carbon Footprint, carbon trading.	2,3,4	02
13.	Assignment on disposal of medical waste. (To study Incineration.)	3	02

14.	Identify the issues related to the programmes in the institute and write the report. (Here disciplinary or interdisciplinary activity can be carried out)	2,3	04*
15.	Write an assignment on role of Ministry of Environment and Forest Organizational Structure (MOEF) and Central Pollution Control Board (CPCB), State Pollution Control Board (SPCB), Environment Protection Act.	5	04*
16	Complete a micro project based on guidelines provided in Sr.no. 11	1 to 5	04*
	Total Hrs.		**32**

Practical marked with* are compulsory.

Sr.No.	Performance Indicators	Weightage in %
a.	Observation, collection, and analysis of data	40
b.	Preparation of report	30
c.	Interpretation of result/ observation and conclusion	10
d.	Answer to questions	10
e.	Submission of report in time	10
Total		**100**

6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

NA

7. THEORY COMPONENTS

The curriculum is activity based. It is expected from the teacher to explain to students the scientific theory behind each assignment.

For e. g. - The assignment stating best out of waste does not mean to make only decorative items from the waste.

In this case it is expected to explain the concept of 4R i.e Reduce, Reuse, Recycle, and Reproduce**.**

8. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

NA

9. SUGGESTED STUDENT ACTIVITIES

NA

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/subtopics.
b. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).

11. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her. In the first four semesters, the micro-project is group-based. However, in the fifth and sixth semesters, it should be preferably be **individually** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three.**

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain a dated work diary consisting of individual contributions in the project work and give a seminar presentation of it before submission. The student ought to submit a micro-project by the end of the semester to develop the industry-oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

a. Prepare a report on a visit to PUC Center.
b. Visit a nearby RO plant and prepare a detailed technical report.
c. Prepare report on Household water filtration unit
d. Prepare a list of polluted natural resources which are responsible for pollution and collect information on how to damage them.
e. Collection of Data from Hospital: Collect everyday information on percentage of solid hazardous and toxic waste for two months
f. Visit of Municipal Effluent Treatment Plant: Visit effluent treatment plant and prepare a report on waste management.
g. Visit of Water Treatment Plant: Visit water treatment plant and prepare a report on various units of water treatment and its management.
h. Preparation of report: Prepare the chart of solid waste management showing effects on the environment.
i. Suggest the remedial measures for the control of pollution of local water source by conduct relevant study
j. Undertake the Impact study of vehicular pollution on the environment.
k. Visit to “Kachara Depot, (dumping yard) and analyze the waste.
l. Write a report on “Best out of Waste.
m. Write a report on GreenHouse effect,
n. Study of air quality of Pune city.
o. Study of noise pollution in Pune city.
p. Study of solid waste management of Pune city.
q. Study of E-waste management of Pune city.
r. Study of Environmental Status Report of Pune city prepared by Pune Municipal Corporation.
s. And any other relevant topic related to course

12. SUGGESTED LEARNING RESOURCES

S.N.	Title	Author, Publisher, Edition and Year of publication	ISBN Number
1.	Basic Civil and Environmental Engineering	S.P. Nisture, D. A. Joshi, G.S.Chhawsaria, Pearson	978-1282531819
2.	Basics of Environmental Studies	Anindita Basak, D.L. Manjunath, Pearson	978-8131756072
3.	Global Warming the Hard Science	L.D.Danny Harvey Pearson	978-8131733318
4.	Environmental Studies	Benny Joseph,Tata McGraw Hill	978-9352605170
5.	Renewable Energy	Godfrey Boyle, Oxford Publications	0199261784, 9780199261789
6.	Environmental studies	R. Rajagopalan, Oxford University Press	9780199459759

13. SOFTWARE/LEARNING WEBSITES

1. **www.nptel.com**
2. **http://www.mpcb.gov.in/**
3. **http://www.cpcb.nic.in/**
4. **http://www.envfor.nic.in/**
5. **http://www.neeri.res.in/**

14. PO - COMPETENCY- CO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	1	1	2	1	3	1	3
CO2	1	1	2	1	3	1	3
CO3	1	1	2	2	2	1	3
CO4	1	1	2	1	2	1	3
CO5	1	1	2	1	2	1	3

CO	PSO1	PSO2	PSO3
CO1	--	1	--
CO2	--	1	--
CO3	1	1	--
CO4	1	1	--
CO5	--	--	--

List of Experts & Faculties Who Contributed for This Curriculum:

S.N.	Name	Designation	Institute / Industry
1.	DR. SMS Shashidhara.	Chairman PBOS	Head Civil Engg. Dept. GOVT. POLYTECHNIC, PUNE
2	Shri. Sanjay Deshpande.	Director,Sanjivani Development	Industry person
3.	Mrs.M.U.Kokate	Faculty from Institute	Head IT. Dept. GOVT. POLYTECHNIC, PUNE
4	Mrs.SeemaV.Kolhe	Faculty from Institute	Lecturer in Civil Engg. GOVT. POLYTECHNIC, PUNE
5	Shri .M.K.Panchawate	Faculty from Institute	Lecturer in Civil Engg. GOVT. POLYTECHNIC, PUNE
6	Mrs. P.M.Zilpe	Faculty from Institute	Lecturer in Electronics Engg. GOVT. POLYTECHNIC, PUNE
7	Mrs. S.S.Chhatwani .	Faculty from Institute	Lecturer in Electronics Engg. GOVT. POLYTECHNIC, PUNE
8	Mrs. M. H. Bilgi	Faculty from Institute	Lecturer in Electrical Engg. GOVT. POLYTECHNIC,Pune

Sign: Name: Mrs.S.V.Kolhe M.K.Panchawate (Course Experts)	Sign: Name: (Dr. S.M.S.Shashidhara) (Former Head of Department) Shri. V G Tambe (HOD I Shift) Shri. V B Kondawar (HOD II shift)
Sign: Name: Shri R.N.Shikari (Program Head)	Sign: Name: Shri A.S.Zanpure (CDC)

Government Polytechnic, Pune

'180 OB'– Scheme

Programme	Diploma in ET/CE/**EE**//ME/MT/CM/IT/DDGM
Programme code	01/**02**/03/04/05/06/07/08/**16**/17/21/**22**/23/24/26
Name of Course	**Renewable Energy Technologies**
Course Code	**AU4102**
Prerequisite course code and name	**NA**
Class Declaration	**No**

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)		Examination Scheme				
					Theory		Practical		Total Marks
L	T	P	C		#ESE	PA	ESE	PA	
02	00	00	02	**Marks**	40	10	00	00	50
				Exam Duration	2Hrs	1/2Hr	----	---	

Legends: L-lecture, T-Tutorial/teacher guided theory practice, P-practical, ESE-End semester examination, PA- Progressive Assessment, # - Online theory exam

2. RATIONALE

Electrical energy is an important aspect in all sectors of economic growth of India. Considering the continuously increased demand of electrical energy, the conventional sources of energy are insufficient to meet these demands and hence the use of renewable sources of energy is the need of the hour. Hence these sources must be known to electrical technicians. This course consists of construction, working principle, operation and applications of Solar, Wind, Biomass, Geothermal and Tidal power plants.

3. COMPETENCY

The aim of this course is to attend following industry identified competency through various teaching learning experiences:

- **Practice of non-conventional energy as power source in electric field. Operate and maintain small Solar plants, Wind power stations, Geothermal plants etc.**

4. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency**:**

1: Know the national scenario of energy production, utilization, consumption and reserves and need of non conventional energy sources.
2: Describe construction, working principle, operation and applications of Solar power panel.
3: Describe construction, working principle, operation and applications for Wind and Biomass power plants.
4: Describe construction, working principle, operation and applications for Geothermal and Tidal energy power plants.

5. SUGGESTED PRACTICALS/ EXERCISES

NA

6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

NA

7. THEORY COMPONENTS

Unit Outcomes (UOs) (in cognitive domain)	**Topics and Sub-topics**
UNIT 1: Review of Conventional Sources of Energy	**Hrs.- 02 Marks- 04**
1a. Classify the conventional energy sources and know their availability in India. 1b. Know the necessity of non-conventional energy sources. 1c. Describe the environmental impact of various energy sources and the need for sustainable development.	1.1 Types of conventional energy sources, Availability and important power plants in India. 1.2 India's production and reserves for Fossil fuels, Water power, Nuclear power. 1.3 Need for non-conventional energy sources. 1.4 Environmental impact of various energy sources, Green building, Sustainable development. Carbon credits and its significance.
UNIT 2:Solar Energy and its Applications	**Hrs.- 12 Marks- 14**

2a. Know the principle of conversion of solar energy to heat and electrical energy. 2b. Know the concept of solar radiation and define the terms used in solar radiation geometry. 2c. Explain the principle of electrical power generation by photovoltaic cell with merits and demerits of the system. 2d. Identify and describe the various applications based on solar energy.	2.1 Principle of conversion of solar energy into heat and electrical energy, Solar radiation, Solar radiations at earth's surface. 2.2 Solar radiation geometry: declination, hour Angle, altitude angle, incident angle, zenith angle, solar azimuth angle. 2.3 Solar collectors and their types, Application, Advantages and Limitations. 2.4 Solar electric power generation: Solar photovoltaic cell, Solar cell Principle and Working, Application, Advantages and Disadvantages. 2.5 Solar water heating, Solar distillation, Solar cooking and furnace 2.6 Solar pumping and Green house, Agriculture and industrial process heat. 2.7 Space heating, Space cooling.
UNIT 3:Wind Energy and Energy from Biomass	**Hrs.- 12 Marks- 14**
3a. Know the principle of conversion of wind energy to electrical energy. 3b. Describe the advantages and limitations and applications of wind energy. 3c. Explain with sketches the working of horizontal and vertical axis wind mills. 3d. Know the concept of obtaining energy from biomass through various methods. 3e. Identify and describe the various types of biomass power plants.	3.1 Basic principles of wind energy conversion, Power in wing, Available wind power formulation, Power coefficient, and Maximum power 3.2 Main considerations in selecting a site for wind mills, Advantages and Limitations of wind energy conversion 3.3 Classification of windmills, Construction and working of horizontal and vertical axis wind mills and their comparison 3.4 Main applications of wind energy for power generation and pumping 3.5 Common species recommended for biomass, methods for obtaining energy from biomass 3.6 Classification of biomass: Gasified, Fixed bed and Fluidized 3.7 Application of gasifier 3.8 Biodiesel production and application 3.9 Agricultural waste as biomass, Biomass digester, Comparison of biomass with conventional fuels
UNIT 4: Geothermal and Tidal Energy	**Hrs.- 06 Marks- 08**
4a. Know the principle of generation of energy from geothermal and tidal source. 4b. Identify and describe the various methods of generation of energy from geothermal and tidal source.	4.1 Availability, Forms of geothermal energy: Dry steam, Wet steam, Hot dry rock, Magnetic chamber system 4.2 Different geothermal power plants available. 4.3 Tidal power, Factors for selection of tidal power plant. 4.4 Classification: Single basin, Double basin type. 4.5 Tidal power plants in world, Ocean thermal plants

8. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Review of Conventional Sources of Energy	02	04	-	-	04
II	Solar Energy and its Applications	12	04	04	06	14
III	Wind Energy and Energy from Biomass	12	04	04	06	14
IV	Geothermal Energy and Tidal Energy	06	02	02	04	08
Total		**32**	**14**	**10**	**16**	**40**

9. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a) To collect information about global and Indian energy market.
b) One field visit to be conducted to demonstrate application of Solar Energy.
c) One field visit to be conducted to Wind Mill
d) To visit a biomass/ biogas plant of municipal waste or elsewhere

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
c. With respect to item No.8, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
d. Correlate subtopics with power plant system and equipments.
e. Use proper equivalent analogy to explain different concepts.
f. Use Flash/Animations to explain various components, operation and working principle.

11. SUGGESTED MICRO-PROJECTS

NA

12. SUGGESTED LEARNING RESOURCES

Sr. No.	Title	Author	Publisher, Edition , Year of publication and ISBN Number
1	Non conventional energy resources	Dr. B.H.Khan	Tata McGraw Hill Education, New Delhi ISBN- 9780070681033
2	Non conventional energy resources	G. D. Rai	Khanna publication ISBN- 9788174090738
3	Solar Energy	Sukhatme S.P., Nayak J.K.	Tata McGraw, New Delhi ISBN- 9781259081965
4	Solar Energy	Garg H. ,Prakash J.	McGraw Hill Education, New Delhi ISBN- 9780074636312
5	India- The energy sector	P.H. Henderson	Oxford University Press ISBN- 9780195606539
6	Industrial energy conservation	D. A. Ray	Pergaman Press ISBN- 9780080232744

13. SOFTWARE/LEARNING WEBSITES

1. www.nptel.com
2. Website for Akshay Urja News Bulletin www.mnes.nic.in

3 .https://www.bioenergyconsult.com/biomass-energy-systems/

3. https://mnre.gov.in/bio-energy

14. PO - COMPETENCY- CO MAPPING

CO-PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2	1	1	1	1	1	1
CO2	2	2	2	2	2	1	3
CO3	2	2	2	2	2	1	3
CO4	2	2	2	2	2	1	3

CO-PSO	PSO1	PSO2	PSO3
CO1	1	2	-
CO2	1	2	-
CO3	1	2	-
CO4	1	2	-

Sign: Name: 1.Shri.B.R.More 2. Smt. M. H. Bilgi (Course Expert /s)	Sign: Name: (Head of Department)
Sign: Name: (Program Head) (Electrical Engineering Dept.)	Sign: Name: Shri A.S.Zanpure (CDC Incharge)

Government Polytechnic, Pune

'180OB' – Scheme

Programme	Diploma in ET/CE/EE//ME/MT/CM/IT/DDGM
Programme code	01/02/03/04/05/06/07/08/16/17/21/22/23/24/26
Name of Course	**Engineering Economics**
Course Code	**AU4103**
Prerequisite course code and name	**NA**
Class Declaration	**No**

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)		Examination Scheme				
					Theory		Practical		Total Marks
L	T	P	C		ESE	PA	*ESE	PA	
02	00	00	02	Marks	40	10			50
				Exam Duration	2 Hrs	1/2Hr	-	-	

(*):OE/POE (Oral Examination/Practical & Oral Examination not applicable)
Legends: L- lecture-Tutorial/teacher guided theory practice, P-practical, ESE-End semester examination, A- Progressive Assessment.

2. COMPETENCY

The aim of this course is to address following industry identified competency through various teaching learning experiences:

- **Ability to analyze and decide acceptance or rejection of offers / project proposals based on economic criteria.**

3. RATIONALE

This course aims at equipping the students with fundamental knowledge of economics and cost analysis to make them capable of taking economically sound decisions.

4. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry-oriented COs associated with the above-mentioned competency**:**

1. Interpret various principles, concepts and applications of Economics in the field of Engineering and technology.
2. Analyze Market Demand.
3. Apply the principles of economics and cost analysis to proposals in engineering and Technology.
4. Read and interpret financial statements and indicators.

5. SUGGESTED PRACTICALS/ EXERCISES
NA

6. MAJOR EQUIPMENT/ INSTRUMENTSREQUIRED
NA

7. THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop UOs for achieving the COs to attain the identified competency**.**

Unit Outcomes (UOs) (in cognitive domain)	**Topics and Sub-topics**
UNIT 1. Introduction to Economics(06hrs, 08marks)	
1a.Define the term Economics. 1b.State the objectives and importance's of engineering Economics. 1c.Differiate between Micro and macro economics. 1d.Describe the functions of Market economy and Command economy. 1e.List the elements of mixed economy.	**1.1** Definitions of economics **1.1.2**Objectives and Importance of engineering economics. 1.1.3Concept of engineering economics. **1.2**General concepts on micro and macro economics **1.2.1**Market economy, **1.2.2**Command economy **1.2.3** Mixed economy.
UNIT 2 Demand Analysis (06hrs, 08marks)	
2a.List the utility related demand. 2b.State the importance of total and marginal utility. 2c.Explain Law of demand. 2d.Analyasis elasticity of demand. 2e.State factors governing the elasticity of demand. 2f.Enlist the techniques and methods for forecasting of demand.	**2.1**Utility related demand **2.1.1**Total and marginal utility **2.1.2** Law of diminishing marginal utility **2.1.3** Cardinal and ordinal utility. **2.2**Law of demand **2.2.1** Determinants of demand **2.2.2** Elasticity of demand **2.2.3** Factors governing the elasticity of demand. **2.3**Techniques and methods for forecasting of demand

UNIT 3Elements of Business/Managerial Economics(12hrs, 12marks)	
3a.Define the term cost and cost control. 3b.Enlist the types of costs. 3c.Interpret the lifecycle costs. 3d.Define the term Budgets. 3e.Determine Break even analysis. 3f.Explain in brief application of Linear Programming. 3h.Importance of Time value of money. 3j.Ellabrorate the methods of cash flow. 3k.Evaluate the Causes of depreciation.	**3.1** Cost and Cost Control –Techniques **3.1.1** Types of Costs **3.1.2**Lifecycle costs 3**.1.3**Budgets **3.1.4**Break even Analysis **3.2**Capital Budgeting **3.2.1**Application of Linear Programming. **3.3** Time value of money **3.4.1**Simple and compoundinterest. **3.4.2**Principle of economic equivalence. **3.5** Evaluation of engineering projects and Cost-benefit **3.6.** Cash flow- Methods of comparison of alternatives – present worth and future worth method (Revenue dominated cash flow diagram) **3.7** Depreciation-Causes of depreciation **3.8.1**Depreciation straight line method and declining balance method
UNIT 4National Income, Finance and Banking (08hrs, 12 marks)	
4a.Expain Balance sheet, Book Keeping and Financial reporting. 4b.Mentionmeasurement parameters ofnational income. 4c.Differiate between Gross domestic and national production (GNP, GDP). 4d.State the functions of commercial banks and Reserve Bank of India.	**4.1**.Concept of profit and loss account 4.1.1 opening stock, closing stock, sales, purchases,wages, creditors, debtors, gross profit, net profit **4.2**. Concept of Balance sheet, &book keeping 4.2.1. Fixed asset, Current assets, share capital, current liabilities,goodwill,debt, inventories, bill receivable, overheads and expenses. **4.3.**Concepts and measurement of national income **4.4.** Gross domestic and national production (GNP, GDP). **4.5**Banking- Meaning and functions of commercial banks and Reserve Bank of India.

8. SUGGESTED SPECIFICATION TABLE FORQUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction to Economics	06	02	02	04	08
II	Demand Analysis	06	02	02	04	08
III	Elements of Business/Managerial Economics	12	04	04	04	12
IV	National Income, Finance and Banking	08	02	02	08	12
Total		**32**	**10**	**10**	**20**	**40**

9.SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a. Study of datasheet of Cash flow of a firm.
b. Prepare charts of depreciation by taking different examples.
c. Case Study-Prepare a comparative statement of of two Engineering projects in respect of investment and profit.(Consider Capital Investment, over head expenses, wages, net profit)
d. Case study- Prepare a cost sheet for a small scale unit.
(In Cost sheet consider production, selling, overhead cost and profit analysis)

10.SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. With respect to item No.9, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
b. Guide student(s) in undertaking micro-projects.
c. Use proper equivalent analogy to explain different concepts.
d. Use Flash/Animations to explain various components, operation.
e. Teacher should ask the students to go through instruction and Technical manuals

11.SUGGESTED MICRO-PROJECTS

NA

12.SUGGESTED LEARNING RESOURCES

S.N.	Title	Author, Publisher, Edition and Year of publication	ISBN Number
1	"Contemporary Engineering Economics",	Author-Chan S.Park,	Publisher-Prentice Hall of India,2011 year. ISBN-9780134105598
2	"Engineering Economics and analysis"	Author-Donald.G.Newman,	Publisher-Jerome.P.LavelleEngg. Press, Texas, 2010 year.ISBN-0824709535
3	"Engineering Economy"	Author-Degarmo, E.P., Sullivan, W.G and Canada, J.R	Publisher- Macmillan, New York, 2011 yearISBN-9780029461396
4	"Engineering Economy"	Author-Zahid A khan: Engineering Economy .	Publisher-Dorling Kindersley, 2012 year ,ISBN-10-8131763870 ISBN-13-978-8131763872

13. SOFTWARE/LEARNING WEBSITES

1) **https://online.nmims.edu/**
2) **https://www.quora.com**
3) **https://www.edx.org**

14. PO - COMPETENCY- CO MAPPING

*NOTE:-THE DEPARTMENT WHO WILL RUN THIS COURSE PLEASE DO THE PSO - COMPETENCY- CO MAPPING ACCORDING TO YOUR PSOs,AS THIS MAPPING IS DONE ACCORDING TO DDGM PSO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	3	-	3	3	3
CO2	3	3	3	1	3	3	3
CO3	3	2	2	-	2	3	3
CO4	3	2	2	-	2	2	3

	PSO1	**PSO2**
CO1	1	1
CO2	2	2
CO3	1	-
CO4	2	2

***NOTE:-** The department who will run this course please do the PSO - competency- CO mapping according to your PSOs, as this mapping is done according to IT dept PSOs.

Sign: Name: Smt.C.M.Ambikar (Course-Expert)	Sign: Name: Shri R.N.Shikari (Head of Department)
Sign: Name: Shri R.N.Shikari (Program Head)	Sign: Name: ShriA.S.Zanpure (CDC)

Government Polytechnic, Pune

'180 OB'– Scheme

Programme	**Diplôma in ET/CE/EE//ME/MT/CM/IT/DDGM**
Programme code	**01/02/03/04/05/06/07/08/16/17/21/22/23/24/26**
Name of Course	**Ethical Sources and Sustainability**
Course Code	**AU4104**
Prerequisite course code and name	**NA**
Class Declaration	**No**

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)		Examination Scheme				
					Theory		Practical		Total Marks
L	T	P	C		#ESE	PA	ESE	PA	
02	00	00	02	**Marks**	40	10	--	--	50
				Exam Duration	2Hrs	1/2Hr	--	--	--

(*): OE/POE (Oral Examination/Practical & Oral Examination-NA)

Legends: **L**- lecture, **T**-Tutorial, **P**-practical, **C**- Credits, **ESE**-End semester examination, **PA**- Progressive Assessment (Test I, II/Term Work), *****- Practical Exam**, $**-Oral Exam, #-Online Examination, Each Lecture/Practical period is of one clock hour.

2. RATIONALE

This course is aimed at creating awareness amongst the students about global level commitment towards sustainable development. The course also creates awareness on ethical manner of production, including the supply chain, the environmental and social impacts of the production process and product as well as the safety and fair deal towards the work force involved at all levels.

3. COMPETENCY

The aim of this course is to attend following industry identified competency through various teaching learning experiences:

- **Adopt ethical practices and sustainable processes and products in industry.**

4. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency

1.Interprets the concept of ethical sourcing and fundamentals of Sustainability.
2.Practice Global Sustainable Development Goals (SDG).
3.Follow ethical and sustainable supply chain**.**
4.Differentiate traditional and sustainable manufacturing.

5. SUGGESTED PRACTICALS/ EXERCISES
NA

6. MAJOR EQUIPMENT/ INSTRUMENTSREQUIRE
NA

7. THEORY COMPONENTS

Unit Outcomes (UOs) (in cognitive domain)	**Topics and Sub-topics**
UNIT 1. ETHICAL SOURCING (06hrs, 08marks)	
1.1 Define Ethical Sourcing. 1.2 Explain Basic Eight Principles of Ethical Sourcing. 1.3 State the laws of industrial ethics. 1.4 Explain the policies of industrial ethics.	1.1 **Definition-**1.1.1 Ethical Sourcing **1.2 Basic Eight Principles** **1.3 Policies** **1.4 Benefits-**Importance of Ethics **1.5 Challenges-** Causes of Unethical Behavior **1.5Laws**
UNIT 2 SUSTAINABILITY (08hrs,10marks)	
2.1 Define Sustainability and Ethical Sourcing and Sustainability. 2.2 Explain the principles of sustainability. 2.3 Explain the need and challenges of environmental sustainability. 2.4 Compare Social sustainability and economic sustainability. 2.5 Explain the agenda of 2030 sustainable development goals.	**2.1 Definition**-2.1.1 Sustainability 2.1.2 Ethical Sourcing and Sustainability **2.2 Twelve green engineering principles.** **2.3 Benefits and Challenges** **2.4 Types-** 2.4.1Human Sustainability 2.4.2Social Sustainability 2.4.3Economic Sustainability 2.4.4 Environmental Sustainability **2.5 Introduction of Sustainable Development Goals (SDGs)=** (Leaving no one behind- Global agenda for 2030- 17 goals, 169 Targets 231 Indicators) **[17Sustainable Development Goals (SDGs)]-** Goal1:No Poverty Goal2:Zero Hunger Goal3:Good Health And Well-Being Goal4:Quality Education Goal5:Gender equality Goal6:Clean water and sanitation Goal7:Affordable and clean energy Goal8:Decent work and economic growth Goal9:Industry Innovation and infrastructure Goal10:Reducedin equality Goal11:Sustainablecities and communities Goal12:Responsible consumption and production Goal13:Climate action Goal14:Life below water Goal15:Life on land Goal16: Peace and justice strong institutions Goal17: Partnerships to achieve the goal.

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
UNIT 3 ETHICAL AND SUSTAINABLE SUPPLY CHAIN (10hrs,12marks)	
3.1 State the use of three P's and E's of sustainability. 3.2 Explain the ways to reduce waste by simplifying supply chain processes with appropriate example. 3.3 Comment on existing environmental risks caused by tradition non sustainable manufacturing process. 3.4 Explain the ways decrease fossil fuel consumption by optimizing routes with appropriate example.	**3.1 Three P's-**3.1.1 Profit 3.1.2 Planet 3.1.3 People **3.2 Three E's-** 3.2.1 Environment 3.2.2 Equity 3.3.3 Economics **3.3 Study of Six Steps for supply-** 3.3.1 Reduce waste by simplifying supply chain processes 3.3.2 Ensure ethical sourcing and introduce transparency 3.3.3 Minimize overproduction through efficient supply and demand planning 3.3.4 Decrease fossil fuel consumption by optimizing routes. 3.3.5 Fully utilize containers and transportation to consolidate shipments. 3.3.6 Monitor for existing environmental risks.
UNIT 4 MATERIALS FOR SUSTAINABILITY (08 hrs,10marks)	
4.1 Explain the impact of material selection over environment. 4.2 Explain the factors to be considered for material selection to optimize performance. 4.3 Explain Life cycle assessment with appropriate example. 4.4 Give a note on "Production of green manufacturing materials" with appropriate example. 4.5 Explain the role of 5R's in sustainable development.	**4.1 Environmental impact of materials** **4.2 life-cycle assessment** **4.3 Material selection to optimize performance** **4.4 Design** **4.5Evaluation** **4.6 Production of green manufacturing materials.** **4.7 Role of 5R's for Sustainable Development-** 4.7.1 Refuse / Reject 4.7.2 Reduce 4.7.3 Reuse / Repurpose / Rethink 4.7.4 Repair 4.7.5 Recycle

8. SUGGESTED SPECIFICATION TABLE FORQUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Ethical Sourcing	06	4	2	2	08
II	Sustainability	08	4	2	4	10
III	Ethical And Sustainable Supply Chain	10	4	4	4	12
IV	Materials For Sustainability	08	2	4	4	10
Total		**32**	**14**	**12**	**14**	**40**

9. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:
a.Select any topic and prepare a Power Point Presentation in a group of three to four students covering economic, social and environmental sustainability aspects and give presentation to other students and teacher. (Example- a)Green Construction Techniques, b)Sustainable Energy solutions for manufacturing, c) Recycling, d)Waste Management e)Rainwater conservation)

OR

a.Prepare a write up in a group of three to four students and present it to other students considering Global agenda for 2030-Leaving no one behind i.e. **Sustainable Development Goals (SDGs)** and its169 Targets 231 Indicators.
b. **Case Study-**Prepare a comparative statement of two Engineering projects in respect to traditional and sustainable manufacturing process considering benefits and challenges.

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
c. With respect to item No.9, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
d. Guide student(s) in undertaking micro-projects.
e. Correlate subtopics with automation.
f. Use proper equivalent analogy to explain different concepts.
g. Use Flash/Animations to explain various components, operation and its application
h. Teacher should ask the students to go through instruction and Technical manuals

11. SUGGESTED MICRO-PROJECTS

NA

12. SUGGESTED LEARNING RESOURCES

Sr.No.	Title	Author, Publisher, Edition and Year of publication	ISBN Number
1	Sustainable Construction Processes	Steve Goodhew , Wiley-Blackwell,1edition13 April 2016	ISBN:140518759X
2.	Sustainable logistics Supply Chain Management	David.B.Grant , Kogan page 1st edition 3 March 2015	ISBN:9780749473860
3.	Global Value Chains, Flexibility and Sustainability	Julia Connell, Renu Agarwal Sushil ,Sanjay Dhir ,09 May 2018	ISBN:978-981-10-8929-9
4.	The Handbook of Ethical Purchasing:Principles and Practice	Rob Harrison ,Routledge,13 oct 2021	ISBN:9781032059952

13. SOFTWARE/LEARNING WEBSITES

1.https://www.ncbi.nlm.nih.gov/books/NBK64933/
2.http://www2.econ.iastate.edu/classes/tsc220/hallam/TypesOfSustainability.pdf
3.https://www.woolworthsgroup.com.au/content/Document/Ethical%20Sourcing%20Policy.pdf
4.https://www.supplychainbrain.com/blogs/1-think-tank/post/29477-how-to-create-a-more-ethical-and-sustainable-supply-chain
5.https://h2mgroup.wordpress.com/2013/06/14/the-three-es-of-sustainability/
https://www.cce.ufl.edu/wpcontent/uploads/2012/08/Ethics%20of%20Sustainability%20Textbook.pdf
6.A global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development:https://unstats.un.org/sdgs/indicators/Global%20Indicator%20Framework%20after%202020%20review_Eng.pdf
7.Transforming our World: The 2030 Agenda for Sustainable Development United Nations,2015-
https://sustainabledevelopment.un.org/content/documents/21252030%20Agenda%20for%20Sustainable%20Development%20web.pdf

14. PO/PSO - COMPETENCY- CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	3	-	3	3	3
CO2	3	3	3	-	3	3	3
CO3	3	2	2	-	2	3	3
CO4	3	2	2	-	2	2	3

	PSO1	**PSO2**
CO1	-	-
CO2	2	2
CO3	2	2
CO4	-	-

***NOTE:-** The department who will run this course please do the PSO - competency- CO mapping according to your PSOs, as this mapping is done according to DDGM dept PSOs.

Sign: Name: Ms. S.M. Waghchaure (Course-Expert) Name: Ms. N.V. Gondane (Course-Expert)	Sign: Name: Mr. V. G. Tambe (Head of Department civil)
Sign: Name: Shri. R.N.Shikari (Program Head)	Sign: Name: Shri . A. S. Zanpure (CDC)

Government Polytechnic, Pune

'180OB' – Scheme

Programme	**Diploma in Computer Engineering** **Diploma in Information Technology**
Programme code	**01/02/03/04/05/06/07/08/16/17/21/22/23/24/26**
Name of Course	Digital Marketing
Course Code	AU4105
Prerequisite course code and name	NA
Class declaration	NA

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)		Examination Scheme				
					Theory		Practical		Total Marks
L	T	P	C		ESE	PA	$ESE	PA	
00	00	02	02	Marks	NA	NA	25	25	50
				Exam Duration	NA	NA	--	--	--

Legends : L- Lecture, P- Practical, T- Tutorial, C- Credits ,ESE-End Semester Examination,PA- Progressive Assessment (Test I,II/TermWork) , *- Practical Exam, $- Oral Exam, #- Online Examination each Lecture/Practical period is of one clock hour;

2. RATIONALE

Digital marketing is advertising or promotions of products and services using digital platforms. Digital Marketing is rapidly evolving technology. And social media is ever growing marketing platform for users. The course will help students to improve skills to market their product or service in the digital media. The course will enable students to explore and create something new who wants to be a good entrepreneur or good professional in design and development.

3. COMPETENCY

The aim of this course is to attend following industry identified competency through various teaching learning experiences:

- **Enhance business using various digital media channels**

4. COURSE OUTCOMES (COs)

The practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry-oriented COs associated with the above-mentioned competency**:**

1. Identify advertisement sections of web pages in a website.
2. Install Google analytics on a website.
3. Use Google analytics for reading analytics data.
4. Generate reports for sample web-site
5. Use e-mail marketing tool

5. SUGGESTED PRACTICALS/ EXERCISES

Sr. No	Unit No	Practical Exercises (Outcomes in Psychomotor Domain)	Relevant CO	Approximate Hours Required.
1	NA	Study and prepare a report of a sample web-site with strategic flow for e-commerce/publication etc. (with the use of: HTML, CSS, and JavaScript etc.)	1, 2	4
2		Set up and create account on Google Analytics and install it on a web-site. Study of Google Analytics GUI/IDE for: ● Inbound and outbound marketing ● Content marketing ● Website Content optimization	2	4
3		Study of Search Engine Optimization (SEO) using Digital marketing platform.	2	4
4		(A)Create the tracking id for web-site and track links (B) Analyze website traffic and leads using DM platform/tool	2	4
5		Read Analytics data. Read audience acquisition and behavior statistics	3	4
6		Generate different types of reports through Google Analytics	4	4
7		Study of any email marketing tool (Freeware)	5	4
8		Complete a micro project based on guidelines provided in Sr. No. 11	All Cos	4
			Total Hrs	**32**

Sr.No.	Performance Indicators	Weightage in %
a.	Study of web pages and web site	10
b.	Installing and setting up the tool for web site	20
c.	Observations and Recording	20
d.	Interpretation of reports, result and Conclusion	20
e.	Answer to sample questions	20
f.	Submission of term work journal in time	10
	Total	**100**

6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major tools with broad specification mentioned here will usher in uniformity in conduct of practical, as well as aid to procure equipment by authorities concerned**.**

Sr.No.	Major tools Required	Experiment Sr. No.
1	Web browser	All
2	Any Web Server (e.g. Glassfish, Tomcat)	
3	Google Analytics	

7. THEORY COMPONENTS

NA

8. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

NA

9. SUGGESTED STUDENT ACTIVITIES

Other than the laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of each activity.

a. Prepare journals based on practical performed in laboratory.
b. Study of different types of web-sites (ecommerce/ publication/ social media) and advertisements on these web-sites.

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:
a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through presentations.
c. Self-learning through Online tutorials to analyze business data
d. Use of freeware marketing tools to check for the effectiveness for particular type of websites

11. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project is group-based. However, in the fifth and sixth semesters, it should be preferably be ***individually*** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed than three.***

Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than ***16 (sixteen) student engagement hours*** during the course. The student ought to submit micro-project by the end of the semester to develop the industry-oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

a. Develop and deploy a sample web-site (using CSS, JavaScript, and similar techniques) for given sample commercial requirements. And identify advertising sections among these pages.

b. Create blog post for educational videos for demonstrating content marketing

c. Create an account on Google analytics and analyze traffic to the sample website

d. Create code for tracking ID for sample web site and generate reports through Google analytics

12. SUGGESTED LEARNING RESOURCES

Sr No	Title	Author	Publisher, Edition, Year of publication, ISBN Number
1	Fundamental of digital Marketing	Punneet Singh Bhatia	Pearson India, 2nd Edition (2019) ● ISBN_109789353434141
2	The Art of SEO	Eric Enge, Stephan Spencer, Jessie Stricchiola	O'Reilly Media ,3 Edition (2015) ● ISBN_10 1491948965 ● ISBN_13 978-1491948965

13. SOFTWARE/LEARNING WEBSITES

1. www.nptel.com
2. https://youtu.be/mXcQ7rVn3ro
3. https://youtu.be/gQe7gGGuzeQ
4. https://www.tutorialspoint.com/digital_marketing/

14. PO - COMPETENCY- CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	-	1	3	2	-	1	-
CO2	-	2	1	2	-	-	1
CO3	1	2	3	3	-	1	1
CO4	-	1	2	3	-	1	1
CO5	-	3	3	3	1	1	1

	PSO1	PSO2
CO1	1	2
CO2	1	3
CO3	-	3
CO4	-	3
CO5	1	3

***NOTE:** The department who will run this course please do the PSO - competency- CO mapping according to your PSOs, as this mapping is done according to computer department PSOs.

Sign: Name: 1) Mrs. M. G. Yawalkar 2) Mrs. A. S. Paike 3) Mrs. K. S. Gaikwad 4) Mrs. P. K. Zade (Course Expert /s)	Sign: Name: Mr. U.V. Kokate Dr. S. B. Nikam (Head of Department) (Department of Computer Engineering)
Sign: Name: **Shri. R.N.Shikari** (Programme Head)	Sign: Name: Mr. A.S. Zanpure (CDC In-charge)

Level 4 - B Curriculum

Government Polytechnic, Pune

'180OB' – Scheme

Programme	**Diploma in CE/EE /CM/ME/MT/ET/IT**
Programme code	01/02/03/**04**/05/06/07/08/15/16/17/**18**/19/21/22/23/**24**/26
Name of Course	**Entrepreneurship and Startup**
Course Code	**MA 4101**
Prerequisite course code and name	**NA**
Class Declaration	**NO**

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)		Examination Scheme				
					Theory		Practical		Total Marks
L	T	P	C		#ESE	PA	ESE	PA	
2	-	-	2	Marks	40	10	-	-	50
				Exam Duration	2Hrs	-	-	-	

Legends: L- Lecture, P-Practical, T-Tutorial, C-Credits, ESE-End semester examination, PA- Progressive Assessment(Test I,II/Term work), *-Practical examination, $-Oral Examination, #-Online Examination, Each Lecture/Practical period is of one clock hour.

2. RATIONALE

Globalization, liberalization and privatization along with revolution in information technology have opened up new opportunities transforming lives of masses. In this context, there is immense opportunity of establishing manufacturing, service, trading, marketing and consultancy enterprises by diploma engineer**.** Our fast growing economy provides ample scope for diploma engineers to succeed as an entrepreneur. Entrepreneurship requires distinct skill sets which are attempted to be developed through this course. To begin with, this course aims to develop the competency and the related outcomes in order to start small enterprises. Government of India also motivates the young engineers to come up with new idea to promote Start ups.

3. COMPETENCY

The aim of this course is to attend following industry identified competency through various teaching learning experiences:

- **Develop project proposals for launching small scale enterprises and starts up.**

4. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency**:**

1 Identify entrepreneurial traits.
2 Collect information from stakeholder for starting starts up

3 Identify support systems available for Starts up
4 Execute plans for managing enterprise effectively.

5. SUGGESTED PRACTICALS/ EXERCISES

NA

6. MAJOR EQUIPMENT/ INSTRUMENTSREQUIRED

NA

7. THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop UOs for achieving the COs to attain the identified competency**.**

Unit Outcomes (UOs) (in cognitive domain)	**Topics and Sub-topics**
Unit-I Introduction to Entrepreneurship Development (08 Hrs, 10 Marks)	
1a. Describe procedure to evaluate entrepreneurial traits as a career option for given product 1b. Explain given terms related to Entrepreneurship 1c. Describe salient features of the resources required for starting the specified enterprise. 1d. Identify characteristics for a given type of enterprise.	1.1 Entrepreneurship as a career 1.2 Traits of successful entrepreneur: consistency, creativity, initiative, independent decision making, assertiveness, persuasion, persistence, information seeking, handling business communication, commitment to work contract, calculated risk taking. 1.3 Entrepreneurship: scope in local and global market. 1.4 Types of enterprises and their features: manufacturing, service and trading.
Unit-II Startup Selection Process (10 Hrs, 14 Marks)	
2a. Describe scheme(s) offered by the governmentfor starting the specified enterprise. 2b. Suggest suitable place for setting up the specified enterprise on the basis of given data/circumstances with justification. 2c. Suggest steps for the selection process of an enterprise for the specified product or service with justification. 2d. Describe market study procedure of the specified enterprise.	2.1 Product/Service selection: Process, core competence, product/service life cycle, new product/ service development process, mortality curve, creativity and innovation in product/ service modification / development. 2.2 Process selection: Technology life cycle forms and cost of transformation, factors affecting process selection, location for an industry, material handling. 2.3 Market study procedures: questionnaire design, sampling, market survey, data analysis 2.4 Getting information from concerned stakeholders such as Maharashtra Centre for Entrepreneurship Development[MCED], National Institute for Micro, Small and Medium Enterprises [NI-MSME], Prime Minister Employment Generation Program [PMEGP], Directorate of Industries[DI], Khadi Village Industries Commission[KVIC]
Unit-III Support System for Startup (08 Hrs, 10 Marks)	

3a. Describe support system required for the specified enterprise. 3b. Describe help provided by the government agencies for the specified product/service. 3c. Describe help provided by the non-governmental agencies for the specified product/service. 3d. Compute breakeven point for the specified business enterprise, stating the assumptions made.	3.1 Categorization of MSME, ancillary industries 3.2 Support systems- government agencies: MCED, NI-MSME, PMEGP,DI, KVIC 3.3 Support agencies for entrepreneurship guidance, training, registration, technical consultation, technology transfer and quality control, marketing and finance. 3.4 Breakeven point, return on investment and return on sales.
Unit-IV Managing Enterprise (06 Hrs, 06 Marks)	
4a. Explain key elements for the given business plan with respect to their purpose/size. 4b. Justify USP of the given product/ service from marketing point of view. 4c. Formulate business policy for the given product/service. 4d. Choose relevant negotiation techniques for the given product/ service with justification. 4e. Identify risks that you may encounter for the given type of business/enterprise with justification. 4f. Describe role of the incubation centre for the given product/service.	4.1 Sources of Product for Business : Feasibility study 4.2 Ownership, Capital, Budgeting, Matching entrepreneur with the project , feasibility report preparation and evaluation criteria 4.3 Unique Selling Proposition [U.S.P.]: Identification, developing a marketing plan. 4.4 Preparing strategies of handling business: policy making, negotiation and bargaining techniques. 4.5 Risk Management: Planning for calculated risk taking, initiation with low cost projects, integrated futuristic planning, angel investors, venture capitalist. 4.6 Incubation centers: Role and procedure.

8. SUGGESTED SPECIFICATION TABLE FORQUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction to EDP	08	2	2	6	10
II	Entrepreneurial Opportunities and selection Process	10	2	4	8	14
III	Support System	08	2	4	4	10
IV	Managing Enterprise	06	2	2	2	06
Total		32	**8**	**12**	**20**	**40**

9. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a. Download product development and innovative films from internet.
b. Invite entrepreneurs, industry officials, bankers for interaction.

c. Identify your hobbies and interests and convert them into business idea.
d. Convert you project work into business.
e. Choose a product and design a unique selling preposition, brand name, logo, advertisement (print, radio, and television), jingle, packing, packaging, and label for it.

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
c. With respect to item No.8, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
    i) To arrange a visit to MCD centre.
    ii) Arrange an expert lecture on entrepreneurship and startups

11. SUGGESTED MICRO-PROJECTS-

NA

12. SUGGESTED LEARNING RESOURCES

S.N.	Title	Author	Publisher, Edition and Year of publication ISBN Number
1	Reading Material of Entrepreneurship Awareness Camp	Gujral, Raman	Entrepreneurship Development Institute of India (EDI), GOI, 2016 Ahmedabad, ISBN: 9946302512012
2	Product Design and Manufacturing	Chitale, A K	PHI Learning, New Delhi, 2014; ISBN: 9788120348738
3	Entrepreneurship Development Small Business Entrepreneurship	Charantimath, Poornima	Pearson Education India,New Delhi; ISBN: 9788131762264
4	Entrepreneurship Development: Special edition for MSBTE	CPSC, Manila	Tata Mc-Graw Hill, New Delhi, ISBN: 9789432961123
5	Entrepreneurship and Small Business Management	Khanka, S.S.	S.Chand and Sons, New Delhi, ISBN: 978-93-5161-094-6

13. SOFTWARE/LEARNING WEBSITES

1. MCED Books links: http://www.mced.nic.in/UdyojakSpecial.aspx?linktype=Udyojak

2. MCED Product and Plan Details: http://www.mced.nic.in/allproduct.aspx
3. The National Institute for Entrepreneurship and Small Business Development Publications: http://niesbud.nic.in/Publication.html
4. Courses : The National Institute for Entrepreneurship and Small Business Development: http://niesbud.nic.in/docs/1standardized.pdf
5. Entrepreneur.com: https://www.entrepreneur.com/lists
6. Govt. Sponsored Schemes:https://www.nabard.org/content1.aspx?id=23andcatid=23andmid=530
7. NABARD - Information Centre: https://www.nabard.org/Tenders.aspx?cid=501andid=24
8. NABARD – What we Do: http://www.nabard.org/content1.aspx?id=8andcatid=8andmid=488
9. Market Review: http://www.businesstoday.in/markets
10. Start Up India: http://www.startupindia.gov.in/pdffile.php?title=Startup%20India%20Action%20Planandtype=Actionandq=Action%20Plan.pdfandcontent_type=Actionandsubmenupoint=action
11. About - Entrepreneurship Development Institute of India (EDII): http://www.ediindia.org/institute.html
12. NSTEDB – Training: http://www.nstedb.com/training/training.htm
13. Tata Exposures: http://www.tatasocial-in.com/project-exposure
14. Ministry Of Micro, Small And Medium Enterprises: http://www.dcmsme.gov.in/schemes/TEQUPDetail.htm
15. List of Business Ideas for Small Scale Industry: https://smallb.sidbi.in/%20/thinking-starting-business/big-list-business-ideas-small-business
16. Thinking of Entrepreneurship: https://smallb.sidbi.in/entrepreneurship-stage/thinking-entrepreneurship
17. List of services for Small Scale Industry: http://www.archive.india.gov.in/business/Industry_services/illustrative.php
18. NSIC Schemes and Services: http://www.nsic.co.in/SCHSERV.ASP
19.

14. PO - COMPETENCY- CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	1	-	-	-	2	2	2
CO2	1	-	-	-	2	2	2
CO3	-	-	-	-		1	3
CO4	-	-	-	1	-	1	2

PSO - CO MAPPING

	PSO1	PSO2	PSO3
CO1	-	1	-
CO2	-	1	-
CO3	-	1	-
CO4	-	1	-

Sign: Name:- Mr. S. S. Harip (Course Expert)	Sign: Name: Dr. N. G. Kulkarni. (Head of Department)
Sign: Name:- Dr. N. G. Kulkarni. (Program Head) (Mechanical Engg Dept.)	Sign: Name: Shri. A. .S. Zanpure. (CDC In charge)

Government Polytechnic, Pune.

'180OB' – Scheme

Programme	Diplôma in **Electronics and Telecommunication**
Programme code	01/02/**03**/04/05/06/07/08/16/17/21/22/**23**/24/26
Name of Course	**Industrial Organization and Management**
Course Code	**MA 4102**
Prerequisite course code and name	**NA**
Class Declaration	**NO**

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)		Examination Scheme				
					Theory		Practical		Total Marks
L	T	P	C		#ESE	PA	ESE	PA	50
02	00	00	02	**Marks**	40	10			
				Exam Duration	2 Hrs	1/2 Hr	--	--	

Legends: L-lecture, T-Tutorial/teacher guided theory practice, P-practical, ESE-End semester examination, PA- Progressive Assessment, # - Online theory exam

2. RATIONALE

The industrial organization is a structured organization which has different levels of management. There are different sections / divisions of industry in which, a diploma engineer is expected to work. There are various roles of diploma engineers at different levels of technical and administration departments in an industry. They must be aware of financing agencies, Market survey, marketing techniques, human relations management and different acts by which the industries are governed.

3. COMPETENCY

The aim of this course is to attend following industry identified competency through various teaching learning experiences:

- **Ability to work with various levels of management in industry, develop awareness about different departments of industry, acts by which, industries are governed, industrial ethics and leadership qualities.**

4. COURSE OUTCOMES (COs)

The theory experiences and behavioral skills associated with this course are to be taught and implemented, so the student will able to exhibit the following CO'S.

1: Understand different levels of Industry Organization and entrepreneurship.
2: Implement skills for organizing Market Survey and Managements technique.
3: Implement various Financial & Material Management technique.
. 4: Use the relevant acts applicable for factories .

5. SUGGESTED PRACTICALS/ EXERCISES

NA

6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

NA

7. THEORY COMPONENTS

Unit Outcomes (UOs) (in cognitive domain)	**Topics and Sub-topics**
Unit-I : **Overview of Business and Organizational Management** (Weightage-08 , Hrs-6)	
1.a.Students can describe types of business. 1.b Students can classify types of industries. 1.c Students can describe Organizational Structure of Industry. 1.d Students can describe forms of ownerships.	1.1 Classification of Industries: Engineering, IT, ITeS Banking, Retail. Small Scale, Large Scale, Pvt. Ltd, India Ltd, Multi-National, MSME. 1.2 Role of engineer in Manufacturing, Service-sector, Trade , Consultancy. 1.3 Introduction to Types of business: Manufacturing, service, Trade, Consultancy. 1.4 definition of Organization. Types : Line, Functional, Line and staff, Project. 1.5 Authority and delegation of power at different levels of organization. 1.6 Forms of Ownerships : Proprietorship, Partnership, Joint Stock, Cooperative Society, Government Sector.
Unit-II **Fundamentals of Management (**Weightage-08, Hrs-6)	

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
2.a Describe concept of Management. 2.b. Describe different levels of Management. 2.c Describe different functions of Management.	2.1 Definition of Management. 2.2 Role of management. 2.3 Levels of Management: Higher, Middle and Lower Level management. 2.4 Scientific management by FW Taylor. 2.5 Function of Management : Planning, Organizing, Directing, Coordinating, Controlling. 2.6.Role of Management with respect to feedback & Corrective actions.
Unit-III **Financial Management, Accounting and Material Management**. (Weightage-12, Hrs-10)	
3.a . Describe different types of capital generation. 3.b Describe different types of budgets. . 3.c Describe advantage of balance sheet to calculate Profit / Loss. . 3.d Describe concept of Inventory management.	3.1 Overview of : Capital generation and Management, Fixed & Working Capital. 3.2 Sources of raising Capital. 3.3 Budget & Accounts : Types of Budget viz. Production budget, fixed and variable budget (concept level) 3.4 (MRP)-function of MRP, input to MRP, benefit of MRP. 3.5 Basic concepts Enterprise resource planning (ERP)-concepts, advantages and disadvantages of ERP . 3.6 Accounts : Profit & Loss accounts, rules for debits & credits, books of accounts. 3.7 Balance Sheet : definition, sample format, various fields. 3.8 Material Management : Inventory (Concept, classification, functions.), Necessity of ABC analysis. 3.9 Standard steps in purchasing. Direct Purchase , tender method, E- Tendering. .
Unit-IV **Marketing, Industrial Safety and various Acts.** (Weightage-12, Hrs10)	
4.a Describe the concept of Market Survey and types of survey. 4.b List different techniques of increasing sales of product. 4.c List and Describe various types of accidents in industry. 4.d List and Describe various acts with respect to industry.	4.1 Market Survey: Need, Advantages and Types of market survey. 4.2 Different techniques of increasing sales of product. 4.3 Packaging of goods. 4.4 Industrial Safety: Types of accidents in industry, Causes of accidents, Preventive measures to avoid accidents. 4.5 Industrial legislation : Indian Factory Act, Minimum Wages Act, Workmen Compensation Act. (Main provisions in the acts). 4.6 Penal actions on violation of Acts. (provisions)

8. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	**Overview of Business and Organizational Management.**	06	02	06	00	08
II	**Fundamentals of Management.**	06	02	06	00	08
III	**Financial Management, Accounting and Material Management**.	10	04	06	02	12
IV	**Marketing, Industrial Safety and various Acts.**	10	02	06	04	12
Total		32	10	**24**	**06**	**40**

9. SUGGESTED STUDENT ACTIVITIES:

1) Prepare/download information about different industrial acts.
2) Visit to manufacturing Industry and Prepare Report on**...**
   i) Structure of Organization/Department
   ii) Safety Measures taken in Organization
   iii) Procedure adopted for quality control
   iv) Any Specific observation you have noticed
3) Prepare the Technical details of 5 (Electronics Product like mobile phone, TV ,Laptop, Home Theatre, Projector etc. of different company including cost and Suggest which is cost effective to buy.
4) Prepare Project report which includes financial Viability of any product of your choice.
5) Prepare a questioner for market survey of electronic product of your choice.
6) Write detailed Processes to start the Partnership firm.

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
c. With respect to item No.8, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.

i. To arrange a Visit to an Industry and observe industrial safety norms followed in the industry. Students should submit a report based on their observations regarding

the safety norms to be followed in the industry.

ii. Arrange an Expert Lecture by a Lawyer to update the students regarding Amendments in Different acts (Factory act, Minimum Wages Act, Workmen Compensation Act) and Penal actions on violation of the acts.

11. SUGGESTED MICRO-PROJECTS:

NA

12. SUGGESTED LEARNING RESOURCES

S.N.	Title	Author	Publisher, Edition and Year of Publication, ISBN Number
1	Industrial Engineering and Management.	O.P. Khanna,	Dhanpat Rai and Sons ISBN-10:818992835X
2	Project Planning and Entrepreneurship.	T.R.Banga, Indu Banga,	CBS Publishers
3	Behavioral Process in Organizations.	Uday Parikh, T.V. Rao and D.M. Pestonjee,	Tata McGrawhill. ISBN-13: 9788120400313

13. SOFTWARE/LEARNING WEBSITES

1. www.nptel.com
2. www.slideshare.net

14. PO - COMPETENCY- CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	-	-	-	-	2	3	2
CO2	-	-	-	-	2	3	2
CO3	-	-	-	-	1	3	2
CO4	-	-	-	-	2	3	2

	PSO1	PSO2	PSO3
CO1	-	1	-
CO2	-	1	-
CO3	--	1	-
CO4	-	1	-

***NOTE:-**The department who will run this course please do the PSO - competency- CO mapping according to your PSOs as this mapping is done according to E&TC Engg. PSOs

Sign: Name: G.W. Sonone (Course Expert)	Sign: Name: Shri.R.N.Shikari (Program Head) (Electronics &Telecommunication Dept.)
Sign: Name: Shri. R. N. Shikari (Program Head) (Electronics &Telecommunication Dept.)	Sign: Name: Shri A.S. Zanpure (CDC)

Government Polytechnic, Pune

'180OB' – Scheme

Programme	**Diploma in Metallurgical Engineering**
Programme Code	01/02/03/04/**05**/06/07/08/15/16/17/18/**19**/21/22/23/24/26
Name of Course	**Materials Management**
Course Code	**MA4103**
Pre-requisite course code and name	**NA**
Class Declaration	**No**

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)		Examination Scheme				
					Theory		Practical		Total Marks
L	T	P	C		#ESE	PA	ESE	PA	
02	00	00	02	Marks	40	10	00	00	50
				Exam Duration	2Hrs	1 Hr	-	-	

Legends: L-lecture, T-Tutorial/teacher guided theory practice, P-practical, ESE-End semester examination, PA- Progressive Assessment, # - Online theory exam

2. RATIONALE

This course deals with management of materials. Smooth running of any industry depends upon the interdepartmental relations and planning for execution of work jointly. Efficiency of the production department also depends upon the availability of raw material of required quality and quantity. Therefore there should be proper coordination between the production department, production planning, stores department and purchase department. Incorrect materials planning can also lead to higher inventories & high cost.

3. COMPETENCY

The aim of this course is to attend following industry identified competency through various teaching learning experiences:

- **To acquaint with the latest techniques in materials management and inventory management.**

4. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented so that the student demonstrates the following industry oriented COs associated with the above mentioned competency**:**

1. State the importance of materials and inventory management.
2. Describe different aspects of buying procedure and price forecasting.
3. To acquaint with latest techniques in materials management.

5. SUGGESTED PRACTICALS/ EXERCISES

NA

6. MAJOR EQUIPMENTS / INSTRUMENTS REQUIRED

NA

7. THEORY COMPONENTS

Unit Outcomes (UOs) [In cognitive domain]	**Topics and Sub-topics**
Unit – I Importance of Materials Management (08 hrs, 10 marks)	
1.a. State needs of material management. 1.b. List the fields of material management. 1.c. State the objectives and functions of material management. 1.d.Describe methods for organization of materials 1.e. Explain importance of specifications in material management.	1.1 Growing importance of Materials Management. 1.2 Materials Management: - Scope - Objectives - Functions 1.3 Organizing for Materials Management. 1.4 Introduction to Materials planning. 1.5 Importance of specifications in Materials Management.
Unit – II Inventory Management (08 hrs, 10 marks)	
2.a. Describe concept of inventory, ABC analysis 2.b. State advantages of ABC analysis mechanics	2.1 Selective control – ABC Analysis Purpose and objectives Advantages and limitations of ABC Analysis. 2.2 Order point, Lead time, safety stock, Reorder point, Standard order, Economic order. 2.3 Economic Order Quantity Concept, graphical representation, determination of EOQ.
Unit – III Buying & Inventory Control (08 hrs, 10 marks)	

3.a. Describe purchase functions & procedures. 3.b. State significance and approaches of price forecast 3.c. Describe coding techniques for inventory. 3.d. State importance of standardization.	3.1 Sourcing, Buy or lease and Purchase systems. 3.2 Value analysis framework, Implementation methodology. 3.3 Ethics in purchasing. 3.4 Price Forecasting- Importance & Approaches. 3.5 Inventory turns ratios. 3.6 Standardization- need & importance. 3.7 Codification- concept, benefits.
Unit - IV Latest Techniques in Materials Management (08 hrs, 10 marks)	
4.a. Explain Just in Time (JIT) inventory concept. 4.b. State importance and applications of SAP.	4.1 Inventory concept - Just in Time (JIT). 4.2 Introduction to SAP - importance and applications of SAP. 4.3 Introduction to Supply chain management. 4.4 Objectives, Importance Forecasting and Applications of supply chain management.

8. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Importance of Materials Management	8	6	2	2	10
II	Inventory Management	8	2	4	4	10
III	Buying & Inventory control	8	2	2	6	10
IV	Latest Techniques in Materials Management	8	2	4	4	10
Total		**32**	**12**	**12**	**16**	**40**

9. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a. Do survey and make a report on actual difficulties faced in materials management in different segments of industries.
b. Study and make a presentation on different Inventory management practices followed in industries.
c. Collect information and make a report on benefits achieved by maintaining good / optimum levels of inventory on the shop floor.
d. Study and make a report on different factors affecting the purchase cost in industrial materials management.
e. Do survey and make presentation on different classes of materials observed w.r.t materials management practices.

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/subtopics.
b. About ***15-20% of the topics/sub-topics*** which are relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
c. With respect to item No.8, teachers need to ensure to create opportunities and provisions for co-curricular activities.
d. Guide student(s) in undertaking micro-projects.
e. Correlate subtopics with concerned equipments / technology.
f. Use the proper equivalent analogy to explain different concepts.
g. Use Flash/Animations to explain various components, operations, processes.
h. Teacher should ask the students to go through instruction and technical manuals.

11. SUGGESTED MICRO PROJECTS

NA

12. SUGGESTED LEARNING RESOURCES

S.N.	Title	Author	Publisher, Edition and Year of Publication, ISBN Number
1	Materials Management	Ammer Deans S	R.D. Irwin Hellions Publisher. ISBN10: 0210226765 ISBN13: 9780210226766
2	Materials Management An Integrated Approach	P. Gopalakrishnan and M. Sundaresan	Prentice – Hall of India Pvt. Ltd. New Delhi ISBN978-81-203-0027-9
3	An Integrated Concept of Materials Management	M.M. Shah	Tata McGraw Hill Publisher Co. Ltd. New Delhi. ISBN: 007451749X 9780074517499
4	Supply chain management strategy, planning and operation	Sunil Chopra	Kellogg School of Management Peter Meindl Kepos Capital- Pearson Education, Inc., publishing as Prentice Hall. ISBN-13:978-0-13-274395-2 (alk. paper)

13. SOFTWARE/LEARNING WEBSITES

1. https://youtu.be/raqi4gjMLm8
2. https://youtu.be/abBvHqf26H8
3. https://nptel.ac.in/courses/110/105/110105095/
4. https://www.digimat.in/nptel/courses/video/110105095/L02.html
5. https://www.digimat.in/nptel/courses/video/110105095/L06.html

14. PO - COMPETENCY- CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	1	1	2	1	2	3	2
CO2	1	2	1	1	3	3	1
CO3	2	1	3	2	2	3	3

	PSO1	PSO2	PSO3	PSO4
CO1	1	-	-	1
CO2	1	-	-	2
CO3	1	-	-	1

***NOTE:-**The department who will run this course please do the PSO - competency- CO mapping according to your PSOs as this mapping is done according to Metallurgical Engg. PSOs

Sign: Name: Shri. R. S. Tuljapurkar (Course Expert) Lecturer in Metallurgical Engg.	Sign: Name: Smt. N. S. Kadam (Head of Department) Department of Metallurgical Engg.
Sign: Name: Smt. N. S. Kadam (Program Head) Department of Metallurgical Engg.	Sign: Name: Shri A. S. Zanpure (CDC)

Government Polytechnic, Pune

'180OB' – Scheme

Programme	**Diploma in CE/EE/ ET/ME/MT/CM/IT/DDGM**
Programme code	**01/02/03/04/05/06/07/08/15/16/17/18/19/21/22/23/24/26**
Name of Course	**Disaster Management**
Course Code	**MA 4104**
Prerequisite course code and name	**NA**
Class Declaration	**No**

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)		Examination Scheme				
					Theory		Practical		Total Marks
L	T	P	C		ESE	PA	ESE	PA	
02	00	00	02	**Marks**	# 40	10	Nil	NIL	50
				Exam Duration	2Hrs	1/2Hr	NA	NA	--

Legends : L- Lecture, P- Practical, T- Tutorial, C- Credits, ESE- End Semester Examination, PA- Progressive Assessment (Test I, II / Term Work), * - Practical Exam, $ - Oral Exam, # - Online Examination. Each Lecture/Practical period is of one clock hour.

2. RATIONALE

Sensitization of every citizen of the country regarding disaster management is of utmost importance. A diploma holder in any discipline has a greater role in disaster management owing to the technical skill sets possessed by him/her. The course is an attempt to sensitize the students pursuing diploma programme in Engineering / Technology about various aspects of Disaster management.

3. COMPETENCY

The aim of this course is to address following Society / Industry identified competency through various teaching learning experiences:

- **Exhibit capability to contribute in Disaster management related activities through the technical skill sets possessed.**

4. COURSE OUTCOMES (COs)

On completion of the course through theory and relevant soft skills, the student shall demonstrate the following tangible outcomes;

1. Define and emphasize the significance of various terms associated with disaster and disaster management.
2. Classify and distinguish various types of disasters.
3. Interpret and elaborate features of the disaster management setup in India
4. Elaborate on the disaster mitigation, disaster preparedness and relief operations.

5. SUGGESTED PRACTICALS/ EXERCISES

The teaching and examination scheme for the course does not mandate any practical for the course.

6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

Nil

7. THEORY COMPONENTS

Unit Outcomes (UOs) (in cognitive domain)	**Topics and Sub-topics**
UNIT I. Disaster and Disaster Management Concepts (hrs-6 , marks- 6)	
1a. Define disaster and disaster management. 1b. Define terms associated with disaster and disaster management. 1c. Correlates the effect of Vulnerability and Coping capacity on disaster management.	**1.1 Disaster and Disaster management:** Definitions of Disaster and disaster management. **1.2 Definition of terms associated with disaster and disaster management:** Definition of terms Vulnerability to disaster, Hazard, Risk, Risk management, Coping capacity **1.3Correlation of Vulnerability and Coping capacity in Disaster management:** Effect of vulnerability to disaster on the effect of disaster and disaster management. Influence of coping capacity on disaster assessment and mitigation.
UNIT II. Types of disasters (hrs- 6 ,marks: 8)	
2a. Classify disasters based on source. 2b.Classify Natural and Manmade disasters in to further categories. 2c.Further classification of disasters based on sequence of occurrence, Pace and scale.	2.1 Classification of disaster based on source as Natural and Manmade. 2.2 Classification of Natural disasters as atmospheric, Terrestrial, Aquatic and Biological. 2.3 Classification of manmade disasters as Industrial, Chemical, Technological, Nuclear, Gas leaks, Oil spills, Dam failures and canal breaches, Wars, Terrorist attacks, Biological, Transportation accidents. 2.4 Primary and secondary, Slow on set and rapid onset, simple and complex disasters.

UNIT III Disaster management in India (hrs- 12, marks: 16)	
3a. Elaborates the provisions of Disaster management Act 2005. 3b. Signifies the role of National Institute of Disaster Management (NIDM) and elaborates on its activities. 3c. Describes the evolution of disaster management set up at national / state / district levels.	3.1 Disaster scenario in India, its vulnerabilities, review of some of the notable disasters in Indian history. 3.2 National disaster management Act 2005, its provisions, authorities at different levels and their roles/ responsibilities. 3.3. National Institute of Disaster Management (NIDM) – the need for its establishment, activities, contributions to disaster management in India. 3.4. National disaster management policy 2009, National Disaster management plan 2016 and 2019, Maharashtra state disaster management plan 2016. Provisions, features and role in strengthening national disaster management.
UNIT IV Disaster mitigation and relief (hrs- 8, marks: 10)	
4a.Describes various stages involved in disaster mitigation. 4b.Elaborates disaster risk reduction strategies. 4.c. Signifies the need for disaster preparedness in disaster management. 4.d.Elaborates Disaster relief and rehabilitation activities.	4.1 Disaster mitigation strategies as per national disaster management plan provisions. 4.2 Disaster risk reduction strategies and study of factors contributing to disaster vulnerability. 4.3 Study of disaster preparedness strategies and early warning systems to anticipate occurrences of disaster to improve preparedness. 4.4 Disaster relief activities as per the provisions of statutes and the action plans and procedures for disaster relief. Stake holders in disaster relief management. 4.5 Capacity building rehabilitation measures and long term reconstruction.

8. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Disaster and Disaster Management Concepts	06	02	04	00	06
II	Types of disasters	06	04	04	00	08
III	Disaster management in India	12	04	12	00	16
IV	Disaster mitigation and relief	08	02	06	02	10
Total		32	**12**	**26**	**02**	**40**

9. SUGGESTED STUDENT ACTIVITIES

Other than the classroom, following student-related ***co-curricular*** activities are suggested which reinforce the cognitive learning and aid in attainment the course outcomes;

a. Individual student shall prepare a report on one natural and one manmade disaster that have occurred in India (Preferably in Maharashtra) in the last 10 years. The report shall highlight classification of the disaster, magnitude, vulnerability of the disaster

location/ site, mitigation measures, relief activities undertaken and long-term measures and their effect.

b. Individual student shall prepare a report on a successful disaster preparedness exercise executed in India in the near past. The report shall highlight the risk reduction strategies adopted, early warning systems used and reduction of vulnerability to hazard measures adopted.
c. Each individual student undergoing this course shall complete "Course 1 – Basics of disaster management under the self-study programme of National Institute of Disaster Management (NIDM) and secure certification for the same.

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

a. All the units of curriculum are supported by selective MOOCS prepared by Educational Multimedia Research Centre (EMRC) Osmania University on Disaster management. The Urls of the earmarked video clips for the course are listed as reference material in the curriculum. The students can access them.
b. The course teacher shall prepare study material to the students based on the MOOCs, reference materials listed.

11. SUGGESTED MICRO-PROJECTS

The scope of the course does not mandate any micro projects. However, suggested student activities suffice as micro projects.

12. SUGGESTED LEARNING RESOURCES

Sr.No.	Title	Author, Publisher, Edition and Year of publication	ISBN Number
1	The Disaster Management Act, 2005	Government of India	N A (pdf of the bare act is available on https://cdn.s3waas.gov.in)
2	National Disaster Management Plan (NDMP) 2016	Government of India	N A (pdf of the bare act is available on https://smartnet.niua.org)
3	Maharashtra State Disaster Management Plan 2016	Government of Maharashtra	N A (pdf of the bare act is available on https://www.mha.gov.in ›
4	National Disaster Management Plan 2019	Government of India	N A (pdf of the bare act is available on https://ndma.gov.in/sites/default/files/PDF/ndmp-2019.pdf)
5	Draft National Disaster Management Plan Part II Disaster mitigation and response function plans	Government of India	N A (pdf of the bare act is available on http://www.mpsdma.mp.gov.in/uploads/media/Draft-NDMP-Part-II.pdf)

13 SOFTWARES / ONLINE LEARNING RESOURCES

The students and faculty can visit following earmarked urls for MOOCs of EMRC Osmania University without indulging in any acts violating copyright.

1. https://youtu.be/DExlZTfKZAM?list=PLC4PaTsQiLcbejXqJR7S59Ohk2OK1rgEG(Disaster and Disaster management concepts)
2. https://youtu.be/7ZhS_HrivqA?list=PLC4PaTsQiLcbejXqJR7S59Ohk2OK1rgEG (Types of Disaster)
3. https://youtu.be/BI38KKij9Nc?list=PLC4PaTsQiLcbejXqJR7S59Ohk2OK1rgEG (Natural Disasters)
4. https://youtu.be/cijSod44Q2g?list=PLC4PaTsQiLcbejXqJR7S59Ohk2OK1rgEG (Manmade Disaster)
5. https://youtu.be/zwIQVKqytD4?list=PLC4PaTsQiLcbejXqJR7S59Ohk2OK1rgEG (Slow onset and Rapid onset Disasters)
6. https://youtu.be/zBqvJkzbk-w?list=PLC4PaTsQiLcbejXqJR7S59Ohk2OK1rgEG (Simple and Complex Disaster)
7. https://youtu.be/e3MwwrRMfZ8?list=PLC4PaTsQiLcbejXqJR7S59Ohk2OK1rgEG (Evolution of Disaster in India)
8. https://youtu.be/iFPMSRCswG0?list=PLC4PaTsQiLcbejXqJR7S59Ohk2OK1rgEG (Disaster and disaster management in India)
9. https://youtu.be/u9ch6eqjG-Y?list=PLC4PaTsQiLcbejXqJR7S59Ohk2OK1rgEG (Disaster management act 2005)
10. https://youtu.be/e5KV2exJTeE?list=PLC4PaTsQiLcbejXqJR7S59Ohk2OK1rgEG (National Institute of Disaster Management)
11. https://youtu.be/6zFOS1VVGLw?list=PLC4PaTsQiLcbejXqJR7S59Ohk2OK1rgEG (National Policy on disaster management)
12. https://youtu.be/PHUf3WFtGfc?list=PLC4PaTsQiLcbejXqJR7S59Ohk2OK1rgEG (National disaster management plan 2016)
13. https://youtu.be/mgb7bs4Yv1g?list=PLC4PaTsQiLcbejXqJR7S59Ohk2OK1rgEG (Stake holders in disaster management)
14. https://youtu.be/GtFO-FaUwbM?list=PLC4PaTsQiLcbejXqJR7S59Ohk2OK1rgEG (Central Government as stake holder in disaster management)
15. https://youtu.be/J4oMdAOuUFQ?list=PLC4PaTsQiLcbejXqJR7S59Ohk2OK1rgEG (State Government as stake holder in disaster management)
16. https://youtu.be/7TFTXqOtARo?list=PLC4PaTsQiLcbejXqJR7S59Ohk2OK1rgEG (District administration as stake holder in disaster management)
17. https://youtu.be/rUziSTV2l9o?list=PLC4PaTsQiLcbejXqJR7S59Ohk2OK1rgEG (Armed forces as stake holder in disaster relief management)
18. https://youtu.be/lv80bN26KeE?list=PLC4PaTsQiLcbejXqJR7S59Ohk2OK1rgEG (Paramilitary forces as stake holder in disaster relief management)
19. https://youtu.be/lDhM8Co1pEs?list=PLC4PaTsQiLcbejXqJR7S59Ohk2OK1rgEG (Fire services as stake holder in disaster relief management)
20. https://youtu.be/ueqXlFC5bg0?list=PLC4PaTsQiLcbejXqJR7S59Ohk2OK1rgEG (Disaster risk reduction strategies)
21. https://youtu.be/VQ6tMdBZARM?list=PLC4PaTsQiLcbejXqJR7S59Ohk2OK1rgEG (Disaster preparedness plan)
22. https://youtu.be/TFLwWMcQll4?list=PLC4PaTsQiLcbejXqJR7S59Ohk2OK1rgEG (Early warning system in disaster preparedness)
23. https://youtu.be/972scfiEPtw?list=PLC4PaTsQiLcbejXqJR7S59Ohk2OK1rgEG (Factors contributing to disaster vulnerability)

24. https://youtu.be/9e-iiKwQ3I4?list=PLC4PaTsQiLcbejXqJR7S59Ohk2OK1rgEG (Disaster risk reduction master plan for the future)
25. https://youtu.be/y0qui7QWTQU?list=PLC4PaTsQiLcbejXqJR7S59Ohk2OK1rgEG (Components of disaster relief)
26. https://youtu.be/9EWZvwE2548?list=PLC4PaTsQiLcbejXqJR7S59Ohk2OK1rgEG (Capacity building rehabilitation measures and long term reconstruction)

14 PO - COMPETENCY- CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	-	-	-	-	-	-	1
CO2	-	-	-	-	1	-	1
CO3	-	1	2	1	2	1	2
CO4	1	1	2	1	2	2	2

	PSO1	PSO2	PSO3
CO1	--	--	--
CO2	1	--	--
CO3	1	1	1
CO4	2	2	2

***NOTE:-**The department which will run this course please do the PSO - competency- CO mapping according to your PSOs as this mapping is done according to Civil Engg. PSOs.

Sign: Dr. S M S Shashidhara Shri. V B Kondawar (Course Experts)	Sign: Name: (Dr. S.M.S.Shashidhara) (Former Head of Department civil) Shri. V G Tambe (HOD I Shift civil) Shri. V B Kondawar (HOD II shift civil)
Sign: Name : Shri R.N. Shikari (Programme Head)	Sign: Name: Shri A.S.Zanpure (CDC)

Government Polytechnic, Pune

'180 OB' – Scheme

Programme	**Diploma in CE/EE/ET/ME/MT/CM/IT/DDGM**
Programme code	**01/02/03/04/05/06/07/08/16/17/21/22/23/24/26**
Name of Course	**Introduction to E-Commerce**
Course Code	**MA4105**
Prerequisite course code and name	**NA**
Class Declaration	**NO**

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)		Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
L	T	P	C		#ESE	PA	ESE	PA	
02	00	00	02	Marks	40	10	-	-	50
				Exam Duration	2Hrs	1/2 Hr	--	--	--

Legends : L- Lecture, P- Practical, T- Tutorial, C- Credits ,ESE-End Semester Examination,PA- Progressive Assessment (Test I,II/TermWork) , *- Practical Exam, $- Oral Exam, #- Online Examination each Lecture/Practical period is of one clock hour;

2. RATIONALE

This course is aimed at providing the students with modules on the use of the Internet and e-commerce. It also includes all aspects of deploying e-business and e-commerce within an organization. It also provides theories and concepts and questions the validity of these models in the light of the differences between the Internet and other media.

3. COMPETENCY

The aim of this course is to attend following industry identified competency through various teaching learning experiences:

- **Understand real time problem solving and relevant soft skills.**

4. COURSE OUTCOMES (COs)

The theory, real time problem solving and relevant soft skills
associated with this course are to be taught and implemented, so that the student demonstrates the following industry-oriented COs associated with the above-mentioned competency:

1. Define E-commerce and various business models.
2. Describe fundamental sales process.
3. Recognise the variants of the process of B2C and B2B.
4. Identify ethical aspects of ICT.

5. SUGGESTED PRACTICALS/ EXERCISES

NA

6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

NA

7. THEORY COMPONENTS

Unit Outcomes (UOs) (in cognitive domain)	**Topics and Sub-topics**
Unit- I Introduction to E-Commerce (Weightage-06, Hrs- 04)	
1a. Define E-commerce. 1b. Differentiate between various business models. 1c. Explain technical challenges. 1d. Explain economic challenges.	1.1 Basics and definitions – E-Commerce. 1.2 Business models related to E-Commerce. 1.3 Technical and economic challenges.
Unit-II Frameworks and Architectures (Weightage-10, Hrs- 08)	
2a. Explain fundamental sales process. 2b. List out Technological elements.	2.1 Actors and Stakeholders. 2.2 Fundamental sales process. 2.3 Technological elements.
Unit-III B2C Business (Weightage-10, Hrs- 08)	
3a. Explain the variants of the process of B2C. 3b. Differentiate between various challenges. 3c. Understand CRM.	3.1 The process model and its variants. 3.2 The pricing challenges. 3.3 The fulfilment challenges. 3.4 The payment challenges. 3.5 B2C-business and CRM. 3.6 B2C software systems.
Unit-IV B2B Business (Weightage-08, Hrs- 06)	
4a. Explain the variants of the process of B2B. 4b. Identify B2B software systems.	4.1 The process model and its variants. 4.2 B2B software systems.
Unit-V Impact of E-Commerce (Weightage-06, Hrs- 06)	
5a. Identify ethical aspects of ICT. 5b. List out different impacts of E-Commerce.	5.1 Ethics, morale and technology. 5.2 Ethical aspects of ICT. 5.3 Overall impacts of E-Commerce. 5.4 Specific impacts of E-Commerce.

8. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction To E-Commerce	04	02	02	02	06
II	Frameworks and Architectures	08	02	04	04	10
III	B2C Business	08	02	04	04	10
IV	B2B Business	06	02	04	02	08
V	Impact of E-Commerce	06	02	02	02	06
Total		**32**	**10**	**16**	**14**	**40**

9. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews: -Student can study and prepare report on any application in which e-commerce they used.

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are strategies, which can be used to accelerate the attainment of the various outcomes in this course:

Sr. No.	Topic	Instructional Strategy
1	Introduction To E-Commerce	Class room teaching
2	Frameworks and Architectures	Class room teaching
3	B2C Business	Class room teaching
4	B2B Business	Class room teaching
5	Impact of E-Commerce	Class room teaching

11. SUGGESTED MICRO-PROJECTS

NA

12. SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publisher, Edition and Year of publication ISBN Number
1	Introduction to E-Commerce: Combining Business and Information Technology	Prof. Dr. Martin Kutz	1st Edition Jan 2020 ISBN 9788740315202

13. SOFTWARE/ LEARNING WEBSITES

1. https://blog.ipleaders.in/introduction-to-e-commerce-an-ultimate-guide/
2. https://noteslearning.com/what-is-e-commerce-introduction-types-and-importance/
3. https://www.techtarget.com/searchcio/definition/e-commerce
4. https://www.investopedia.com/terms/e/ecommerce.asp

14. PO - COMPETENCY- CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	-	-	-	-	1	3	2
CO2	1	1	-	1	1	3	2
CO3	1	-	-	1	1	3	3
CO4	1	1	-	1	1	3	3

	PSO1	PSO2	PSO3
CO1	-	2	--
CO2	-	2	--
CO3	-	2	--
CO4	-	2	--

Sign: Name: 1. Smt. H. S. Pawar 2. Smt. N. R. Wagh 3. Smt. P. N. Yewale 4. Smt. S. S. Ingavale 5. Smt. S. J. Siraskar 6. Smt. S. R. Hande (Course Experts)	Sign: Name: Mr. U.V. Kokate Dr. S. B. Nikam. (Head of Department) (Department of Computer Engineering)
Sign: Name: Shri R.N. Shikari (Programme Head)	Sign: Name: Mr. A.S. Zanpure (CDC In-charge)

Government Polytechnic, Pune

'180OB' – Scheme

Program Name	**Diploma in CE/EE/ET/ME/MT/CM/IT/DDGM**
Program Code	**01/02/03/04/05/06/07/08/16/17/21/22/23/24/26**
Course Title	**Information Management**
Course Code	**MA4106**
Pre-requisite Course code and Name	**NA**
Class Declaration	**No**

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)		Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
L	T	P	C		# ESE	PA	ESE	PA	
02	-	-	02	**Marks**	40	10	-	-	50
				Exam duration	2 Hrs	1/2 Hrs	--	--	--

Legends : L- Lecture, P- Practical, T- Tutorial, C- Credits ,ESE-End Semester Examination, PA-Progressive Assessment (Test I,II/TermWork) , *- Practical Exam, $- Oral Exam, #- Online Examination each Lecture/Practical period is of one clock hour;

2. RATIONALE

Organizations of all sizes generate and work on information .Collection and management of Information becomes an important aspect in each and every field. This course is aimed at providing the students with the basics of Information Management.

3. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Use information management system in industries.**

4. COURSE OUTCOMES (COs)

The theory, real time problem solving and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry-oriented COs associated with the above-mentioned competency:

1. Recognize information system in any organization.
2. Enlist types of Information Systems.
3. Identify the competitive environment of business.
4. Identify challenges in Information management.
5. State Social and Ethical issues with Information Management.

5. PRACTICALS/ EXERCISES
(Not Applicable)

6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED
(NotApplicable)

7. THEORY COMPONENTS

Unit Outcomes (UOs) (in cognitive domain)	**Topics and Sub-topics**
Unit-I Organizations and Information Systems (Weightage-08, Hrs-06)	
1a. List different types of Modern organizations. 1b. Explain IT interaction mod- el. 1c. Identify challenges for the manager.	1.1 Modern Organization- IT enabled, Net- worked, Dispersed, Knowledge Information Systems in Organizations. 1.2Managing Information Systems in Organization. 1.3 Challenges for the manager. 1.4 The Role of Internet 1.5 Managing the Internet era
Unit-II Concepts of Management Information Systems (Weightage-08, Hrs-06)	
2a. Enlist types of Information Technology. 2b. Enlist types of Information Systems. 2c. Differentiate between various decisions. 2d. Explain communication in organizations.	2.1 Data and Information, Information as a re- source. 2.2 Information in organizational functions. 2.3 Types of Information Technology, Types of Information Systems. 2.4 Decision making with MIS. 2.5 Communication in organization.
Unit-III Information Systems and Management Strategy (Weightage-10, Hrs-08)	
3a. Identify the competitive environment of business. 3b. Find out the properties of Information Goods. 3c. Explain value chain.	3.1 The competitive environment of business. 3.2 Using IT for competing. 3.3 Information Goods. 3.4 Information Systems and Competitive strat egy.
Unit-IV Managing Information Systems (Weightage-08, Hrs-06)	
4a. Understand the challenges of managing the IT function. 4b. Identify vendor. 4c. Explain the role of CIO.	4.1 Challenges of managing the IT function. 4.2 Vendor Management. 4.3 The Role of CIO.
Unit-V Ethical and Social Issues (Weightage-06, Hrs-06)	
5a. Explain Ethical issues. 5b. Explain Social issues.	5.1 Ethical issues- Privacy, Workplace Monitoring and Power over Users. 5.2 Social issues- Workplace behavior and Health, De-skilling and Alienation, Tele- commuting, E-Waste.

8. SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Organizations and Information Systems	6	4	2	2	08
II	Concepts of Management Information Systems	6	4	2	2	08
III	Information Systems and Management Strategy	8	4	4	2	10
IV	Managing Information Systems	6	2	4	2	08
V	Ethical and Social Issues	6	2	2	2	06
Total		**32**	**16**	**14**	**10**	**40**

9. STUDENT ACTIVITIES

Other than the classroom learning, following are the suggested student-related *co-curricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for the activity mentioned, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews :-
Student can study and prepare report on information management as done in any small setup like cyber café, canteen, medical or grocery shops etc.

10. SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are strategies, which can be used to accelerate the attainment of the various outcomes in this course:

Sr. No.	Topic	Instructional Strategy
1	**Organizations and Information Systems**	Class room teaching
2	**Concepts of Management Information Systems**	Class room teaching
3	**Information Systems and Management Strategy**	Class room teaching
4	**Managing Information Systems**	Class room teaching
5	**Ethical and Social Issues**	Class room teaching
6	**Organizations and Information Systems**	Class room teaching

11. SUGGESTED LIST OF MICROPROJECTS:-

Not Applicable

12. LEARNING RESOURCES

Sr No	Title	Author	Publisher, Edition, Year of publication, ISBN Number
1	Managing Information Systems in Business, Government and Society.	Rahul De	Wiley Publication, Second Edition 2018 ISBN-9788126571222

13. SOFTWARE/LEARNING WEBSITES

1.https://en.wikipedia.org/wiki/Information_system

14. PO - COMPETENCY- CO MAPPING

CO/PO	Basic and Discipline Specific knowledge	Problem Analysis	Design/ Development of Solutions	Engineering Tools, Experimentations and Testing	Engineering Practices for Society ,Sustainability and Environment	Project Management	Life Long Learning
Recognize information system in any organization.	-	-	-	-	2	2	3
Enlist types of Information Systems	-	-	-	-	1	2	3
Identify the competitive environment of business.	-	-	-	-	2	2	3
Identify challenges in Information management	-	-	-	-	1	3	3
State Social and Ethical issues with Information Management.	-	-	-	-	3	2	3
Summary	**-**	**-**	**-**	**-**	**2**	**3**	**3**

PSO - COMPETENCY- CO MAPPING

	PSO 1	PSO 2	PSO 3
CO1	-	1	-
CO2	-	1	-
CO3	-	1	-
CO4	-	1	-
CO5	-	1	-

Sign : 1. Smt. P. N. Yewale 2. Smt.G.B.Garud 3. Smt. A.S.Paike 4. Smt.P.K.Zade 5. Smt.S.R.Hande (Course Expert)	Sign : Mrs.M. U. Kokate (Head of the Department) (Department of Information Technology)
Sign : Name: Shri R.N.Shikari (Program Head)	Sign: Name : Mr. A.S. Zanpure (CDC In-charge)

Level 4 - C Curriculum

Government Polytechnic, Pune

Scheme: 180 OB

Programme Name	**:**	**Diploma in Computer Engineering** **Diploma in Information Technology** **Diploma in Electronics and Telecommunication**
Programme Code	**:**	01/02/03/**04**/05/**06/07**/08/15/16/17/18/19/21/22/23/**24**/**26**
Course Title	**:**	**Professional Practices-I**
Course Code	**:**	**CM4104**
Prerequisite course code and name	**:**	**No**
Class Declaration	**:**	**No**

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	PA	ESE	PA	
-	-	2	2	-	-	-	50	50

Legends: L-lecture, T-Tutorial/teacher guided theory practice, P-practical, ESE-End semester examination, PA- Progressive Assessment, # - Online theory exam

2. RATIONALE

Due to globalization and competition in the industrial and service sectors the selection for the job is based on campus interviews or competitive tests. While selecting candidates a normal practice adopted is to see general confidence, ability to communicate and attitude, in addition to basic technological concepts. The purpose of introducing professional practices is to inculcate soft skills through active learning. Micro-Project, MOOCs courses, Industrial visits, expert lectures and related presentations and/ group discussions on technical topics are planned so that there will be increased ,active participation of students in learning process and hence impart life-long learning ability.

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant Professional skills associated with First and second semesters courses are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency**:**

1. **Apply acquired knowledge**
2. **Learn independently and develop life long learning ability.**
3. **Work in group.**
4. **Learning through observations and Interactions.**
5. **Understand and prepare Reports.**

4. PRACTICALS / EXERCISES

Sr. No.	Learning Outcome	Practical Exercises	Marks	Approx. Hrs.
1	a. Application and integration of knowledge from minimum three course outcomes of two courses for development of a project. b. Write reports and state outcomes achieved. c. Work in group d. Present/Demonstrate project	**Micro-Project –** **a) Microprojects allocation and development (06-08 hrs.)** Faculty must allocate one real life simple problem statement(least complexity) for Microproject which is combination of application of minimum two courses learnt/being learnt during First and Second semesters to a group of 3-4 students. The problem statement must involve simple logic building which can be designed and implemented within 06-08 hours. **b) Report Writing :** Not more than 7-8 pages **(to be prepared simultaneously with development)** a. Problem Definition b. Platform and/Hardware Specifications c. Flow charts/diagram related to micro-project d. Source Code/Related Procedure for Micro-Project e. Outcome (Technical/Personal) achieved f. Books/References/Websites. **c) Microproject Presentations/Demonstrations (04 hrs.)** (Preferrably by arranging Project exhibition/ classroom presentations as is applicable)	20M	12
2	a. Learn from alternate sources. b. Enhance self learning ability	**MOOCs** (Massive open online courses)**: Undertake SWAYAM/NPTEL/Spoken Tutorial/Any other Online Courses** learning courses and certificate courses **Each individual student can select any relevant online course under the guidance of course teacher as per interest areas.**	10M	10
3	a. Interpersonal skill and personal skill development. b. Develop conflict resolution ability.	**Group Activity:** 1. Group Activity: Case studies to be discussed in a group and presentation of the same by group and summarization by group leader.	5M	06

		2. Role play by individual/group leader. **3.** Sharing of self -experiences in a group. **Out of above three any one activity can be conducted for group of students. Different groups can be considered for different activities based on their likings**.		
4	a. Learning through observations. b. Understanding professional environment. c. Report writing.	**Industrial Visit** Industrial visits must be arranged for fulfilling the requirement of programme/ course outcomes of undertaken courses of first and second semester and report of the same should be submitted by the individual student, to form a part of the term work.	07M	02
5	a. Understanding industry practices or evolving concepts. b. Report writing.	**Expert Lecture** Lectures by Professional / Industrial Expert to be organized to bridge the gap of learnt/ undertaken courses during first and second semester. Probably the Professional / Industrial Expert can be organized in the following areas - 1. Project presentation tips. 2. Spoken English. 3. Personality development. 4. How to develop positive thinking. 6. Any topic related to social awareness 7. Hygiene Awareness 7. Any other topics.	08M	02
		Total	**50**	**32**

Sr.No.	Performance Indicators	Weightage in Marks
a.	**Micro-Project –**	20
b.	**MOOCs**	10
c.	**Group Activity**	05
d.	**Industry Visit**	07
e.	**Guest Lecture**	08
Total		**50**

5. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practicals, as well as aid to procure equipment by authorities concerned**.**

6. SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching/PR Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Micro-Project	12	--	--	--	--
II	MOOCs: SWAYAM-NPTEL and Spoken Tutorial Courses	10	--	--	--	--
III	Group Activity	06	--	--	--	--
IV	Industrial Visit	02	--	--	--	--
V	Expert Lecture	02	--	--	--	--
	Total	**32**	--	--	--	--

7. STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a. Prepare group activity Report
b. Prepare Industrial Visit Report
c. Prepare Guest lecture Report
d. Undertake micro projects
e. Undertake MOOC certifications.

8. SPECIAL IMPLEMENTATION/INSTRUCTIONAL STRATEGIES

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Microproject:
   - Teachers must brief the students about outcome expected through Microproject, form groups, and allocate micro projects to group of 3-4 within first two weeks.
   - Micro-Projects must be on a problem statement with the aim to achieve not more than three outcomes by combining outcomes from two courses. Assessment will be as per Rubrics (A) done progressively.
   - Students must utilize the allocated slots as per the course for development of Microproject. Faculty must take care that the problem statement to be developed and presented are fair enough for stipulated time duration (12hrs.)
   - Teachers may organize departmental/interdepartmental project exhibition or presentations as per convenience to enhance demonstration/presentation skills.

NOTE: All first year and Second year faculty members prepare combined document regarding detail problem statement of Microproject. Other than this Individual Teaching Faculty may add other problem statements.

b. MOOCs : Teachers are advised to guide students into undertaking the MOOCs courses offered through various platforms. Students may take up different courses under the guideline of faculty. Faculty may take help of SWOC analysis for deciding the relevance of course allocation. Following are the guidelines , students may follow:-
   - May take technical courses for enhanced knowledge in interested areas.

- Students requiring courses on language ability may take-up those courses
- Students interested in Management/Entrepreneurship may opt for relevant courses.
- Students requiring mathematical skills may opt for mathematics courses with relevant topics.
- Faculty must motivate students to acquire certifications. If not faculty may take orals, ensure that proper outcome is being acquired and assign marks in proportion.
- Students must use the timetable slots allotted for course and may utilize extra hours if interested.
- Assess students performance with the help of RUBRICs (B).

c. Guest Lecture/Industry Visit :

- Faculty must undertake Expert Lectures and Industry visit planned at start of semester by Department to fulfill gaps/knowledge and relevant skill enhancements.
- Students must submit Report as per given format (FORMAT-Visit and FORMAT-Guest Lecture)
- Assessment will be done as per RUBRICs(C/D) as applicable

d. Group activity :RUBRICs

- Faculty must assign different group activity to different groups based on their abilities and preferences. Students must complete activity , prepare report and cite acquired affective domain outcome.(Format – Group activity)
- Faculty will guide students regarding the same.

9. LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication
1	Personality Development and soft skills	Barun K. Mitra Oxford University	Press
2	Entrepreneurship	Rajeev Roy Oxford University	Press
3	First Semester learnt & Second semester learning courses reference Books	--	--
4	Journals and magazines IEEE Journals, IT Technologies	--	--
5	Local newspapers and events	--	--

10. SOFTWARE/LEARNING WEBSITES

a. http://www.nptel.ac.in
b. http://www.seminarforyou.com

12. PO - COMPETENCY- CO MAPPING

	Basic and Discipline Specific knowledge	Problem Analysis	Design/Development of Solutions	Engineering Tools, Experimentations and Testing	Engineering Practices for Society ,Sustainabilit	Project Management	Life Long Learning
CO1	3	3	3	3	1	3	3
CO2	2	1	-	2	1	-	3
CO3	-	-	-	-	-	1	2
CO4	3	-	-	-	2	-	2
CO5	3	-	-	-	-	-	3

PSO - COMPETENCY- CO MAPPING

	PSO1	PSO2	PSO3
CO1	2	2	2
CO2	1	1	1
CO3	2	2	2
CO4	2	2	2
CO5	1	1	1

(Smt. M.U.Kokate) (Smt.A.D.Kshirsagar) (Smt.A.B.Bhusagare) (Smt.Pranita Zilpe) (Smt.B.K.Vyas) Signature of Course Experts	(Mr.U.V.Kokate) Signature of Head of the Department (Computer Engineering)
(Mr. U. V. Kokate) Signature of Programme Head	(Mr. A.S. Zanpure) Signature of CDC In-charge

Micro-Project Guidelines

1. Micro-project selection should be based on First Semester learnt and Second Semester learning courses.
2. Group of 3-4 students can work on micro-project under the guidance of Course teacher. Students can finalise micro-project topics through number of discussions with course teacher .
3. Abstract must not be greater than 100 words. Report must not be more than 7-10 pages.
4. Micro-project topics across all students must not be repeated.
5. Due care must be taken to write reports with grammatically correct statements and in neat and clean handwriting. Statement must not contain shortcups and spelling mistakes.
6. Evaluation of Micro-project should be based on Topic Selection, Problem Definition, Requirement gathering, Development, Presentation , Report writing and Response to the Questions.
7. Micro-project Report must include
    1. Cover Page
    2. Index
    3. Abstract
    4. Chapters
    5. References/Bibliography
8. The page size of the Micro-project report should be A4 .
9. **Page Numbering (Centered having format Page No__of __)**
10. **Paper Size:** A- 4 size paper
    1. **Margins :**

    Top: 1" (1 inch=2.54cm)
    Bottom: 1.15" (2.86cm)
    Left: 1.5"
    Right: 0.6"

    2. **Line Spacing:** 1.5 line
    3. **Title of Chapter**

    Font: Times New Roman (Bold face)
    Size: 14 point
    Alignment: Centre

11. **Text**

    Font: Times New Roman
    Size: 12 point
    Alignment: Justified (Full Text)

12. **Figures and Tables:**
    a. **Font:** Times New Roman (**Bold**)
    b. **Size:** 12 point
    c. **Alignment:** Centered
    d. Figure Caption must be below the figure and centered
    e. Table caption must be above the table and centered

Assignment 1:Rubrics for Micro-project Evaluation

Topic Selection Relevant to course outcome (2)	Problem Definition (2)	Course Outcome Achievement in terms of Output (5)	Involvement in project development(2)	Presentation (5)	Report Writing(4)	Total (20)

Assignment 2: Rubrics for MOOCs Evaluation

Completion of Topics/ tutorial (05)	Weekly Assignment submission (10)/ Progressive assessment through internal orals	Final Certificate(05) Or final Internal orals	Total(20)

Assignment 3:Rubrics for Group Activity

Involvement (5)	Performance(5)	Total (10)

Assignment- 4 :Rubrics for Industrial Visit Evaluation

Note : Students who have attended Industrial Visit will only be eligible for marks assignment, else they will be marked as absent. Marks will be awarded from Reports submitted by present students only.			
Discipline and Behavior (3)	Knowledge (Q & A) (5)	Report Writing(2)	Total (10)

Assignmnet-5 :Rubrics for Professional / Industrial Expert Lecture Evaluation

Note : Students who have attended Lecture will only be eligible for marks assignment, else they will be marked as absent. Marks will be awarded from Reports submitted by present students only.			
Representation of concepts (4)	**Representation of best/Motivational Part(4)**	**Representation of Outcome achieved/Relevance to the course(2)**	**Total (Out of 10)**

Report Formats

1) Seminar/Micro-Project Report format

i) Cover page

Government Polytechnic, Pune-16

(An Autonomous Institute of Government of Maharashtra)

A
Seminar Report
On

"SEMINAR TITLE"

SUBMITTED BY:

<Name of the student>

Under the Guidance of

<Guide Name>

DEPARTMENT OF COMPUTER ENGINERING

Industry Visit Report format
Government Polytechnic, Pune

Department of Computer Enginerring

Industry Visit Report

Name of Industry Visited:_____ Date & Time of Visit:_____

Name of Student:_____ Enrollment No.:_____

Term Name:_____ Std:_____ Email-d:_____

1. Equipment Observed/Demonstrated
2. Specific Standard/processes observed in technical practices/management processes
3. Comments on Industry dressing/uniform
4. Industry Culture

5. Sections/Divisions/offices visited along with description
6. Any observation of facilities ex. Canteen/Recreational facilities etc.
7. Can you relate the experience gathered with any course of your curriculum State: Course Name: Course Code: Details : Specific Outcomes: 8. SAFTY MEASURESS

Expert Lecture Report
Government Polytechnic, Pune
Department of Computer Engineering

Title of Session: _____ Speaker:_____
Name of Student: _____ Enrollment No.:_____
Organized By:_____Date & Time:_____
Venue : _____Term:_____

1. Highlights of Technologies/Concepts introduced in session.
2. Association of Topics/Title/Concepts with courses learnt(Mentione Cours Name).
3. High light the best/Motivational Part:

Signature of Student:

Government Polytechnic, Pune

(An Autonomous Institute of Govt. of Maharashtra)

Scheme: 180 OB

Government Polytechnic, Pune

'180OB' – Scheme

Programme	Diploma in **ET**/CE/EE//ME/MT/**CM/IT**/DDGM
Programme code	01/02/03/**04**/05/**06/07**/08/16/17/21/22/23/24/**26**
Name of Course	**Professional Practice-II**
Course Code	**CM4105**
Prerequisite course code and name	-

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)		Examination Scheme				
					Theory		Practical		Total Marks
L	T	P	C		ESE	PA	ESE	PA	
00	00	02	02	Marks	-	-	-	50	50
				Exam Duration	-	-	-		

Legends: L-lecture, T-Tutorial/teacher guided theory practice, P-practical, ESE-End semester examination, PA- Progressive Assessment, # - Online theory exam

2. RATIONALE

Due to globalization and competition in the industrial and service sectors the selection for the job is based on campus interviews or competitive tests. While selecting candidates a normal practice adopted is to see general confidence, ability to communicate and attitude, in addition to basic technological concepts. The purpose of introducing professional practices is to inculcate soft skills through active learning. Micro-Project , MOOCs courses, Industrial visits, expert lectures and related presentations and/ group discussions on technical topics are planned so that there will be increased ,active participation of students in learning process and hence impart life-long learning ability.

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant Professional skills associated with First and second semesters courses are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency**:**

1. **Apply acquired knowledge**
2. **Learn independently and develop life long learning ability.**
3. **Perform SWOT analysis.**
4. **Learning through observations and Interactions.**
5. **Understand and prepare Reports.**

4. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency**:**

Sr. No.	Learning Outcome	Practical Exercises (Outcomes in Psychomotor Domain)	Relevant CO	Approximate Hours Required.
1	a. Application and integration of knowledge from minimum three course outcomes of two courses for development of a project. b. Write reports and state outcomes achieved. c. Work in group d. Present/Demonstrate project	**Micro-Project –** **a) Microproject allocation and development (06-08 hrs.)** Faculty must allocate one real life simple problem statement(least complexity) for Microproject which is combination of application of minimum two courses learnt/being learnt during **Third and Fourth semesters** to a group of 3-4 students. The problem statement must involve simple logic building which can be designed and implemented within 06-08 hours. **b) Report Writing :** Not more than 7-8 pages **(to be prepared simultaneously with development)** a. Problem Definition b. Platform and/Hardware Specifications c. Flow charts/diagram related to micro-project d. Source Code/Related Procedure for Micro-Project e. Outcome (Technical/Personal) achieved f. Books/References/Websites. **c) Microproject Presentations/Demonstrations (04 hrs.)** (Preferrably by arranging Project exhibition/ classroom presentations as is applicable)	CO1	12
2	a. Learn from alternate sources. b. Enhance self learning ability	**MOOCs**(Massive open online courses)**:** **Undertake SWAYAM/NPTEL/Spoken Tutorial/Any other Online Courses**learning courses and certificate courses **Each individual student can select any relevant online course under the guidance of course teacher as per interest areas.**	CO2	10
3	a. Interpersonal skill and personal skill development. b. Develop conflict resolutionability.	**SWOT Analysis :** Self SWOT analysis **Study Habits (Group discussions)**Sharing of self -experiences in a group **on** Note taking, Methods of Learning, Memory Enhancement, self - Study Techniques,Techniques for effective Reading	CO3	06

		and Writing. **Stress Management(**Role play by group) Stresses in groups, how to control emotions, Strategies to overcome stress, understanding importance of good health to avoid stress. **Out of above three SWOT analysis is compulsory for all students . Half groups can get involved in group discussions on study habits and each group leader will present abstract to all. Half groups will present role play on stress management.** **Groups can be considered for different activities based on their likings**.		
4	a. Learning through observations. b. Understanding professional environment. c. Report writing.	**Industrial Visit** Industrial visits must be arranged for fulfilling the requirement of programme/course outcomes of undertaken courses of first and second semester and report of the sameshould be submitted by the individual student, to form a part of the term work.	CO4	02
5	a. Understanding industry practices or evolving concepts. b. Report writing.	**Expert Lecture** Lectures by Professional / Industrial Expert to be organized to bridge the gap of learnt/ undertaken courses during first and second semester. Probably the Professional / Industrial Expert can be organized in the following areas - 1. Project presentation tips. 2. Spoken English. 3. Personality development. 4. How to develop positive thinking. 6. Any topic related to social awareness 7. Hygiene Awareness 7. Any other topics.	CO5	02
		Total		**32**

Sr.No.	Performance Indicators	Weightage in Marks
a.	**Micro-Project –**	20
b.	**MOOCs**	10
c.	**Group Activity**	05
d.	**Industry Visit**	07
e.	**Guest Lecture**	08
Total		**50**

5. MAJOR EQUIPMENT/ INSTRUMENTSREQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practicals, as well as aid to procure equipment by authorities concerned**.**

6. SPECIFICATION TABLE FORQUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching/PR Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Micro-Project	12	--	--	--	--
II	MOOCs:SWAYAM-NPTEL and Spoken Tutorial Courses	10	--	--	--	--
III	Group Activity	06	--	--	--	--
IV	Industrial Visit	02	--	--	--	--
V	Expert Lecture	02	--	--	--	--
	Total	**32**	--	--	--	--

7. STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a. Prepare group activity Report
b. Prepare Industrial Visit Report
c. Prepare Guest lecture Report
d. Undertake micro projects
e. Undertake MOOC certifications.

7. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Microproject:
   - Teachers must brief the students about outcome expected through Microproject, form groups, and allocatemicro projects to group of 3-4 within first two weeks.
   - Micro-Projects must be on a problem statement with the aim to achieve not more than three outcomes by combining outcomes from two courses. Assessment will be as per Rubrics (A) done progressively.
   - Students must utilize the allocated slots as per the course for development of Microproject. Faculty must take care that the problem statement to be developed and presented are fair enough for stipulated time duration (12hrs.)
   - Teachers may organize departmental/interdepartmental project exhibition or presentations as per convenience to enhance demonstration/presentation skills.

NOTE: All first year and Second year faculty members prepare combined document regarding detail problem statement of Microproject. Other than this Individual Teaching Faculty may add other problem statements.

b. MOOCs : Teachers are advised to guide students into undertaking the MOOCs courses offered through various platforms. Students may take up different courses under the guideline of faculty. Faculty may take help of SWOC analysis for deciding the relevance of course allocation.Following are the guidelines , students may follow:-
   - May take technical courses for enhanced knowledge in interested areas.
   - Students requiring courses on language ability may take-up those courses
   - Students interested in Management/Entrepreneurship may opt for relevant courses.

- Students requiring mathematical skills may opt for mathematics courses with relevant topics.
- Faculty must motivate students to acquire certifications. If not faculty may take orals , ensure that proper outcome is being acquired and assign marks in proportion.
- Students must use the timetable slots allotted for course and may utilize extra hours if interested.
- Assess students performance with the help of RUBRICs (B).

c. Guest Lecture/Industry Visit :
- Faculty must undertake Expert Lectures and Industry visit planned at start of semester by Department to fulfill gaps/knowledge and relevant skill enhancements.
- Students must submit Report as per given format (FORMAT-Visit and FORMAT-Guest Lecture)
- Assessment will be done as per RUBRICs(C/D) as applicable

d. Group activity :RUBRICs
- Faculty must assign different group activity to different groups based on their abilities and preferences. Students must complete activity , prepare report and cite acquired affective domain outcome.(Format – Group activity)
- Faculty will guide students regarding the same.

8. SUGGESTED MICRO-PROJECTS

NA

9. LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication
1	Personality Development and soft skills	Barun K. Mitra Oxford University	Press
2	Entrepreneurship	Rajeev Roy Oxford University	Press
3	First Semester learnt & Second semester learning courses reference Books	--	--
4	Journals and magazines IEEE Journals, IT Technologies	--	--
5	Local newspapers and events	--	--

10. SOFTWARE/LEARNING WEBSITES

a. http://www.nptel.ac.in
b. http://www.seminarforyou.com

11. PO - COMPETENCY- CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	3	2	1	3	3
CO2	1	1	1	1	1	-	3
CO3	-	-	-	-	-	2	1
CO4	2	-	-	1	2	-	2
CO5	2	-	-	1	2	-	2

PSO - COMPETENCY- CO MAPPING

	PSO1	PSO2	PSO3
CO1	-	2	1
CO2	-	2	2
CO3	-	1	1
CO4	-	1	-
CO5	-	2	1

(Smt. U.V.Kokate) (Smt. M.U.Kokate) (Smt.A.D.Kshirsagar) (Smt.A.M.Galshetwar) (Smt.Pranita Zilpe) Signature of Course Experts	(Mr.U.V.Kokate) Signature of Head of the Department (Computer Engineering)
(Mr. U. V. Kokate) Signature of Programme Head	(Mr.A.S. Zanpure) Signature of CDC In-charge

Micro-Project Guidelines

1. Micro-project selection should be based on Third Semester learnt and Fourth Semester learning courses.
2. Group of 3-4students can work on micro-project under the guidance of Course teacher. Students can finalise micro-project topics through number of discussions with course teacher .
3. Abstract must not be greater than 100 words. Report must not be more than 7-10 pages.
4. Micro-project topics across all students must not be repeated.
5. Due care must be taken to write reports with grammatically correct statements and in neat and clean handwriting. Statement must not contain shortcups and spelling mistakes.
6. Evaluation of Micro-project should be based on Topic Selection, Problem Definition, Requirement gathering, Development, Presentation , Report writing and Response to the Questions.
7. Micro-project Report must include
    1. Cover Page
    2. Index
    3. Abstract
    4. Chapters
    5. References/Bibliography
8. The page size of the Micro-project report should be A4 .
9. **Page Numbering (Centered having format Page No__of __)**
10. **Paper Size:** A- 4 size paper
    1. **Margins :**

    Top: 1" (1 inch=2.54cm)
    Bottom: 1.15" (2.86cm)
    Left: 1.5"
    Right: 0.6"

    2. **Line Spacing:** 1.5 line
    3. **Title of Chapter**

    Font: Times New Roman (Bold face)
    Size: 14 point
    Alignment: Centre

11. **Text**

    Font: Times New Roman
    Size: 12 point
    Alignment: Justified (Full Text)

12. **Figures and Tables:**

a. **Font:** Times New Roman (**Bold**)
b. **Size:** 12 point
c. **Alignment:** Centered
d. Figure Caption must be below the figure and centered
e. Table caption must be above the table and centered

Assignment 1:Rubrics for Micro-project Evaluation

Topic Selection Relevant to course outcome (2)	Problem Definition (2)	Course Outcome Achievement in terms of Output (5)	Involvement in project development(2)	Presentation (5)	Report Writing(4)	Total (20)

Assignment 2: Rubrics for MOOCs Evaluation

Completion of Topics/	Weekly Assignment	Final	Total(20)
tutorial (05)	submission (10)/ Progressive assessment through internal orals	Certificate(05) Or final Internal orals	

Assignment 3:Rubrics for Group Activity

Involvement (5)	Performance(5)	Total (10)

Assignment- 4 :Rubrics for Industrial Visit Evaluation

Note : Students who have attended Industrial Visit will only be eligible for marks assignment, else they will be marked as absent. Marks will be awarded from Reports submitted by present students only.			
Discipline and Behavior (3)	Knowledge (Q & A) (5)	Report Writing(2)	Total (10)

Assignmnet-5 :Rubrics for Professional / Industrial Expert Lecture Evaluation

Note : Students who have attended Lecture will only be eligiblefor marks assignment, else they will be marked as absent. Marks will be awarded from Reports submitted by present students only.			
Representation of concepts (4)	Representation of best/Motivational Part(4)	Representation of Outcome achieved/Relevance to the course(2)	Total (Out of 10)

Report Formats

1) Seminar/Micro-Project Report format

i) Cover page

Government Polytechnic, Pune-16

(An Autonomous Institute of Government of Maharashtra)

A
Seminar Report
On

"SEMINAR TITLE"

SUBMITTED BY:

<Name of the student>

Under the Guidance of

<Guide Name>

DEPARTMENT OF INFORMATION TECHNOLOGY

Industry Visit Report format
Government Polytechnic, Pune

Department of Information Technology

Industry Visit Report

Name of Industry Visited:_____Date & Time of Visit:_____

Name of Student:_____Enrollment No.:_____

Term Name:_____ Std:_____ Email-d:_____

1 Equipment Observed/Demonstrated .
2 Specific Standard/processes observed in technical practices/management processes .
3 Comments on Industry dressing/uniform .
4 Industry Culture .

5 Sections/Divisions/offices visited along with description .
6 Any observation of facilities ex. Canteen/Recreational facilities etc. .
7. Can you relate the experience gathered with any course of your curriculum State: Course Name: Course Code: Details : Specific Outcomes:
8.SAFETY MEASURES .

Expert Lecture Report
Government Polytechnic, Pune
Department of Information Technology

Title of Session: _____
Name of Student: _____

Speaker:_____ Enrollment No.:___Organized By:_____Date & Time:__
_____ Venue : _____Term:_____

1. Highlights of Technologies/Concepts introduced in session.
2. Association of Topics/Title/Concepts with courses learnt(Mention Course Name).
3. State the best/Motivational Part:

Signature of Student

Government Polytechnic, Pune

'180 OB' – Scheme

Programme	**Diploma inElectronics & Telecommunication Engineering**
Programme code	01/02/**03**/04/05/06/07/08/21/22/23/24/26/15/16/**17**/18/19/26
Name of Course	**INDUSTRY INPLANT TRAINING**
Course Code	**ET4101**
Prerequisite course code and name	**Concerned Level 1 & Level 2 courses Term grant**

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)		Examination Scheme				
					Theory		Practical		Total Marks
L	T	P	C		ESE	PA	ESE	PA	
-	-	06	06	Marks	-	-	50	50	100
				Internship Duration	6 weeks duration				

Legends: L-lecture, T-Tutorial/teacher guided theory practice, P-practical, ESE-End semester examination, PA- Progressive Assessment, # - Online theory exam

Note: Both ESE and PA part of assessment will be carried out by institute faculty and industry training mentor as explained in Table 1 and Table 2, Table 3.

2. RATIONALE :

Employability competencies can be enhanced by exposing students to the actual real time working environment in industry . The industrial skills like, soft skills, life skills and hands-on will be inculcated among the students. Inplant training is the only way students learn application of acquired knowledge to fulfill market demand and develop skills and competencies required to become employable.

3. COMPETENCY:

Following competencies are expected to be developed through INDUSTRY INPLANT TRAINNG:

a) Soft Skills : Communication, Presentation, Technical Report Writing.
b) Life Skills : Time management, Safety, Innovation, Entrepreneurship, Team building etc..
c) Hands-on Practices: Implementation of production process and development of software and Quality Assurance aspects.

4. COURSE OUTCOMES:

Industry Inplant training is intended to acquire the competencies as mentioned above to supplement those attained through several courses up to fourth semester of the program:

1: Communicate effectively (verbal as well as written) to execute the work.

2: Prepare the report of the executed work atthe industry.
3:Exercise time management and safety in the work environment.
4:Work in teams for successful completion of projects assuring quality.

5. GENERAL GUIDELINES FOR INDUSTRIAL TRAINING

a) **Period of Industrial Training:** Between 4th and 5th semester (Summer Vacation).
b) **Duration of the training:** Six weeks
c) The Industries/Organizations can be Government/Public limited/or Private family enterprises.

- **Training Area:** Students should be placed in large and medium scale Industry / Organization. However, despite the best efforts by the institute, if large and medium scale Industry / Organization are not available to all students then, students can also be placed in small scale Industry / Organization.

For **Civil engineering** it can be public works department, irrigation department, public health engineering, municipal corporations, town and country planning, highway and roads authorities, railways, large and medium scale civil contractors, rural engineering departments, environment corporations, large and medium scale private construction companies, mining companies etc.

For **Mechanical Engineering** it can be manufacturing, fabrication, foundry or processing industry which may include compressors, boilers, engines, heat exchangers, air conditioning and refrigeration plants, conveyors ,automationetc are either manufactured or used. Power plants, Railways, process plants, ordinance factories, textile factories, automobile manufacturers or major automobile workshops

For **Electrical Engineering**it can be electricity transmission and distribution companies, power generating stations, sub stations, railways, industries manufacturing electrical products which may include industry where large motors/transformers etc. are used, process plants, electrical contractors.

For **Electronic Engineering**it can be telecommunication companies, post and telegraph department, manufacturer of telecommunication product, manufacturers of control equipments, manufacturer of CNC machines, any manufacturing industry where electronic controls are used either in production process or in its products, computer hardware manufacturers, signal divisions of railways, etc.

For **Computer and IT Engineering** it can be any software developers, cyber security companies, web page developers, networking companies, data base management companies, telecommunication companies or IT division of any other industries/finance/retail companies or organizations where software are used and maintained for various applications.

For **Metallurgical Engineering**it can be manufacturing industry such as fabrication , foundry , processing industry, forging, galvanizing, Iron making and steel making industries.

For **Dress Designing and Garment Manufacturing** it can be Textile industries, Weaving and

Knitting industries, Garments industries, Design and Styling fashion garments , Retail malls.

6. ROLE OF PARENT DEPARTMENT & THE INSTITUTE:

A. Formation of Placement cell for IIP at institute level: (one time activity)

It will be consisting of Training& Placement Officer (TPO), CDC Incharge and one Faculty from each program .

Activities to be carried by Institute IIP Cell:

A.1 Collecting information about Industry / Organization available for training along With the capacity.

A.2 Communication with Industry / Organization available for training along with capacity and its confirmation.

A.3 Issue letter to the Industry / Organization for the training along with details of students and mentors.

B. Formation of IIP Cell At program level:(one time activity)

It will be consisting of A faculty from Institute IIP cell , One faculty per division.

for examiners coordination ,orientation +mentors ,letters initialization,

Activities to be carried by Program level IIP Cell:

B.1 Student and mentor allocation as per the slots available for in-plant Training.

B.2 Obtaining consent letter from parents / guardian.(Undertaking on Rs100 stamp, Insurance)

B.3 Orientation and selection of Students in before start of Industry inplant training through counseling.

B.4 Mentors to carry out progressive assessment of the students during the in-plant training.

B.5 End of training assessment by mentor along with Industry / Organization expert as external

- **Scheduling for Implant Training placements –**

Sr. no	activity	Period	Responsibility
1	Industries to be identified	6^{th}-8^{th} week of 4^{th} Semester.	Departmental inplant training coordinator
2	Communication and coordination with industry	8^{th}-10^{th} week of 4^{th} Semester	Departmental inplant training coordinator
3	Allocation of faculty /	8^{th}-10^{th} week of 4^{th}	Departmental inplant

	Mentor	Semester	training coordinator
4	Acquire undertaking from students and parents .	10^{th} – 12^{th} week of 4^{th} Semester	Allocated faculty / Mentor
5	Finalise and prepare letter of placements	12^{th} – 16^{th} week of 4^{th} Semester	Allocated faculty / Mentor
6	Organise orientation and guidance and counseling Session for respective students	12^{th} – 16^{th} week of 4^{th} Semester	Allocated faculty / Mentor
7	Progressive assessment of the students during the in-plant training	Each week of training	Allocated faculty / Mentor
8	End of training assessment by mentor along with Industry / Organization expert	Before 5^{th} semester ESE	Allocated faculty / Mentor

- Faculty will be visiting the industry **at least once** during training phase after third week for assessment in coordination with industry personnel and for taking feedback. Weekly assessment can be done through online mode .

7. FORMAT FOR TRAINING REPORT

Following is the suggestive format for the training report, actual format may differ slightly depending upon the nature of Industry / Organisation. The training report may contain the following

- Title page
- Certificate
- Abstract
- Acknowledgement
- Content Page

Chapter 1. Organizational structure of Industry / Organisation and General Lay Out

Chapter 2. Introduction of Industry / Organisation (Type of products and services, history, turn over and number of employees etc.)

Chapter 3. Types of major equipment/instruments/machines/hardware and software used in industry with their specification, approximate cost and specific use and their routine maintenance.

Chapter 4. Manufacturing Processes/Models along with planning , handling and control methods.

Chapter 5. Testing of Hardware/Software/raw materials, components and finished products along with quality assurance procedures.

Chapter 6. Safety procedures followed and safety gear used (includes Preventive maintenance schedule and breakdown maintenance procedures).

Chapter 7. Particulars of Practical Experiences in Industry / Organisationif any in Production/ Assembly/ Testing/Maintenance.
Chapter 8. Detailed report of the Task . (if any done during the training)
Chapter 9. Special/challenging experiences encountered during training if any (may include students liking & disliking of work places)
Chapter 10. Conclusion
Chapter 11. References /Bibliography

8. SUGGESTED LEARNING & EVALUATION STRATEGIES/GUIDELINES

- Students should visit the website of the industry where they are undergoing training to collect information about products, processes, capacity, number of employees, turnover etc.
- They should also refer the handbooks of the major machinery, softwares and operation, testing, quality control and testing manuals used in the industry.
- Students may also visit websites related to other industries wherein similar products are being manufactured as their learning resource.
- Both the industry supervisor and the faculty supervisor are responsible to assess the students' performance and soft-skills.
- To assess the students, the scoring rubric, scoring schemes and rating scales are developed. The components to be assessed are :

- Industrial training Report,
- Logbook(Diary),
- Industrial training Oral Presentation,
- Student Performance Evaluation by Organization Supervisor, and
- Student Performance Evaluation by Faculty Supervisor

- Industrial Training report writing require students to produce a substantial report to explain about the organization's background, the overall training that have been performed and the specific projects that they have conducted along with specific conclusions /solutions.
- The students must apply the skills of communicating using written language, outlining, organizing, and planning a report, as well as using reference materials and sources and follow the above format.
- The student plays important role in deciding what should be included in the log book and learn to understand and evaluate her own progress.
- In exceptional case, on line training can also be considered as an option, provided, the contents and the assessment schemes are approved from the concerned authorities.
- Student performance evaluation focuses on a student's work performance and the personality. The scoring rubric forms are used that relates assessment item to the learning outcome. The work performance is the ability to complete the given tasks within the specified time frame independently using their knowledge and skills with good quality of work. The soft skills include the socialization, communication, initiative and motivation, discipline, cooperation and teamwork

9. TENTATIVE WEEK-WISE SCHEDULE OF INDUSTRIAL TRAINING

Industrial training is a common course to all programs; therefore the industry / Organisation selection will depend upon the nature of programme and its related industry. The training activity may vary according to nature and size of Industry / Organisation. The following table details suggestive schedule for industrial training for all programs.

Table 1: Guidelines for generalized week schedule and PA Marks distribution

S. No.	Week No.	Details of activities to be completed during Industrial training	Marks distribution/ week for PA
1	Week No. 1	Induction to industry and its departments or study of assigned job.	04
2	Week No. 2	Study of layout and specifications of major machines, equipment and raw materials / components / software and models used.	04
3	Week No. 3	Execute/study Task. **(Execution may start from first week as per job assigned and nature of industry)**	04
4	Week No. 4	Study of QA/QC/Testing procedures.	04
5	Week No. 5	safety and maintenance procedure in an industry/organization .	04
		Total	**20**
6b	Week No. 6	Report Writing (PA marks to be given by faculty based on report writing)	**10**
PA marks to be given by industry supervisor based on student involvement and quality of job performed or job assigned.			**20**
		Total PA marks for training	**50**

Table 2: Suggested Rubric for PA Assessment of Internships/Implant Training

Note: Allot the marks in the appropriate cell given based on Presentations Done

Week No	Task to be assessed	Outcome Achievement – Poor	Outcome Achievement- Moderate	Outcome Achievement – High		Total week wise Marks
		Poor (Marks 1)	Average (Marks 2)	Good (Marks 3)	Excellent (Marks 4)	
Week 1 : Industry Induction	Induction to industry and its departments or study of assigned job.	Minimal knowledge of departments, processes, products & work culture of the company	Moderate knowledge of departments, processes, products & work culture of the company	Good knowledge of all departments, processes, products & work culture of the company	Extensive knowledge of all departments, processes, products & work culture of the company	
Week 2 : Study of Existing Systems	Study of layout and specifications of major machines, equipment and raw materials / components / software and models used.	Minimal Explanation of existing systems & Objectives of the proposed work are not identified	Moderate Explanation of existing systems & Objectives of the proposed work are not well defined	Good Explanation of existing systems & Some objectives of the proposed work are well defined	Detailed Explanation of existing systems & All objectives of the proposed work are well defined	

Week No. 3: Execution of task	Execute/study Task. **(Execution may start from first week as per job assigned and nature of industry)**	Minimal efforts and participation and poor understanding	Moderate efforts and participation and preliminary understanding	Good efforts and participation and fair understanding	Extensive efforts and participation and well understanding	
Week 4 : Testing Procedures	Study of QA/QC/Testing procedures.	Applications are not appropriate	Applications are Appropriate but not well delivered	Applications are appropriate and well delivered Student cannot apply his/her knowledge on top of assessing what he/she knows	Applications are appropriate and well delivered Student can apply his/her knowledge on top of assessing what he/she knows.	
Week 5 : Study Safety & Maintenance Procedure	Study safety and maintenance procedure in an industry/organization .	Not very appropriate	Appropriate but not well delivered	Appropriate and well delivered Student cannot apply his/her knowledge on top of assessing what he/she knows	Appropriate and well delivered Student can apply his/her knowledge on top of assessing what he/she knows.	

Week No	Task to be assessed	Outcome Achievement – Poor	Outcome Achievement- Moderate	Outcome Achievement – High	Week No	Task to be assessed
		Poor (Marks 5)	Average (Marks 6)	Good (Marks 8)	Excellent (Marks 10)	
Week 6 : Report Writing	Description of concepts and technical details Conclusions and Discussion	Results are not presented properly Project work is not summarized and concluded Future extensions in the project are not specified	Results are presented in good manner Project work is not well summarized and concluded Future extensions in the project are not properly specified	Results are presented in good manner Project work is well summarized and concluded Future extensions in the project are not properly specified	Results are presented in very appropriate manner Project work is well summarized and concluded Future extensions in the project are well specified.	
Total Marks Out of 60						
Marks mapped to 50						

Table 2.1 -PA of Industrial training

Academic year : 20 -20

Name of the industry:

Sr. No.	Enrolment Number	Name of student	Marksfrom above Rubrics(Mapped to 4 marks for each week)						PA Marks by Industry Supervisor	PA based on Report by mentor faculty (Week 6)	Total
			Week 1	Week 2	Week 3	Week 4	Week 5	Total out of 20 (A)	Out of 20 (B)	Out of 10 (C)	Out of 50 (A)+(B)+(C)

Marks for PA are to be awarded out of 4 for each week considering the level of completeness of activity observed, from the daily diary maintained and feedback from industry supervisor.

Signature of mentor

Name of mentor:

Table 3 Assessment Scheme ESE

	Contents(30 marks)					Presentation(20 marks)					Total Out of (50)
Enrollment No.	Title of Industrial project	Topic Selection (5)	Presentation skill (10)	Overall understanding capability(5)	Knowledge (Q & A) (10)	Speech Clarity (5)	Body Language(3)	Neat Dressing(2)	Slides (05)	Report Writing(5)	Total Out of (50)

10. COPO - COMPETENCY&CO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3

CO5	3	3	3	3	3	3	3	3	3	3
CO6	3	3	3	3	3	3	3	3	3	3

Suggested structure for industry Inplant training	
Mrs. M. U. Kokate, Head of Department of Information Technology, G.P.Pune	Shri A.S.Zanpure CDC Incharge
Dr.V.K.Jadhav, Lecturer,Electrical Engineering.,GPP.	Smt.P.M.Zilpe Lecturer,E&TC Engineering.,G. P. Pune

Government Polytechnic, Pune

'180 OB' – Scheme

Programme	Diploma in CE/EE/ **ET** /ME/MT/CM/IT/DDGM
Programme Code	01/02/**03**/04/05/06/07/08/16/**17**/21/22/**23**/24/26
Name of the Course	**Project**
Course Code	**ET4102**
Prerequisite Course Code and Name	90 credits & L1 passed
Class Declaration	YES

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)		Examination Scheme				
					Theory		Practical		Total Marks
L	**T**	**P**	**C**		**ESE**	**PA**	***ESE**	**PA**	
--	04	--	04	**Marks**	**--**	**--**	**50**	**50**	100

(*):*POE (External Practical & Oral Examination)*

Legends: L-lecture, T-Tutorial/teacher guided theory practice, P-practical, ESE-End semester examination, PA- Progressive Assessment, # - Online theory exam

2. RATIONALE

This course tends to mould students towards integrating the knowledge acquired throughout and applying it to the real life projects, in order to gain the confidence of acquiring Engineering skills and thus fulfil the objective of Diploma Programme. Projects mainly serve the purpose of developing learning-to-learn skills.

3. COMPETENCY

The course should be taught and implemented with the aim to develop the required course outcomes (COs) so that students will acquire following competency needed by the industry:

- **The discipline of planning, organizing, and managing resources to bring about the successful completion of a specific project.**

4. COURSE OUTCOMES (COs)

After undergoing this course, the student will demonstrate the following Course Outcomes

1. Analyze and Define the real life problem from Project Development point of view
2. Apply appropriate design methodology to the Projects.
3. Make use of designing tools.
4. Conduct feasibility study and cost estimation
5. Create test and debug working model.
6. Compile and Write a Project Report
7. Communicate effectively and confidently as a member /and leader of team.

5. GUIDELINES FOR UNDERTAKING A PROJECT :

I. During the guidance and supervision of the project work, faculty should ensure that students acquire following ***learning outcomes***(depending upon the nature of the project work some of these learning outcomes may not be applicable):

a) Identify the problems in the area related to their programme based on the competencies acquired since inception into the programme.
b) Identifytheinformationsuggestingthecauseoftheproblemandpossiblesolutions.
c) Assessthefeasibilityofdifferentsolutionsandthefinancialimplications:
d) Collect relevant data from different sources (books/internet/market/suppliers/experts etc. through surveys/interviews).
e) Prepare required drawings and detailed plan for execution of the work.
f) Prepare seminar presentations to present findings/features of the project.

II. In case of Industry sponsored/guided project , implementation stages may vary as per industry requirements but same format of project report, diary, demonstration and RUBRICs will be required to be fulfilled.

Sr. No.	General Guidelines
1.	Project can be Hardware or Software or Combination of Both. It must involve logic building and application of various technologies learnt during Diploma Completion
2.	Project has to be done in a group of 3-4 students under the guidance of allotted faculty
3.	Faculty may Form a team of students as per industry roles- Requirement Gathering, Developers, testers, Business Analysts, Project managers. Assign this team a project. Each group is to be assigned a guide faculty. Project titles are to be decided in co-ordination with Faculty.
4.	Students are required to prepare working model of the Project and simultaneously prepare a report. In general project can be - i. Prototype (design, make, test and evaluate). ii. Application development using hardware/software.
5.	Students Must Submit One Hard copy and one Soft copy each of Project Report and soft-copy of the project code or the working model.

6.	Generically these titles are to be covered in Project Report: a. Problem Definition b. Platform and/Hardware Specifications c. Feasibility Study: Cost Estimation, Time Estimation d. Various Design UML charts/diagrams as applicable like Use Case Diagram, Activity Charts, Class Hierarchy, DFD, CFD, ER-Diagrams, Dependency charts or any other e. Important project Code f. Testing details g. Limitations h. Future Scope/Extendibility i. Books/References/Websites (Other titles may be added and used as applicable, based on the nature of project)
7.	Student should maintain a project diary and note down all the progress steps and details in the diary. Faculty should check the diary each week and accordingly interact with students based on the progress shown and keep proper notings.Impart proper guidance. This will assist in proper evaluation of students. Format of cover page of diary is as Annexure IV. Project diary may contain not more than 5-10 pages.

Course Implementation Stages:

1. **Orientation Session:** Portfolio Incharge faculty has to coordinate conduction of Project orientation session during last week of fifth semester.
2. **Problem Search and problem statement finalization:** Students have to undergo survey activity under the guidance of faculty . This activity maybe started during earlier semester in parallel with Seminar activity and **completed during first week of semester start.**
3. **Requirement Gathering :** One week to be utilized for gathering detailed project requirements including human resource, technical requirements/resources (software and hardware platforms), feasibility study and cost requirements. Presented to the faculty.
4. **Planning: Next week** must be utilized towards prepare a detailed project proposal and plan which must be executed or implemented within the time allocated. **Planning includes resources required, work allocation, time estimations and cost estimations.** Decide the development model to be implemented.
5. Outcome to be published under **project proposal .** May only be submitted in softcopy.
6. **Project Development, Testing& Report preparations:** Project development to proceed under faculty guidance as per planned.
7. **Project Demonstration:** Phase wise demonstration to faculty is done. The project would have to go through minimum two demonstrations :

a. Preliminary demonstration (Given to faculty guide)

b. Final Demonstration: During ESE final demonstration of working model is to be presented.

Note:

i. Student must be maintaining a project diary simultaneously as well as preparing a project report, periodically monitored and assessed by the teacher as per provided RUBRICS.

ii. Some stages maybe done recursively.

6. ASSESSMENT OF PROJECT WORK

A. Progressive Assessment (PA) Guidelines and criteria

The assessment of the students in the fifth semester Progressive Assessment (PA) for 50 marks is to be done based on following criteria.

Sr. No.	Criteria	Marks
1	Topic Selection & Problem definition	10
2	Requirement Gathering	10
3	Stage wise progress as per discussion	10
4	Involvement in project development	10
5	Report Writing	10

B. End Semester Exam Assessment (ESE) criteria/Term Work assessment criteria

The assessment of the students in the fifth semester End-Semester-Examination (ESE)for 50 marks is to be done based on following criteria. Thisassessment shall be done by the Faculty.

Sr. No.	Criteria	Marks
1	Knowledge	20
2	Development	20
3	Innovation	5
4	Presentation	5

7. **THEORY COMPONENTS**
   NA
8. **SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN**
   NA

9. **SUGGESTED STUDENT ACTIVITIES**
   NA

10. **SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)**
    As per the guidelines mentioned in Annexure-I or any other guidelines given by faculty.

11. **SUGGESTED MICRO-PROJECTS**
    NA

12. **SUGGESTED LEARNING RESOURCES**
    As per the guidelines mentioned in Annexure-I or any other guidelines given by faculty.

13. **SOFTWARE/LEARNING WEBSITES**
    NA

14. **PO - COMPETENCY- CO MAPPING**

- **Mapping Course Outcomes With Program Outcomes:**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	3	-	2	3	3
CO2	3	3	3	3	2	3	3
CO3	3	3	3	3	2	3	3
CO4	3	3	3	2	2	3	3
CO5	3	3	3	3	2	3	3
CO6	2	-	3	1	2	3	3
CO7	-	-	-	-	-	3	3
Summary	**3**	**2**	**3**	**2**	**2**	**3**	**3**

- **Mapping Course Outcomes with Program Specific Outcomes:**

CO /PSO			
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3
CO6	3	3	3
CO7	3	3	3
Summary	**3**	**3**	**3**

Annexure-II
Major Project Report

After completion of the project work, every student will submit a project report which should contain the following:

1. Cover Page (as per annexure 1)
2. Title page (as per annexure 2)
3. Certificate by the Guide (as per annexure3)
4. Acknowledgment (The candidate may thank all those who helped in the execution of the project.)
5. Abstract (It should be in one page and include the purpose of the study; the methodology used.)
6. Table of Contents(as per general guidelines):Detailed description of the project (This should be split in various chapters/sections with each chapter/section describing a project activity in totality). This portion of report should contain all relevant diagrams, tables, flow charts,which are properly labelled.
7. Conclusion
8. References (The listing of references should be typed 2 spaces below the heading "REFERENCES" in alphabetical order in single spacing left – justified. It should be numbered consecutively (in square [ ] brackets, throughout the text and should be collected together in the reference list at the end of the report. The references should be numbered in the order they are used in the text. The name of the author/authors should be immediately followed by the year and other details). Typical examples of the references are given below:

Report Specifications:

1. Project Report's Cover Type: Hard-bound
2. Color of Project Report Cover: Black only with golden alphabets (as per annexure 1)
3. Number of Copies: 5 (Individual copies(each per student) + Departmental Copy(one))
4. Paper Size (orientation): A4 (portrait)
5. Margins: 1" top / bottom / right and 1.5" left
6. Font Type: Times New Roman
7. Font Size: 16 bold for chapter names, 14 bold for headings and 12 for normal text
8. Line Spacing: 1.5 throughout
9. Page Numbering: Bottom center of page in the format – Page 1 of N

NOTE: Project report must contain only a relevant and short mention – technology or platform or OS or tools used . It must be more focussed on project work carried out and its implementation details without including any source code.

Details of Softcopy to be submitted:

CD of the project work is required to be pasted on the back cover of the project report in clear packet, which should include the following folders and contents:

1. **Presentation** (should include a PPT about project in not more than 15 slides)
2. **Documentation** (should include a word file of the project report)
3. **SourceCode** (full source code of the project with libraries used)
4. **Program** (final copy of the project executable)
5. **Support** (any third party tools used or runtime environment setups that are required to run the project)
6. **Help** (user manual on how to run the project)

NOTE: CD must be checked for any harmful viruses before submission. Source Code and Program folders can be combined into single folder **Project** if it's a web project etc.

Annexure-III

Government Polytechnic,Pune

(An Autonomous Institute of Government of Maharashtra)

CERTIFICATE

This is to certify that

1)Name Of Student Enrollment Number

2)Name Of Student Enrollment Number

3)Name Of Student Enrollment Number

4)Name Of Student Enrollment Number

Has completed the necessary project work and prepared the bonafide on

"Project Title"

In a satisfactory manner as a partial fulfillment of requirement of the

THIRD YEAR DIPLOMA IN

INFORMATION TECHNOLOGY

FOR THE ACADEMIC YEAR

2017-2018

(H.O.D) **(Principal)**

(Internal Guide) **(External Examiner)**

Table of Contents

	INDEX	
Sr.No.	**Chapter**	**Page No.**
1.	**INTRODUCTION***	
2.	**PROBLEM DEFINATION**	
3.	**REQUIREMENT SPECIFICATION**	
4	**FEASIBILITY STUDY**	
5	**FLOWCHARTS / DFDS / ERDS/UML DIAGRAMS**	
6.	**SCREENSHOTS**	
7.	**ADVANTAGES & DISADVANTAGES**	
8.	**CONCLUSIONS**	
9.	**REFERENCES**	

***Students can add/remove/edit chapter names as per the discussion with their guide**

Annexure-IV

PROJECT DIARY

Name of the Student: _____ Name of Guide (Faculty) : _____

Enrollment Number: _____ Semester: _____Project batch Number: _____

Date	Discussion Topics/Activity Details	Work Allotted Till Next Session/Corrections Suggested/Faculty Remarks	Dated Signature of Faculty

Dated Signature of Faculty **Dated Signature of HOD**

Annexure-V

Rubrics

Progressive Assessment					Project Presentation			
Topic Selection & Problem definition (10)	**Requirement Gathering (10)**	**Stage wise progress as per discussion (10)**	**Involvement in project development (10)**	**Report Writing (10)**	**Knowledge (20)**	**Development (20)**	**Innovation (5)**	**Presentation (5)**

1)Sign: Smt. P.M.Zilpe 2)Sign: Name: Smt.S.S.Chhatwani	Sign: Name: Shri.R.N.Shikari (Program Head) (Electronics &Telecommunication Dept.)
	Sign: Name: Shri A.S.Zanpure (CDC)

Government Polytechnic, Pune

'180OB' – Scheme

Programme	Diploma in CE/EE/ **ET**/ME/MT/CM/IT/DDGM
Programme Code	01/02/**03**/04/05/06/07/08/16/**17**/21/22/**23**/24/26
Name of the Course	Seminar
Course Code	**ET4103**
Prerequisite course code and name	90 credits & L1 passed
Class Declaration	YES

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)		Examination Scheme				
					Theory		Practical		Total Marks
L	T	P	C		ESE	PA	*ESE	PA	
--	04	--	04	**Marks**	--	--	25	25	50

(*): OE (Internal Oral Examination)

Legends: L-lecture, T-Tutorial/teacher guided theory practice, P-practical, ESE-End semester examination, PA- Progressive Assessment, # - Online theory exam

2. RATIONALE

This course tends to mould students towards integrating the knowledge acquired throughout and applying it to understand and interpret evolving technologies in order to strengthen the confidence over acquired Engineering skills and thus fulfill the objective of Diploma Programme. Seminar mainly serves the purpose of developing learning-to-learn skills with an aim to develop the following attributes in the students:

3. COMPETENCY

The course should be taught and implemented with the aim to develop the required course outcomes (COs) so that students will acquire following competency needed by the industry:

- **Interpret innovative/new technologies independently.**

4. COURSE OUTCOMES (COs)

After undergoing this course, the student will demonstrate the following Course Outcomes

1. Analyze and study new technologies/tools.
2. Apply technical knowledge.
3. Compile and Write a Seminar Report
4. Work independently, prepare and deliver presentations.

5. GUIDELINES FOR UNDERTAKING A SEMINAR :

1. Department must organize a Seminar Orientation session for all the registered students.
2. The process of conducting a Seminar includes allocating a topic to individual student who should perform the required search, decide on the topic objectives, design and prepare an appropriate method of presentation, and present the topic to their fellow students and teachers with all of the necessary explanation and discussion. Faculty assigned to student should be providing necessary guidance.
3. Students would individually prepare the Seminar report with the following sub-titles:
    a. Acknowledgement
    b. Abstract
    c. Index
    d. List of Figures
    e. Introduction
    f. Information/Chapters related to Seminar topic
    g. Advantages and Disadvantages
    h. Conclusion
    i. References
4. Seminar topic shall be approved by the respective guide.
5. The student will begin to maintain a dated Seminar Diary for the whole semester. This diary should be assessed by respective guide timely. Format of diary is as given in **table I**

Suggested Seminar Activities to be performed:-

- Collection of **at least three Seminar topics** on recent technologies and presentation of their abstract to faculty guide.
- Finalization of Seminar topic.
- Submission of final abstract on selected topic.
- Weekly interaction of students in group with seminar guide.
- Weekly assessment of seminar and work is labeled as Progressive Assessment.
- Group of Students should prepare and submit Report writing and presentation slides of Seminar in consultation with Seminar guide.
- Presentation of Seminar in well defined manner within specified time.
- Submission of Seminar report with the permission of faculty and Head of the Department..

6. ASSESSMENT OF SEMINAR WORK

- Like other courses, assessment of Seminar work also has two components, first is progressive assessment, while another is end of the term assessment that is Term Work.
- The faculty will undertake the progressive assessment to develop the COs in the students. They can give oral informal feedback about their performance and

their interpersonal behavior while guiding them on their seminar work every week.

- There will also be regular progressive assessment by the teacher.

A. Progressive Assessment (PA) Guidelines and criteria :

The assessment of the students in the fifth semester Progressive Assessment (PA) for 25 marks is to be done based on following criteria.

Sr. No.	Criteria	Marks
1	Topic Selection	5
2	Regularity in Seminar work as mentioned in Diary	5
3	Overall understanding capability	5
4	Progress in work and efforts displayed (Interactions with Q & A)	10

B. End Semester Assessment(ESE) criteria/Term Work assessment criteria :

The assessment of the students in the fifth semester end-semester-examination (ESE) for 25 marks is to be done as per RUBRICS of Annexure V. This assessment shall be done by the faculty.

7. THEORY COMPONENTS

NA

8. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

NA

9. SUGGESTED STUDENT ACTIVITIES

NA

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

As per the guidelines mentioned in Annexure-I or any other guidelines given by faculty.

11. SUGGESTED MICRO-PROJECTS

NA

12. SUGGESTED LEARNING RESOURCES

As per the guidelines mentioned in Annexure-I or any other guidelines given by faculty.

13. SOFTWARE/LEARNING WEBSITES

NA

14. PO - COMPETENCY- CO MAPPING

- **Mapping Course Outcomes With Program Outcomes:**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
	Basic and Discipline Specific knowledge	Problem Analysis	Design/Development of Solutions	Engineering Tools, Experimentations and Testing	Engineering Practices for Society ,Sustainability and Environment	Project Management	Life Long Learning
Analyze and study new technologies.	3	2	-	-	-	1	3
Apply technical knowledge.	3	2	-	-	-	1	3
Compile and Write a Seminar Report	1	-	-	-	-	1	3
Work independently and deliver presentations.	1	-	-	-	-	1	3

- **Mapping Course Outcomes With Program Specific Outcomes:**

CO /PSO	PSO1	PSO2	PSO3
Analyze and study new technologies.	2	2	-
Apply technical knowledge.	2	2	-
Compile and Write a Seminar Report	1	2	-
Work independently and deliver presentations.	3	3	-

Annexure-I

Seminar Report Guideline

1. **All students should submit their seminar report to their respective guide on or before _____.**
2. **Seminar report must include**
    1. **Cover Page**
    2. **Certificate**
    3. **Acknowledgement**
    4. **Index**
    5. **Abstract**
    6. **Chapters (as per discussion with guide)**
    7. **References/Bibliography**
3. The page size of the seminar report should be in A4 size.
4. The seminar report should be **Spiral bonded.**
5. Two copies of the report (hard copy only). One for self and one to be submitted to department.
6. **Page Numbering (Centered having format Page No__ of __)**
7. **Paper Size:** A- 4 size paper
    1. **Margins :**

        Top: 1" (1 inch=2.54cm)
        Bottom: 1.15" (2.86cm)
        Left: 1.5"
        Right: 0.6"

    2. **Line Spacing:** 1.5 line
    3. **Title of Chapter**

        Font: Times New Roman (Bold face)
        Size: 14 point
        Alignment: Centre
8. **Text**

    Font: Times New Roman
    Size: 12 point
    Alignment: Justified (Full Text)

9. **Figures and Tables:**
    a. **Font:** Times New Roman (**Bold**)
    b. **Size:** 12 point
    c. **Alignment:** Centered
    d. Figure Caption must be below the figure and centered
    e. Table caption must be above the table and centered

Annexure-II

Government Polytechnic, Pune-16

(An Autonomous Institute of Government of Maharashtra)

A
Seminar Report
On

"SEMINAR TITLE"

SUBMITTED BY:

<Name of the student>

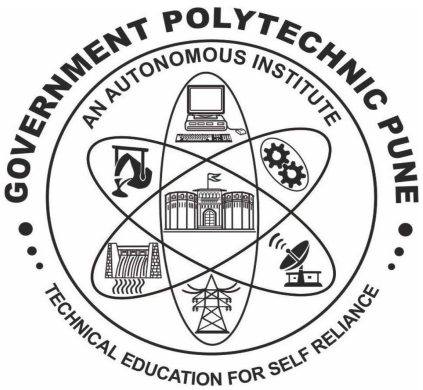
Under the Guidance of

<Guide Name>

DEPARTMENT OF INFORMATION TECHNOLOGY
(Academic Year: 2019-20)

Government Polytechnic, Pune-16
(An Autonomous Institute of Government of Maharashtra)

Department Information Technology



CERTIFICATE

This is to certify that Ms/Mr._____with Enrollment No._____, of Third Year Diploma in Information Technology has successfully completed the seminar titled "_____" as part of his/her diploma curriculum in academic year 2019-20.

Seminar Guide	**H.O.D**	**Principal**
(Shri/Smt. Name of Guide)	(Mrs. M. U. Kokate)	(Dr. V. S. Bandal)

ACKNOWLEDGEMENT

Acknowledgement should be prepared by the students in their wordings expressing their gratitude towards department.

Government Polytechnic Pune

Department of Information Technology

General Guideline

for

Seminar-CM4103

Annexure-III

Department of Information Technology
GENERAL SEMINAR GUIDELINES (Odd 2019)

Purpose of carrying out Seminars is to develop self learning capability of students wherein they will be able to apply the knowledge gathered to a new technology, understand it and deliver the presentations accordingly. All students must follow the guidelines given below :

- Seminar Presentation should be on Technical Topic only. The topic (technology) chosen may be related to perspective project.
- Seminar topic contents cannot be the contents of their Diploma course.
- Evaluation of Seminar should be based on Topic Selection, Technical Contents, Content Understanding, Content Delivery and Response to the Questions.
- Seminar topics across all students must not be repeated.
- Seminar Topics of last year should not be repeated.
- Each student has to collect 3-4 topics, present their abstract to guide, discuss with guides and finalise topics through number of discussions. Abstract must also contain key terms in topics.
- Each abstract should not exceed 200 words.
- Abstract must be written with grammatically correct statements. Shortcuts must not be used for any words and should not contain spelling mistakes with neat and clean handwriting.
- Each student must prepare and attach the seminar diary to their Seminar Reports containing:
    - Table I .
    - Abstract of 3-4 topics with keywords.
- Every student must report to respective guide as per timetable, perform necessary work and submit as per plan, get necessary attestations on activities done in seminar diary on due dates and time as per Time Table.

Annexure-IV

SEMINAR DIARY

Name of the Student: _____ Name of Guide (Faculty) : _____
Enrollment Number: _____ Semester: _____ Batch Number: _____

Date	Discussion Topics/Activity Details	Work Allotted Till Next Session/ Corrections Suggested/Faculty Remarks	Dated Signature of Faculty

Dated Signature of Faculty **Dated Signature of HOD**

Annexure-V

Rubrics

SeminarTerm work(50)										
				Presentation(20)						
Topic Selection(5)	**Regularity in Seminar Work(5)**	**Overall understanding capability(5)**	**Knowledge (Q & A) (10)**	**Speech Clarity (5)**	**Body Language(3)**	**Neat Dressing(2)**	**Slides (10)**	**Report Writing(5)**	**Total Out of (50)**	**Marks mapped to (25)**

1)Sign: Smt. P.M.Zilpe 2)Sign: Name: Smt.S.S.Chhatwani	Sign: Name: Shri.R.N.Shikari (Program Head) (Electronics &Telecommunication Dept.) Sign: Name: Shri A.S.Zanpure (CDC)

GOVERNMENT POLYTECHNIC, PUNE

'180OB' – SCHEME

Programme	Diploma in **Electronics&Telecommunication Engineering**
Programme code	01/02/**03**/04/05/06/07/08/15/16/**17**/18/19/21/22/**23**/24/26
Name of Course	**Maintenance of Electronics & EDA Tools**
Course Code	**ET4104**
Prerequisite course code and name	**NA**
Class Declaration	**NO**

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)		Examination Scheme				
					Theory		Practical		Total Marks
L	T	P	C		ESE	PA	*ESE	PA	
00	00	04	04	Marks			50	50	100
				Exam Duration	NA	NA	-	-	

(*):POE (Practical&Oral Examination)

Legends: L-lecture, T-Tutorial/teacher guided theory practice, P-practical, ESE-End semester examination, PA- Progressive Assessment, # - Online theory exam

2. RATIONALE

Equipments with electronic circuitry are increasingly being used in all the industries and maintenance of them is the essential work for the proper functioning of the complete system. This course will enable the students to develop skill to maintain the basic electronic circuitry used in electronic equipment. This course will also enable them to fulfill the basic prerequisite for the advance maintenance issues which they will face in the industries.

3. COMPETENCY

The aim of this course is to attend following industry identified competency through various teaching learning experiences:

- **Maintain electronic equipment/appliance using EDA tools.**

4. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency**:**

1.Select maintenance policy for specified equipment.

2.Select troubleshooting tool for specified work.

3.Maintain electronic home appliances /product.

4.Troubleshoot and Simulate electronic circuit using EDA tool.

5. SUGGESTED PRACTICALS/ EXERCISES

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Relevant CO	Approximate Hours Required.
1	1	Prepare the work order for the maintenance of the given equipment	1	02
2	1	Prepare Bin card for the maintenance of the given equipment	1	02
3	2	Install offline/online UPS	2	02
4	2	Test the performance of the given stepper motor	2	02
5	2	Troubleshoot the data projector	2	02
6	3	Install DTH receiver (indoor and outdoor unit)	3	04
7	2	Troubleshoot the regulated power supply circuit of the given equipment.	2	02
8	3	Assemble various parts of computer system and install operating system, applications software and antivirus..	3	04
9	2	Troubleshoot the photovoltaic solar panel power system	2	04
10.	4	Installation and overview of EDA tool components	4	02
11	4	Create new file using given EDA tool to develop the layout of regulated power supply circuit	4	04
12	4	Measure DC current and DC voltage of the given circuit using Node analysis through EDA tool.	4	02
13	4	Simulate /Test half wave rectifier circuit using EDA tool	4	02
14	4	Measure AC current and voltage of RL,RC&RLC in an AC circuit with EDA tool	4	04
15	4	Simulate /Test full wave rectifier circuit using EDA tool	4	02
16	4	Plot response of two stage RC/direct coupled amplifier using EDA tool	4	02
17	4	Using EDA tool to draw and simulate schematic circuit of inverting /non inverting amplifier using IC 741.	4	02
18	4	Simulate various analog/digital modulation techniqueswith the help of EDA tool.	4	02
19	4	Simulate temperature controller using ADC and DAC with the help of EDA tool.	4	04
20	4	Use EDA tool to simulate any digital circuit used in domestic appliances.	4	02
21	4	Develop application based circuit using EDA tool.	4	04
22	4	Use EDA tool to simulate mobile operated door Locking system or any equivalent security system.	4	04
23	4	IR trans receiver based home automation system	4	02
24	4	Test/Transmit data using Bluetooth / WI-FI module	4	02
25	All	Complete a Micro- project based on guidelines provided in sr.no. 11.	All	04

		Total Hrs		64

Note: Any 20 practicals from sr. no. 1 – 24 can be performed and 25 is compulsory.

S.No.	Performance Indicators	Weightage in %
a.	Arrangement of available equipment / test rig or model	20
b.	Setting and operation	20
c.	Observations and Recording	10
d.	Interpretation of result and Conclusion	10
e.	Submit report in time	30
f.	Attendance and punctuality	10
Total		**100**

6. MAJOR EQUIPMENT/ INSTRUMENTSREQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practical, as well as aid to procure equipment by authorities concerned**.**

Sr.No.	Major Equipment/ Instruments Required	Experiment Sr. No.
1	Variable DC Power supply 0-30V with display for voltage and current	All
2	Stepper motor	4
3	CRO	All
4	Function Generator	1-5
5	Different types of cables and connectors	All

7. THEORY COMPONENTS

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
UNIT 1. Maintenance and management and troubleshooting	
1a. Explain with sketch the steps of the given electronic equipment maintenance 1b. Explain the maintenance policy for the given equipment 1c. Choose the service option for the maintenance of the given equipment with justification. 1d. Describe the S/W installation procedure for the given the given equipment 1e. Describe the procedure to troubleshoot the specified equipment	1.1 Objective of maintenance management; service and maintenance lab. 1.2 Maintenance policy: concept of warranty and guarantee Equipment service option 1.3 Interpreting the service and operation manuals 1.4 troubleshooting process 1.5 Fault finding tools and instruments 1.6 troubleshooting technique and measures 1.7 S/W installation procedure and policies

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
UNIT 2. FUNDAMENTALS OF TROUBLESHOOTING	
2a. Describe with block diagram for given equipment, the wiring diagram 2b. Describe the procedure to locate the fault in the given equipment. 2c. Identify the relevant tools for troubleshooting of given equipment. 2d. Choose the relevant measure to troubleshoot given equipment with justification.	2.1 Block, Circuit, wiring/line diagram of equipment. 2.2 General troubleshooting procedure 2.3 Fault finding tools 2.4 General troubleshooting techniques 2.5. General troubleshooting measures.
UNIT 3. Maintenance of Electronic domestic appliances	
3a. Describe common steps of maintenance of given home appliances. 3b. Describe common steps of installation of DTH. 3C. Describe common steps of installation of solar power system. 3d. Explain steps to install surveillance system .3e. Describe the procedure to troubleshoot given electronic home appliance.	3.1 Maintenance of home appliances, battery charger, water level controller, emergency light system, SMPS, Public address (PA) system. 3.2 Demonstration of offline/online UPS and DTH. 3. 3 Installation of solar power system 3.4 Mobile hardware 3.5 Surveillance system-CCTV
UNIT 4.EDA tool and other simulation software's.	
4a. Write main features of the given EDA tool. 4b. Describe the procedure to use different windows to perform the given operations. 4c. Describe the procedure to create new file in the given EDA software. 4d.Describe the procedure to make changes in the given file	4.1 Introduction to any of the EDA tools. (SCILAB,e-sim,spice,LabVIEW, Proteus, Orcad,Multisim, TINA, MATLAB or any other) 4.2 Main features of EDA tool: Open file, create new file, run, simulation, virtual instrument 4.3. Editing windows, functions, controls. 4.4 File formats, report generation in the given EDA tool.
UNIT 5.CIRCUIT ANALYSYS USING EDA TOOLS	
5a. Describe the procedure to determine the current flowing through the component of the given circuit using Mesh analysis/Nodal 5b. Calculate current through and	5.1 Analog circuit: DC analysis –Loop/Mesh and Nodal 5.2AC analysis- RL, RC, RLC circuit, peak value, RMS value and phase value. 5.3 Op- Amp based circuits: Inverting/ Non inverting amplifiers 5.4 Digital Circuit: Boolean expression, logic gates, Combinational circuit: Adder, Substractor, multiplexer, decoder.

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
voltage across component of given RLC circuit to check the same with EDA tool. 5c. Describe the steps to use EDA tools to simulate the given type of rectifier. 5d. Sketch the MUX/DEMUX tree for the given number of input and output lines to simulate using EDA tool. 5e. Describe with sketches the process of making PCB for the given circuit	5.5Sequential circuits: Flip-flops. 5.5 PCB: layout, etching, drilling, mounting, soldering And testing. 5.6 Simulation of various real life applications like water level controller, temperature controller, Security system etc.

8. SUGGESTED SPECIFICATION TABLE FORQUESTION PAPER DESIGN

NA

9. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a. Prepare journals based on practical performed inlaboratory.
b. Diagnose fault in the non-working appliances and rectify them.
c. Discuss case study of any fault detection and rectification problem.
d. Search internet websites about manufactures, specifications and cost of equipments.
e. Develop and demonstrate simple mobile App.

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Demonstrate students thoroughly before they start doing the practice.
b. Encourage students to refer different websites to have deeper understanding of the subject.

11. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***

The micro-project could be industry application based, internet-based, workshopbased, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs.(Affective Domain Outcomes) .Each student will have to maintain activity chart consisting of individual contribution in the project work and give a seminar presentation of it before

submission.. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.
A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

a. Proforma for Logbook-Each group will prepare proforma of logbook, preventive and corrective maintenance (for any one equipment in laboratory).
b. Prepare a flow chart for fault diagnosis of equipment/gadget available in the laboratory (CRO, Function Generator, power supply etc.)
c. Design and simulate simple emergency light system using any EDA tool.
d. Simulate and build circuit on general purpose PCB of Half adder.
e. Prepare annual maintenance record of UPS available in college.
f. Prepare proposal for installation and maintenance of EPABX system.
g. Prepare proposal for installation and maintenance solar photovoltaic module.
h. Prepare proposal for installation and maintenance CCTV.
i. Prepare proposal for maintenance of PC.
j. Prepare proposal for maintenanceof TV.
k. Prepare proposal for maintenanceof mobile phon.

12. SUGGESTED LEARNING RESOURCES

S.N.	Title	Author	Publisher, Edition ,Year of publication and ISBN Number
1	Trouble shooting electronic equipments. Include repair and maintenance.	Khandpure R.S.	Mcgraw-hill publishing, New delhi,2014ISBN 9780070483576
2	Trouble shooting and maintenance of electronic equipments.	K. SudeepSingh	S. K.Kataria and Sons ISBN:978-8188458639
3	Handbook of repair and maintenance of domestic electronic appliances	SashiBhushan.Sinha	BPB publications ISBN :9788183335027

13. SOFTWARE/LEARNING WEBSITES

1. WWW.ESIM.FOSSEE.IN
2. Tutorial for e-sim software:esim.wikia.com/wiki/tutorial_the_basic_of_e-sim
3. www.scilab.org

14. PO - COMPETENCY- CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2	2	-	-	-	2	-
CO2	2	3	1	-	-	2	-
CO3	-	2	3	3	2	-	2
CO4	1	2	1	3	2	2	2

	PSO1	PSO2	PSO3
CO1	2	1	-
CO2	2	1	-
CO3	2	3	3
CO4	2	3	3

Sign: Name: SmtP.G.Gahukar: Smt.A.M.Kulkarni Smt.M.S.Datar (Course Experts)	Sign: Name: Shri.R.N.Shikari (Head of Department)
Sign: Name: Shri.R.N.Shikari (Program Head) (E & TC Department)	Sign: Name: ShriA.S.Zanpure (CDC)

Government Polytechnic, Pune

'180OB'– Scheme

Programme	Diploma in **Electronics&Telecommunication Engineering**
Programme code	01/02/**03**/04/05/06/07/08/15/16/**17**/18/19/21/22/**23**/24/26
Name of Course	**Consumer Electronics**
Course Code	**ET4105**
Prerequisite course code and name	**NA**
Class Declaration	**NO**

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)		Examination Scheme				
					Theory		Practical		Total Marks
L	T	P	C		ESE	PA	$ESE	PA	
03	00	02	05	Marks	80	20	25	25	150
				Exam Duration	3 Hrs	1 Hr	-	-	

($):OE (Oral Examination)

Legends: L-lecture, T-Tutorial/teacher guided theory practice, P-practical, ESE-End semester examination, PA- Progressive Assessment, # - Online theory exam

2. RATIONALE

In developing nations demand of consumer electronics appliances is increasing day by day. This requires large number of technically trained man power in the relevant industries. Looking towards the present need, in depth knowledge for maintaining various consumer electronic appliances is necessary for diploma engineering pass out students. This course will introduce the students with working principles of consumer electronic appliances like audio-video systems, microwave oven, washing machine, air conditioner, camcorder and other to develop skills to troubleshoot in systematic way .Knowledge so gained would also help in production units of these consumer gadgets help the students to start their own enterprises

3. COMPETENCY

The aim of this course is to attend following industry identified competency through various teaching learning experiences:

- **Maintain various consumer electronic appliance**

4. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency**:**

1.Troubleshoot different types of microphones and speakers

2.Maintain audio systems.

3.Analyze the composite video signal used in TV signal transmission.

4.Troubleshoot color TV receivers.

5.Maintain various consumer electronic appliances.

5. SUGGESTED PRACTICALS/ EXERCISES

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Relevant CO	Approximate Hours Required.
1.	1	Test the performance of given Microphone.	1	02
2.		Test the performance of given Speaker.	1	02
3.	2	Test output voltage and power of the Hi-Fi amplifier.	2	02
4.		Identify any three different faults by voltage analysis method for Hi-Fi audio amplifier.	2	02
5.		Select exact speed to write a CD for given type of data.	2	02
6.		Install the CD for given type of data.	2	02
7.	3	Measure voltage levels to sketch composite video signal at different stages of receiver.	3	02
8.	4	Use multimeter to measure voltage at various test points of Color TV receiver a) chroma section b) Picture tube	4	02
9.		Use multimeter to test various test points at Horizontal section of Color TV receiver..	4	02
10.		Use multimeter to test voltage at various test points of Vertical section of Color TV receiver..	4	02
11.		Suggest the remedy for the created faults and in the given Color TV trainer kit for the following faults a)No Color b) Red Color c) Green Color only d)No sound	4	02
12.		Suggest the remedy for the following faults in the given Color TV a) Fault in HSYNC section b) Fault in VSYNC section	4	02
13.		Suggest the remedy for the following	4	02

		faults in Color TV a)Fault in SYNC separator b)Fault in video amplifier		
14.		Test the various section of LED/LCD television receiver.	4	02
15	5	Test the various functions of Camcoder	5	02
16		Test the various features of the given type of printer.	5	02
17	All	Complete a Micro- project based on guidelines provided in sr.no. 11	All	04
		Total Hrs		**32**

Note: Any 12 practicals from sr. no. 1 – 16 can be performed and 17 is compulsory.

S.No.	Performance Indicators	Weightage in %
a.	Preparation of experimental setup	20
b.	Setting and operation	20
c.	Safety measures	10
d.	Observations and Recording	10
e.	Interpretation of result and Conclusion	20
f.	Answer to sample questions	10
g.	Submission of report in time	10
Total		**100**

6. MAJOR EQUIPMENT/ INSTRUMENTSREQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practical, as well as aid to procure equipment by authorities concerned**.**

Sr.No.	Major Equipment/ Instruments Required	Experiment Sr. No.
1	Digital Multimeter	ALL
2	CRO/DSO	6,7,8
3	Hi-Fi amplifier system	3
4	CD player trainer kit	4
5	Different types of cables and connectors	All
6	Color TV receiver trainer kit	5,6,7,8
7	LED/LCD television receiver trainer kit	15
8	Color pattern generation kit	3 to 15
9	Camcoder	16

7. THEORY COMPONENTS

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
UNIT 1 : AUDIO FUNDAMENTALES(Weightage-14, Hrs- 08)	
1a. Differentiate between mono and stereo amplifier. 1b. Describe working principles of given type of microphones 1c. Select the microphone for given application. 1d. Explain with sketches the working principle of given type of speakers. 1e. Describe the troubleshooting procedure of given microphone and speaker.	1.1 Basic characteristics of sound signal: level and loudness, pitch, frequency response, fidelity, sensitivity and selectivity 1.2 Audio Amplifiers: Mono, Stereo 1.3 Microphone: working principle and characteristics, Types: carbon ,condenser, crystal, electrets and tie clip 1.4 Speakers: working principle and characteristics Types: electrostatic ,dynamic, permanent magnet etc., woofers, tweeter and mid range . 1.5 Troubleshooting procedure.
UNIT 2 : AUDIO SYSTEMS(Weightage- 14 , Hrs-08)	
2a. Describe with block diagram the given section of CD player. 2b. Explain with sketch the component used for CD mechanism. 2c. Explain with sketch the working of Hi –Fi amplifier. 2d. Describe working principle of PA system. 2e. Describe troubleshooting procedure of given section of audio amplifier.	2.1 Block diagram and operation of CD player, types and comparison of VCD,DVD and BD. 2.2 Component used for CD mechanism: CD pick-up assembly, gear system, drive motors, CD lens. 2.3 Block diagram of Hi Fi amplifier and it's working. 2.4 Public Address(PA) system: Block diagram and operation, Speaker impedance matching and characteristics. 2.5 Typical installation planning for auditorium ,sports ground ,sport stadium. 2.6 Home theatre system. 2.7 Troubleshooting procedure of audio systems 2.8 Block diagram and working of MP3 PLAYER
UNIT 3 : TELEVISION FUNDAMENTALES AND TRANSMITTER (Weightage-16 , Hrs-10)	
3a. Explain with sketch the given type of scanning process. 3b.Describe with sketch the features of given component of composite video signal. 3c. Explain with sketch the type of modulation used in TV signal	3.1 Concept: Aspect ratio, image continuity, interlace scanning, scanning periods – horizontal and vertical, vertical resolution, horizontal resolution. 3.2 Vestigial sideband transmission, bandwidth for Color signal, brightness, contrast, viewing distance, luminance, Hue, saturation, compatibility. 3.3 Color theory, Grassman's law, additive Color mixing subtractive Color mixing. Composite Video Signal - Pedestal height, Blanking pulse, Color burst,

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
transmission . 3d. Explain with block diagram the working of Color TV transmitter . 3e. Describe the troubleshooting procedure of given section of Color TV transmitter.	Horizontal sync pulse details, Vertical sync pulse details, Equalizing pulses 3.4 CCIR B standards for Color signal transmission & reception, TV channel allocation for band I and band III ,Positive and Negative modulation, Merits and Demerits of Negative modulation. 3.5 Block diagram of Color TV transmitter 3.6 Troubleshooting procedure of Color TV transmitter.
UNIT 4: TELEVISION RECEIVER (Weightage- 12 , Hrs- 18)	
4a. Describe with sketch the function of Color TV receiver. 4b. Describe with sketch the function of given section of PAL-D decoder. 4c. Compare the features of given type of TV receiver. 4d. Explain with diagram the function of DTH receiver. 4e. Describe the troubleshooting procedure of given section of Color TV receiver.	4.1 Block Diagram and operation of color TV receiver 4.2 Block diagram and operation of PAL-D decoder 4.3 HDTV: Development of HDTV, NHK MUSE System and NHK Broadcast. 4.4 Comparison between NTSC ,PAL and SCEM systems 4.5 LCD/LED Technology: Principle and working of LCD and LED TV systems. 4.6 Direct to Home Receiver (DTH):Concept ,receiver block diagram, Indoor and Outdoor unit. 4.7 Block diagram and working of OLED 4.8 Troubleshooting procedure of Color TV Receiver systems.
UNIT 5 : CONSUMER ELECTRONIC APLLIANCES(Weightage- 10 , Hrs- 18)	
5a. Explain with sketch the working of photocopier machine with its specifications. 5b. Explain with sketch the working of Microwave Oven with its specifications. 5c Explain with sketch the working of Washing Machine. 5d. Describe with sketch the working of Digital camera. 5e. Describe the troubleshooting procedure of given consumer devices	5.1 Photocopier block diagram, working 5.2 Microwave Oven: types ,single chip controllers, block diagram, types, and wiring and safety instructions, electrical specifications 5.3 Washing Machine :Block diagram of washing machine, electrical specifications, types of washing machine: Automatic, semi automatic 5.4 Digital camera and cam coder : Pick up devices ,picture Processing, and picture storage electrical specification. 5.5 Troubleshooting procedure of given consumer devices.

8. SUGGESTED SPECIFICATION TABLE FORQUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	AUDIO FUNDAMENTALES	08	4	6	4	14
II	AUDIO SYSTEMS	08	4	6	4	14
III	TELEVISION FUNDAMENTALES AND TRANSMITTER	10	4	6	6	16
IV	TELEVISION RECEIVER	12	4	8	6	18
V	CONSUMER ELECTRONIC APLLIANCES	10	4	8	6	18
Total		48	**20**	**34**	**26**	**80**

9. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a. Prepare a survey report on a specification and applications of different types of microphones and speakers
b. Conduct market survey for latest home applications and compare specification of reputed brand and prepare a report.
c. Make visit to service center of electronics gadgets
d. Follow the safety precautions.
e. Give seminar on relevant topic.
f. Library / Internet survey regarding different data books and manuals.
g. Prepare power point presentation on applications of electronics devices.
h. Undertake a market survey of different consumer appliances.

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
c. With respect to item No.9, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
d. Guide student(s) in undertaking micro-projects.
e. Correlate subtopics with power plant system and equipments.

f. Use proper equivalent analogy to explain different concepts.
g. Use Flash/Animations to explain various components, operation and
h. Teacher should ask the students to go through instruction and Technical manuals

11. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***
The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs.(Affective Domain Outcomes) .Each student will have to maintain activity chart consisting of individual contribution in the project work and give a seminar presentation of it before submission.. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.
A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

a. Build a battery charger for mobile phone.
b. Develop a PA system for small conference hall.
c. Install DTH (indoor and outdoor unit) system for home .
d. Develop a circuit for LPG gas leakage detector.
e. Develop a circuit for light on off control using mobile application.
f. Install CCTV system for small conference hall.
g. Build a bar code reader circuit for library.
h. Compare the specifications/Technology/features of different types of television systems.
i. Compare the specifications and features of different types of consumable devices. (Microwave, Washing Machine, CD/DVD player etc.)

12. SUGGESTED LEARNING RESOURCES

S.N.	Title	Author	Publisher, Edition ,Year of publication and ISBN Number
1	Audio video systems principles, maintenance and troubleshooting.	Gupta R.G.	Tata McGraw Hill, New Delhi, India 2010 ISBN :9780070699762
2	Audio Video System: Principle practices and troubleshooting	Bali S.P.,	Rajeev Khanna book Publishing Co. Ltd,2014 Delhi ISBN-9788187522058
3	Modern Television	Gulati ,R.R	New Age International ,New Delhi 2015ISBN :9788122437843

	Practice: Transmission, Reception and Applications		
4	Television and Video Engineering	Dhake A.M.	McGrew-Hill, New Delhi,2017 ISBN:9780074601051

13. SOFTWARE/LEARNING WEBSITES

1. www.nptel.com
2. www.electronics-notes.com/.../carbon-microphone.php
3. CDplayer:www.duplication.ca/cdpaper.htm
4. Color TV theory: https://www.slideshare.net/slhallman/color-theory-533704
5. electronicscoach.com/difference-between-led-and

14. PO - COMPETENCY- CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2	1	2	2	-	2	2
CO2	2	1	3	2	-	2	2
CO3	2	1	2	2	-	2	2
CO4	2	2	2	3	-	2	2
CO5	2	2	2	2	-	2	2

	PSO1	PSO2	PSO3
CO1	2	-	1
CO2	2	-	1
CO3	2	-	1
CO4	2	-	1
CO5	2	-	1

Sign: Name: Smt. S.S.Chhatwani Smt. P.C.Mitkari (Course Experts)	Sign: Name: Shri.R.N.Shikari (Head of Department)
Sign: Name: Shri.R.N.Shikari (Program Head) (E & TC Department)	Sign: Name: ShriA.S.Zanpure (CDC)

Government Polytechnic, Pune

'180OB' – Scheme

Programme	Diploma in **Electronics & Telecommunication Engineering**
Programme code	01/02/**03**/04/05/06/07/08/15/16/**17**/18/19/21/22/**23**/24/26
Name of Course	**Basics of Internet of Things**
Course Code	**ET4106**
Prerequisite course code and name	level 1 completed
Class Declaration	**YES**

1. TEACHING AND EXAMINATION SCHEME:

Teaching Scheme (In Hours)			Total Credits (L+T+P)		Examination Scheme				
					Theory		Practical		Total Marks
L	T	P	C		ESE	PA	*ESE	PA	
03	-	02	05	Marks	80	20	25	25	150
				Exam Duration	3 Hrs	1 Hr	-	-	

(*):POE (Practical & Oral Examination)

Legends: L-lecture, T-Tutorial/teacher guided theory practice, P-practical, ESE-End semester examination, PA- Progressive Assessment, # - Online theory exam

2. RATIONALE

Internet of Things (IoT) is presently a hot technology worldwide. Government, academia, and industry are involved in different aspects of research, implementation, and business with IoT. IoT cuts across different application domain verticals ranging from civilian to defense sectors. These domains include agriculture, space, healthcare, manufacturing, construction, water, and mining, which are presently transitioning their legacy infrastructure to support IoT. Today it is possible to envision pervasive connectivity, storage, and computation, which, in turn, gives rise to building different IoT solutions. IoT-based applications such as innovative shopping system, infrastructure management in both urban and rural areas, remote health monitoring and emergency notification systems, and transportation systems, are gradually relying on IoT based systems. Therefore, it is very important to learn the fundamentals of this emerging technology.. The objective of this course is to develop the basic competency in students for using these office automation tools to accomplish the job.

3. COMPETENCY

The aim of this course is to attend following industry identified competency through various teaching learning experiences:

- **Maintain Internet of Things(IoT) based systems.**

4. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency**:**

1. Describe the need and architecture of Internet of Things.
2. Describe Architecture of Arduino Uno-ATMega328
3.Programming for Arduino Uno-ATMega328 in C languge.
4.Identify Sensors and actuators for interfacing with Arduino Uno-ATMega328 required for IoT
5.Describe protocols for Wireless Sensor Network.
6. Create IoT based applications. .

5. SUGGESTED PRACTICALS/ EXERCISES

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Relevant COs	Approximate Hours Required
1	**3**	Introductio to Arduino IDE	3	**2**
2	**3, 4**	Interfacing LED, Buzzer & Relay with Arduino/NodeMCU/Raspberry Pi to turn it ON/OFF.	3,4	**2**
3	**3, 4**	Interfacing Switch with Arduino/ NodeMCU /Raspberry Pi	3,4	**2**
4	**3, 4**	Interfacing LDR with Arduino/ NodeMCU/ Raspberry Pi to Sense Light Presence	3,4	**2**
5	**3, 4**	Interfacing Analog Temperature Sensor i.e. LM35 with Arduino to Sense Temperature	3,4	**2**
6	**3, 4**	Control action using Relay with Arduino/NodeMCU/Raspberry Pi to Turn it ON/OFF when Temperature increases or decreases	3,4	**2**
7	**3, 4**	Interfacing I2C LCD with Arduino/NodeMCU to Display Message	3,4	**2**
8	**3, 4**	Interfacing DHT11 Sensor with Arduino/NodeMCU/Raspberry Pi to get Temperature and Humidity and display same on I2C LCD	3,4	**4**

9	**3, 4**	Interfacing PIR Sensor with Arduino/NodeMCU/Raspberry Pi to Detect Motion	3,4	**2**
9	**3, 4**	Interfacing IR Sensor with Arduino/NodeMCU/Raspberry Pi to Detect Obstacle.	3,4	
10	**3, 4**	Interfacing Ultrasonic Sensor with Arduino/NodeMCU/Raspberry Pi to Measure Distance	3,4	**2**
11	**6**	Interfacing Bluetooth Module with Arduino& Creating Android Application using MIT App Inventor to control LED /Relay.	3,4,5,&6	**6**
12	**6**	Creating Android Application using MIT App Inventor &NodeMCU to control LED / Relay.	3,4,5,&6	**6**
13	**6**	Creating Web Application using Node MCU to Display Temperature & Humidity on Web Browser	3,4,5,&6	**6**
14	All	Complete a Micro- project based on guidelines provided in sr.no. 11.	All	**4**
	Total			**32**

Note: Any 12 practicals from sr. no. 1 – 13 can be performed and 14 is compulsory.

S.No.	Performance Indicators	Weightage in %
a.	Preparation of experimental setup	20
b.	Setting and operation	20
c.	Safety measures	10
d.	Observations and Recording	10
e.	Interpretation of result and Conclusion	20
f.	Answer to sample questions	10
g.	Submission of report in time	10
Total		100

6. MAJOR EQUIPMENT/ INSTRUMENTSREQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practical, as well as aid to procure equipment by authorities concerned.

Sr.No.	Major Equipment/ Instruments Required	Experiment Sr. No.

1	Multimeter	ALL
2	IoT Trainer kit using Arduino/ NodeMCU /Raspberry Pi with all sensors and relay	ALL
3	Computers/laptops	ALL
4	Sensors-Swiches,LDR,IR,PIR,Ultrasonic Sensor,DHT11,LM35	2 to 10
5	Acuators-LED, Buzzer & Relay	ALL
6.	Software tools-Arduino IDE,PUTTY,VNC viewer etc.	ALL

7. THEORY COMPONENTS

Unit Outcomes (UOs) (in cognitive domain)	**Topics and Sub-topics**
SECTION I	
UNIT 1. Introduction to Internet of Things(Weightage-12 , Hrs-06)	
1. Draw the block diagram of Basic IoTsystem 2. Draw Architecture of IoT 3. List categories of IoT. 4. Discus Issues,Challenges Security and privacy. 5. Write applications of IoT.	1.1 Basics of IoT: Need,History, Definition, Things, framework, Emerging Trends, Economic Significance, Technical Building Blocks 1.2 Physical design of IoT, Logical design of IoT, Functional design of IoT, Service Oriented Architecure. 1.3 IoTCategories . 1.4 IoT Issues and Challenges. 1.5 IoT Security and privacy. 1.6 IoT Applications.
UNIT 2:Arduino Uno and Node MCU(Weightage- 12 , Hrs- 10)	
1. Draw block diagram ATMega328 architecture and explain 2. Explain working I/O ports timer and PWM module of ATMega328. 3. Discus I2C and ADC modules . 4. Draw block diagram Node MCU8266 5. List specifications and pins of ESP8266	2.1 Arduino Uno ATMega328: Pins, hardware architecture, AVR CPU Core, Power management, System Controls, Registers in Atmega328 2.2 I/O ports ,8bit timer with PWM,16 bit timer with PWM 2.3 PWM (Pulse Width Modulation), I2C, ADC 2.4 Node MCU ESP8266 : features,specifications, pinout, connections with Arduino Uno. (No programming only architectural details)

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
UNIT 3: Arduino Programming (Weightage- 16 , Hrs-08)	
1. Write a C program for connecting LEDs & Switches. 2. Write a C program for connecting Analog input and output.	3.1 Arduino programming environments: Arduino IDE, C Program on, Arrays, loops , If statements, Functions, 3.2 Programming on Digital I/O, connecting LEDs, Switches 3.3 Programming Analog I/O : reading Potentiometer through analog input, Fading LEDs through analog output, Calibrating sensors through maximum and minimum values.
SECTION- II	
UNIT 4.Interfacing sensors & actuators(Weightage-16 , Hrs-10)	
1. Write a C program to interface Display 2. Write a C program to interface Sensor 3. Write a C program to interface actuator 5.1. DisscussWi Fi connectivity to WEB using ESP8266.	Programming and Interfacing sensors & actuators and displaying on LED/LCD with ATMEGA328. 5.2. Displays: LCD, I2C LCD 5.3. Sensors: LDR,LM35, DHT11,IR sensor 5.4. Actuators: Relay, stepper motor,Buzzer 5.5. Wi Fi connectivity to WEB using ESP8266
UNIT 5. IoT network Protcols(Weightage- 12, Hrs-08)	
1. Disscuss gateways and routing. 2. Compare different IoT protocols. 3. Describe IEEE standards for wireless networks. 4. Compare wireless network protocols.	4.1. Introduction to IoT networking - Gateways and Routing, 4.2. IoT Protocols-HTTP, MQTT, SMQTT, CoAP. (features, methods, communication, frame format, applications) 4.3. IEEE Standards-IEEE 802.15.4 Zigbee, IEEE802.11 Wi-Fi , (features,frame format, applications) 2.4. Wireless protocols-NFC, RFID, Bluetooth (features, frame format, applications)
UNIT 6IoT Enabled Applications (Weightage- 12 , Hrs-06)	
1. Discus IoTeanabled technology. 2. Draw block diagram of IoT enabled system applications	6.1. IoT enabling technologies (Embedded System,Sensor technology, Wireless network, Cloud Computing, Bigdata& Analytics). 6.2 Case study on: Home Automation, Smart City, Intelligent Traffic Control System, Health Care, Logistics, Smart Farming, Industry 4.0 etc., (CaseStudy Involves Sensors, Actuators, Wireless Connectivity, IoT Protocols & Platform)

8. SUGGESTED SPECIFICATION TABLE FORQUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
SECTION- I						
1.	Introduction to Internet of Things	06	2	6	4	12
2.	Arduino Uno and Node MCU	10	2	6	4	12
3.	Arduino Programming	08	2	4	10	16
	Total	24	6	16	18	40
SECTION- II						
4.	Interfacing sensors & actuators	10	2	4	10	16
5.	IoT network Protcols	08	2	6	4	12
6.	IoT Enabled Applications	06	2	4	6	12
	Total	24	6	14	20	40
	Total	**48**	**12**	**30**	**38**	**80**

9. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a. Preparejournals based on practical performed in laboratory.
b. Prepare power point presentation for understanding different circuit behaviour.
c . Follow the safety Precaution.
d. Use various meters to test electronics circuits.
e. Study of datasheets for sensors
f. Study of datasheets for ATMegaMicrocontroller.

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.

b. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
c. Guide student(s) in undertaking micro-projects.
d. Demonstrate the students thoroughly before they start doing practices.
e. Encourage the students to refer different websites to have deeper understanding of the subject.
f. Observe continuously and monitor the performance of the students in lab.

11. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs.(Affective Domain Outcomes) .Each student will have to maintain activity chart consisting of individual contribution in the project work and give a seminar presentation of it before submission.. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

a. Prepare a chart of various features using data sheets of ARDUINO microcontroller and its derivative.
b. Prepare a chart of various features using data sheets RASPBERRY PI microcontroller and its derivative.
c. Build Digital Clock using ARDUINO.
d. Build Flashing RGB LED Interfacing.
e. Build Compact Arduino Based Pulse Oximeter Sensor Circuit
f. Portable Arduino Weighing Machine with Set Weight Option for Retail Packing.
g. Interfacing IR Obstacle Avoidance Proximity Sensor with Arduino.
h. IoT Based IPL Scoreboard using Arduino to Display Live Score using Cric API
i. Controlling a WS2812B RGB LED Matrix with Android App using Arduino and Blynk
j. Internet-enabled Fishtank

12. SUGGESTED LEARNING RESOURCES

S.N.	Title	Author	Publisher, Edition ,Year of publication and ISBN Number
1	Internet of Things: A Hands-On Approach	ArshdeepBahga,	Vijay Madisetti VPT Paperback 2015,ISBN: 978-0996025515 628/- 2
2	IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things	David Hanes, Gonzalo Salgueiro, Patrick Grossetti Cisco	Press – Paperback – 16 A ISBN: 978-1- 58714-456- 1 599.
3	Smart Internet of Things projects	AgusKurniawan	Sep 2016 2012, ISBN:9788131766613
4	The Internet of Things Connecting Objects to the Web	HakimaChaouchi	Willy Publications 978-1-84821- 140-7
5.	Datasheets for ATMega328	http://ww1.microchip.com/	

13. SOFTWARE/LEARNING WEBSITES

1. http://ww1.microchip.com/downloads/en/DeviceDoc/Atmel-7810-Automotive-Microcontrollers-ATmega328P_Datasheet.pdf
2. https://www.arduino.cc/en/Guide/ArduinoUno
3. https://www.arduino.cc/en/Guide/ArduinoUno
4. http://www.nptel.ac.in
5. https://www.microsoft.com/en-in/learning/office-training.aspx
6. http://www.tutorialsforopenoffice.org
7. https://s3-ap-southeast-1.amazonaws.com/r4ltue295xy0d

14. PO - COMPETENCY- CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2	2	2	1	1	-	2
CO2	3	1	2	2	1	2	2
CO3	3	3	3	3	2	3	2
CO4	3	3	3	3	2	3	2
CO5	3	2	3	2	2	3	2
CO 6	3	3	2	2	3	3	2

	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3
CO6	3	3	3

Sign: Name: Smt. P.M.Zilpe (Course Expert)	Sign: Name: Shri. R. N. Shikari (Head of Department)
Sign: Name: Shri.R.N.Shikari (Program Head) (E & TC Department)	Sign: Name: Shri A. S. Zanpure (CDC)

Government Polytechnic, Pune

'180OB' – Scheme

Programme	Diploma in **Electronics&Telecommunication Engineering**
Programme code	01/02/**03**/04/05/06/07/08/15/16/**17**/18/19/21/22/**23**/24/26
Name of Course	**Digital Communication**
Course Code	ET 4107
Prerequisite course code and name	Principles of communication(ET3105)&Completed level 1 courses
Class Declaration	**YES**

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)		Examination Scheme				
					Theory		Practical		Total Marks
L	T	P	C		ESE	PA	*ESE	PA	
03	00	02	05	Marks	80	20	50	25	175
				Exam Duration	3 Hrs	1 Hr	-	-	

(*):POE (Practical&Oral Examination)

Legends: L-lecture, T-Tutorial/teacher guided theory practice, P-practical, ESE-End semester examination, PA- Progressive Assessment, # - Online theory exam

2. RATIONALE

Communication technologies have undergone radical changes, especially due to convergence of computers and communication. No industry is untouched by digital communication. This course will enable the diploma engineer to apply facts, concept and working principle of digital communication for maintenance of digital communication system. This course is design to develop the skills to diagnose and rectify the errors occurs in digital communication system. The concepts and principles of digital communication will also ley the foundation to understand the various modern communication systems.

3. COMPETENCY

The aim of this course is to attend following industry identified competency through various teaching learning experiences:

- **Maintain Basic Digital Communication Systems**

4. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency**:**

1: Explain the Basic Building Blocks of Digital Communication System.

2.Use Various Pulse Code Modulation Techniques.

3.Maintain Systems Based on Digital Modulation Techniques.

4.Analyze Various Error Detection and Correction Codes in Digital Communication Systems.

5.Understand the Concept of Multiplex and De-multiplex Digital Signals.

6.Maintain Spread Spectrum based Systems.

5. SUGGESTED PRACTICALS/ EXERCISES

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Relevant CO	Approximate Hours Required.
1	2	Test the performance of natural and flat top sampling circuit.	2	02
2		Write a program using relevant simulation tool to observe sampling process for sampling rate less than, equal to and greater than the Nyquist rate.	2	02
3		Test the performance of Pulse Width modulation and demodulation circuit..	2	02
4		Test the performance of Pulse Position modulation and demodulation circuit. .	2	02
5		Test the performance of Pulse code modulation and demodulation circuit.	2	02
6		Test the performance of Delta modulation and demodulation circuit.	2	02
7		Test the performance of Adaptive delta modulation and demodulation circuit..	2	02
8	3	Test the performance of ASK modulation & demodulation	3	02
9		Test the performance of FSK	3	02

		modulation & demodulation		
10.		Test the performance of PSK modulation & demodulation.	3	02
11		Test the performance of QPSK modulation & demodulation	3	02
12		Test the performance of QAM modulation & demodulation..	3	02
13	4	To construct the circuit for generation of hamming code for 4 bit data.	4	02
14		Generate (i) Unipolar NRZ,RZ (ii) Bipolar NRZ, Manchester for given data,	4	02
15	5	Generate TDM/FDM signal using relevant simulation software	5	02
16	6	Generate PN sequence for given maximum length.	6	02
17	All	Complete a Micro- project based on guidelines provided in sr.no. 11.	All	04
		Total		**32**

Note: Any 12 practicals from sr. no. 1 – 16 can be performed and 17 is compulsory.

S.No.	Performance Indicators	Weightage in %
a.	Preparation of experimental setup	20
b.	Setting and operation	20
c.	Safety measures	10
d.	Observations and Recording	10
e.	Interpretation of result and Conclusion	20
f.	Answer to sample questions	10
g.	Submission of report in time	10
Total		100

6. MAJOR EQUIPMENT/ INSTRUMENTSREQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practical, as well as aid to procure equipment by authorities concerned.

Sr.No.	Major Equipment/ Instruments Required	Experiment Sr. No.
1	CRO	ALL
2	RF generator/ Wide Band Oscillator Wide frequency range 100khz to 150 Mhz	12,15
3	Function generator	ALL
5	Digital Communication Trainer kit, In-built internal data Generator, Type of Modulation and Demodulations: Sampling , Line coding, PWM, PPM PCM,DM,ADM,ASK,FSK,BPSK, QPSK , QAM ,TDM, FDM	ALL
6	Digital Storage Oscilloscope	ALL

7. THEORY COMPONENTS

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
SECTION I	
UNIT 1. Introduction of Digital Communication system (Weightage-08, Hrs-06)	
1. Draw the block diagram of Basic digital communication system 2. Write the different characteristics of communication Channel 3. Define channel capacity and write its Equation. 4. Interpret the Shannon – Hartley Theorem for given sampling rate. 5. Write advantages and disadvantages of digital of digital communication.	1.1 Elements of Basic digital communication system with block diagram Communication channel characteristics: bit rate, baud rate bandwidth , repeater distance, applications. 1.2 Concept of Entropy and information rate, Channel capacity-definition and equation, Channel noise and its effect, Hartley's law. Shannon-Hartley theorem. 1.3Advantages and disadvantages of digital communication.
UNIT 2 Pulse code modulation techniques (Weightage-16 , Hrs-10)	

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
1. Define the different type of Sampling process . Explain the Natural sampling. 2. Explain the term aliasing effect , quantization process, quantization error , companding , inter symbol interference. 3. Calculate the sampling Frequency for given frequency signal. 4. Interpret the utilization bandwidth for the given pulse modulation technique. 5. Compare the performance of the given type of pulse modulation technique. 6. Draw and explain Pulse code modulation.(PCM)	2.1 Sampling & quantization process: Types of sampling (Natural & flat top sampling), Nyquist , Sampling theorem , aliasing effect , quantization process, quantization error , companding , inter symbol interference. 2.2 PAM, PWM, PPM definition, generation, block diagram, waveform analysis, and their comparison. 2.3 Pulse code modulation(PCM), Differential Pulse code modulation(DPCM) : Transmitter & Receiver block diagram and its working, Advantages and disadvantages. 2.4 Delta modulation (DM)- Block diagram of Transmitter & Receiver, slope overload, granular noise. Advantages and disadvantages. 2.5 Adaptive Delta modulation (ADM): Transmitter &Receiver block diagram and its working, Advantages and disadvantages. 2.6 Comparison of Pulse code modulation with Continuous Wave Modulation,
UNIT 3 Digital Modulation Techniques(Weightage- 16 , Hrs- 08)	
1. Summaries the given type of shift keying techniques. 2. Utilize the given shift keying techniques on the basis of their analysis. 3. Interpret the constellation diagram for given keying signals. 4. Explain the generation of given type of shift keying signal 5. Compare the salient feature of the given types of digital modulation techniques for the following : Bandwidth requirement ,SNR, Detection method. 6. Explain the working principal of Quadrature amplitude Modulation (QAM).	3.1 Types of Digital modulation techniques and their advantages, Concept of Coherent and Non Coherent detection. 3.2 Shift keying Techniques : Amplitude Shift Keying (ASK), Frequency Shift keying (FSK) ,Phase Shift keying(PSK), Differential Phase Shift keying(DPSK),Quadrature Phase Shift keying(QPSK),Constellation diagram , transmitter and Receiver block diagram and their working with waveforms. 3.3 M-ary encoding: Need, M-ary FSK and M-ary PSK 3.4 Quadrature amplitude Modulation (QAM): Need, transmitter and Receiver block diagram and their working with waveforms.

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
SECTION II	
UNIT 4 Coding Methods and Error Control (Weightage- 08 , Hrs-06)	
1. Construct the Huffman code for the given 'n'bit data. 2. Compare the given line code on the basis of average DC value, bit period , Bandwidth. 3. Apply the error detection and correction technique for the given length of data bit to generate the coded data .	4.1 Source Coding: Huffman coding 4.2 Channel coding: Error, Causes of error and its effects, error detection & correction using parity, checksum, Vertical redundancy check (VRC), Longitudinal redundancy check (LRC),Cyclic redundancy check (CRC), Linear block code, Hamming code . 4.3 Line coding formats: Classification of Line codes, Unipolar- RZ,NRZ, Polar –NRZ.RZ, Bipolar NRZ/AMI, Manchester split phase and Differential Manchester and their Waveforms.
UNIT 5 Multiplexing and Multiple Access Technique(Weightage- 16 , Hrs-10)	
1. Classify the given multiplexing techniques on the basis of domain of working . 2. Choose the suitable multiplexing techniques for multiplexing the given number of signal. 3. Contrast the given type of multiplexing techniques and multiple access techniques.	5.1. Need and method of Multiplexing: Time Division Multiplexing(TDM), Frequency Division Multiplexing (FDM) , Code Division Multiplexing(CDM) definition ,block diagram and their comparison. 5.2. Access techniques: Need and methods Time Division Multiple Access (TDMA), Frequency Division Multiple Access (FDMA), Code Division Multiple Access(CDMA).Advantages of TDMA over FDMA.
UNIT 6 Spread Spectrum Modulation (Weightage- 16 , Hrs-08)	
1. Interpret the aspect of spread spectrum (SS)Modulation for the given application. 2. Interpret the given spread spectrum modulation techniques. 3. Develop the PN Sequence for the given length of data bits. 4. Compare the performance of the fast and slow frequency hopping on the basic of	6.1 Introduction to spread Spectrum modulation : advantages over fixed frequency, application of SS Modulation ,Model of spread spectrum modulation System, 6.2 Pseudo-noise (PN) Sequences : Definition , generation and maximum length sequence. 6.3 Types of SS Modulation : Direct Sequence spread spectrum signal, Frequency hop Spread Spectrum, Slow frequency hopping, and fast frequency hopping,

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
given parameter.	

8. SUGGESTED SPECIFICATION TABLE FORQUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
SECTION I						
1.	Introduction of Digital Communication system	06	2	4	2	08
2.	Pulsecode modulation techniques	10	4	6	6	16
3.	Digital Modulation Techniques	08	4	6	6	16
	Total	24	10	16	14	40
SECTION II						
4.	Coding Methods and Error Control	06	2	4	2	08
5.	Multiplexing and Multiple Access Technique	10	4	6	6	16
6.	Spread Spectrum Modulation	08	4	6	6	16
	Total	24	10	16	14	40
	Total	**48**	**20**	**32**	**28**	**80**

9. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a. Preparejournals based on practical performed in laboratory.
b. Prepare power point presentation for understanding different circuit behaviour.
c . Follow the safety Precaution.
d. Use various meters to test electronics equipment and component.

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
c. Guide student(s) in undertaking micro-projects.
d. Demonstrate the students thoroughly before they start doing practices.
e. Encourage the students to refer different websites to have deeper understanding of the subject.
f. Observe continuously and monitor the performance of the students in lab.

11. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs.(Affective Domain Outcomes) .Each student will have to maintain activity chart consisting of individual contribution in the project work and give a seminar presentation of it before submission.. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

a. Build a transistorized chopper circuit to check natural sampled signal.
b. Build the circuit to generate flat top sampled signal.
c. Develop a circuit to generate PWM signal.
d. Develop a circuit to generate PPM signal.
e. Develop a circuit to generate ASK signal.
f. Develop a circuit to generate FSK signal.
g. Build a parity generator circuit using gates
h. Develop a PN sequence generator for various input sequence

12. SUGGESTED LEARNING RESOURCES

S.N.	Title	Author	Publisher, Edition ,Year of publication and ISBN Number
1	Electronic Communication system	Tomasi ,Wayne	Pearson Education , Delhi , 2009ISBN :9788131719534
2	Digital communication	Rao.Ramkrishna P.	McGrew Hill ,Delhi, 2011ISBN :9780070707764
3	Data Communication & Networking	Forouzan ,Behrouz	McGrew Hill ,Delhi, 2011ISBN 9781259064753
4	Digital communication	Sklar ,Bernald	Pearson Education India , Delhi , Second Edition,2014,ISBN: 9781292026060

13. SOFTWARE/LEARNING WEBSITES

1. www.nptel.com
2. Hamming Code :https://www.youtube.com/watch?v=1A_NcXxdoCc
3. Digitalmodulationtechniques:https://www.youtube.com/watch?v=GLnGVB92K78
4. Multiple access : https://www.youtube.com/watch?v=VTIUP1w1c4E
5. CDMA : https://www.youtube.com/watch?v=vdbc9P3U-Xo

14. PO - COMPETENCY- CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2	2	1	3	-	1	2
CO2	3	*2*	3	2	-	2	2
CO3	3	*2*	3	2	-	2	2
CO4	*3*	*3*	*3*	3	-	2	2
CO5	*2*	2	3	*2*	-	2	*2*
CO 6	2	3	2	3	-	2	2

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-

Sign: Name: Smt. S. S. Chhatwani Smt. R. P.More (Course Experts)	Sign: Name: Shri. R. N. Shikari (Head of Department)
Sign: Name: Shri.R.N.Shikari (Program Head) (E & TC Department)	Sign: Name: Shri A. S. Zanpure (CDC)

Government Polytechnic, Pune

'180OB'– Scheme

Programme	Diploma in **Electronics &Telecommunication Engineering**
Programme code	01/02/**03**/04/05/06/07/08/15/16/**17**/18/19/21/22/**23**/24/26
Name of Course	**Mobile and Wireless Communication**
Course Code	**ET4108**
Prerequisite course code and name	Digital Communication (ET4107) & level 1 completed
Class Declaration	**YES**

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)		Examination Scheme				
					Theory		Practical		Total Marks
L	T	P	C		ESE	PA	$ESE	PA	
04	00	02	06	Marks	80	20	25	25	150
				Exam Duration	3 Hrs	1 Hr	-	-	

($): OE (Oral Examination)

Legends: L-lecture, T-Tutorial/teacher guided theory practice, P-practical, ESE-End semester examination, PA- Progressive Assessment, # - Online theory exam

2. RATIONALE

In this world of connectivity and collaborative work environment, it is necessary to connect to the network from anywhere, with anybody, at anytime. Wireless communication provides connectivity with mobility, flexibility and convenience. Wireless devices are used across the various industries like Healthcare, Education, Automation, Automobile etc. Effective use of social networking has become possible due to high end wireless devices. This course will help the students to develop skill to handle wireless and mobile communication systems.

3. COMPETENCY

The aim of this course is to attend following industry identified competency through various teaching learning experiences:

- **Maintain mobile communication systems.**

4. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency**:**

1. Troubleshoot mobile handsets.
2. Access basic cellular system.
3. Access cellular system capacity.
4. Access performance of standards of different cellular mobile systems.
5 .Select relevant wireless technology suitable for various applications.
6. Test the performance of various wireless protocols.

5. SUGGESTED PRACTICALS/ EXERCISES

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Relevant CO	Approximate Hours Required.
1	1	Identify different section and components of mobile phone.	1	02
2		Identify the inbuilt sensor of mobile handset and test their performance.	1	02
3		Test the power supply section of mobile phone unit.	1	02
4		Test the battery charger section and power management unit of mobile phone unit.	1	02
5		Test the LCD and SIM section of mobile phone unit	1	02
6		Test the user interface section (keyboard, Mic, speaker) of mobile phone unit.	1	02
7		Troubleshoot the battery charger section, LCD section and SIM card section of mobile handset.	1	02
8		Troubleshoot the speaker problem, microphone problem	1	02
9	2	Determine the coverage area of a split cell which has radius half the radius of original cell	2	02
10.	3	Determine the channel capacity if each microcell exercise split into 4 mini cell.	3	02
11		Perform installation, registration, activation and authentication of mobile	4,5	02

		application on mobile handset		
12		Read the content of SIM card using relevant software.	4,5	02
13	4,5	Execute call control commands using relevant software.	4,5	02
14		Execute Network service command using relevant software.	4,5	02
15	5	Execute specific AT command using relevant software.	5	02
16		Execute AT commands for call control in 3G/4G network.	5	02
17		Execute AT commands for microphone and loudspeaker volume control commands in 3G/4G network.	5	02
18	6	Build a Personal Area Network of mobile devices using Bluetooth.	6	02
19		Test the reset function , hotspot and other networking function of given smart phone.	6	02
20	All	Complete a Micro- project based on guidelines provided in sr. no. 11.	All	04
		Total Hrs		**32**

Note: Any 12 practicals from sr. no. 1 – 19 can be performed and 20 is compulsory.

S.No.	Performance Indicators	Weightage in %
a.	Preparation of experimental setup	20
b.	Setting and operation	20
c.	Safety measures	10
d.	Observations and Recording	10
e.	Interpretation of result and Conclusion	20
f.	Answer to sample questions	10
g.	Submission of report in time	10
Total		**100**

6. MAJOR EQUIPMENT/ INSTRUMENTSREQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practical, as well as aid to procure equipment by authorities concerned**.**

Sr.No.	Major Equipment/ Instruments Required	Experiment Sr. No.
1	Digital multimeter	2 to 8
2	CRO/DSO	2 to 8
3	Spectrum Analyzer	2 to 8
4	Different types of cables and connectors	ALL

5	Mobile phone trainer kit	1 to 8
6	3G GSM Mobile phone trainer	2 to 8
7	SIM card Reader	2 to 8
8	Mobile handset tools	2 to 8
9	Computer system with modem	13 to19

7. THEORY COMPONENTS

Unit Outcomes (UOs) (in cognitive domain)	**Topics and Sub-topics**
SECTION- I	
UNIT 1 : Introduction to Wireless Standard(Weightage- 16 , Hrs- 12)	
1. Explain the application of wireless communication. 2. Explain the features of the given mobile standards. 3. Describe with relevant sketch the working of the specified application of mobile/fixed wireless communication system. 4. Describe with relevant sketch the working of the given fixed wireless network system 5. Describe step by step trouble shooting procedure for given section of mobile phone.	1.1 Introduction to wireless communication system, Application of wireless communication 1.2 Mobile Radio standards :AMPS,N-AMPS,IS-95,GSM,UMTS,CDMA 2000 1.3 Mobile wireless Systems : Cordless Telephone system and cellular Telephone system 1.4 Fixed wireless networks: Wireless local loop (WLL) and Local multipoint distribution system (LMDS) 1.5 Mobile phone unit: Block diagram, working, features of transmitter and receiver section, frequency Synthesizer, unit and Logic unit of mobile phone, sensors, speakers, camera, touch screen, motion sensor and other common sensor.
UNIT 2 : Introduction to Cellular Mobile system (Weightage- 12 , Hrs-10)	
1. Explain the limitations of conventional mobile communication system 2. Explain the given terms ,with respect to cellular systems. 3. Apply the principle of frequency reuse for given coverage area.	2.1 Mobile system: Limitation of conventional mobile communication system, History of 800 MHz frequency, Trucking efficiency 2.2 Cellular concept fundamentals: Cell, cell structure, Cluster, Reuse factor, minimum reuse distance, basic cellular system, mobile station, base station, Traffic Channel (Forward and Reverse),Control Channel (Forward and Reverse),Frequency reuse, Channelassignements strategies.

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
UNIT 3 :Fundamentals of Cellular system (Weightage- 12 , Hrs- 10)	
1. Choose the handoff mechanism for given situation with justification. 2. Explain the effect of the given interference on cellular system. 3. Select the relevant method to improve coverage and system capacity of the given cellular system. 4. Calculate number of traffic channels and control channels for the given frequency spectrum and the given frequency reuse ratio.	3.1 Handoff strategies: Concept of handoff, types of handoff: Hard, Soft, Queued, delayed, MAHO(mobile Assisted handoff),proper and Improper Handoff, Umbrella cell approach. 3.2 Interference and system capacity: Co-Channel Interference, Adjacent channel Interference, Channel planning for wireless system. 3.3 Improving Coverage and capacity in cellular system: Cell splitting, Sectoring, Microcell Zone concept, Repeater for range extension.
SECTION- II	
UNIT 4: Digital Cellular Mobile Standards(Weightage- 16 , Hrs- 12)	
1. Describe with relevant sketch the architecture of the given 3G cellular standards. 2. Explain features of given mobile communication system. 3. Describe with sketch call processing stages in given cellular standards. 4. Explain the features of the services and performance of the given type of signaling system.	4.1 Global System for Mobile communication(GSM): Features and services, GSM radio aspects, GSM architecture, GSM channel types ,Security aspects. 4.2 GSM call routing: Mobile terminated call and mobile originated call sequence,stages of call processing in GSM. 4.3 IS 95/CDMA One: Features, Radio aspects, Comparison with GSM standards, 4.4 Signalling system No.7(SS7):Network system parts(NSP),Message transfer parts(MTP),Signalling correction control part (SCCP),Services and performance of SS7.
UNIT 5: Advance Wireless Standards(Weightage- 12 , Hrs- 10)	
1. Explain compatibility requirements of the given wireless standards. 2. Explain features of the given next generation wireless standards. 3. Describe with relevant sketch the function of the given section of	5.1Need for 3G and 4G technology . 5.2 IMT-2000 global standards :Vision, compatibility, service and spectrum requirements 5.3 UMTS /W-CDMA standards: Features, architecture, UMTS Air interface specification, security procedure. 5.4 CDMA 2000,features and advanced versions,advantages of CDMA2000 over 3G –GSM standards. 5.5 Next generation mobile standards :Features of 4G and 4G LTE ,VoLTE,4.5G,5G

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
UMTS network architecture. 4. Select the relevant wireless technology for given application.	
UNIT 6: Wireless network Technology(Weightage- 12 , Hrs- 10)	
1. Explain the procedure to develop personal area network for the given number of devices using Bluetooth. 2. Describe with relevant sketch given IEEE protocol standard for wireless communication networks. 3. Classify the RFID tags on the basis of the given type of parameters. 4. Compare the performance of given wireless network technology based on given parameters.	6.1 Bluetooth Technology :Features, architecture, frequency band, IEEE 802.15.1 and other wireless protocols, applications, personal area network(PAN) 6.2 RFID :Concept, frequency band, classification of RFID tags, applications 6.1. WLAN technology: IEEE 802.11,WLAN system architecture 6.2. WMAN/Wi-max: IEEE 802.16a WMAN and IEEE 802.16a Wimax 6.3. Wireless Broadband : Technology, speeds, Mobile wireless broadband 6.4. Mobile Ad-hoc networks: MANET topologies, applications

8. SUGGESTED SPECIFICATION TABLE FORQUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
SECTION- I						
I	Wireless Introduction and Standard	12	04	06	06	16
II	Introduction to Cellular Mobile system	10	04	04	04	12
III	Fundamentals of Cellular system	10	04	04	04	12
	Total	32	12	14	14	40
SECTION- II						
IV	Digital Cellular Mobile Standards	12	04	06	06	16
V	Advance Wireless Standards	10	04	04	04	12
VI	Wireless network Technology	10	04	04	04	12
	Total	32	12	14	14	40
	Total	**64**	**24**	**28**	**28**	**80**

9. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a. Demonstrate the general steps to repair mobile handset.
b. Prepare the detail list equipment and software required to troubleshoot the mobile handset.
c. Give seminar on any relevant topic.
d. Visit nearby MTNL/BSNL exchange and prepare detail report of entire setup of their cellular system.

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
c. With respect to item No.9, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
d. Guide student(s) in undertaking micro-projects.
e. Correlate subtopics with power plant system and equipments.
f. Use proper equivalent analogy to explain different concepts.
g. Use Flash/Animations to explain various components, operation and
h. Teacher should ask the students to go through instruction and Technical manuals

11. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs.(Affective Domain Outcomes) .Each student will have to maintain activity chart consisting of individual contribution in the project work and give a seminar presentation of it before submission.. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

a. Compare the specifications/Technology/features of different types of mobile phones available in market.(Minimum 10)
b. Collect the information regarding the special services provided by various mobile service providers in your area.(Minimum 5)
c. Market serve on various wireless devices available in market .Examples (wireless speakers, wireless printer, wireless hand phones, wireless charger)
d. Prepare a report on TRAI regulation related to mobile communication.(spectrum Allocation)
e. Prepare a report on FCC regulation for spectrum allocation /interferences for mobile Communication.
f. Prepare a report on how radiations from BTS and handsets affect Human beings.
g. Prepare a report on Li-Fi technology.
h. Collect detailed information on various wireless technologies based on IEEE standard, frequency band, speed , range ,advantages and disadvantages and submit the brief report of it.

12. SUGGESTED LEARNING RESOURCES

S.N.	Title	Author	Publisher, Edition ,Year of publication and ISBN Number
1	Mobile cellular Telecommunication System.	Albert Malvino	McGraw HillEdition,New Delhi,2017ISDN-13:978-0070635999
2	Wireless communication principles and practice	Rappaport,S.Theodore	Pearson Publication New Delhi,2005ISBN-978-81-317-3186-4
3	Wireless communication	Singal	McGraw Hill Education Private Limited,New Delhi,2010ISBN:978-0-07-068178-1
4	Wireless and mobile network Architecture	Lin Yi Bang	John wiley and sons, New Delhi ,2001ISBN: 978-81-265-1560-8

13. SOFTWARE/LEARNING WEBSITES

1. eBook:-www.philadelphia.edu.jo/newlibrary
2. Mobile network standards:-http://gallucci.net
3. Mobile phone repairing tools and equipments:www.mobilecellphonerepairing.com
4. Bluetooth technology:www.radio-electronics.
5. GSM:http://youtu.be/oBiGDhnRI8M
6. IS95-http://youtu.be/Ftknj4geu1a
7. Wi-Fi- http://youtu.be/r9392Wi7G6E
8. Wi-Max- http://youtu.be/S67OfmwFSkw
9. www.nptel.com

14. PO - COMPETENCY- CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2	2	2	3	-	2	2
CO2	2	2	3	2	-	2	2
CO3	2	2	3	2	-	2	2
CO4	2	2	2	2	-	2	2
CO5	2	2	3	2	-	2	2
CO6	2	2	2	2	-	2	2

	PSO1	PSO2	PSO3
CO1	3	-	1
CO2	3	-	1
CO3	3	-	1
CO4	3	-	1
CO5	3	-	1
CO6	3	-	1

Sign: Name: Smt. S.S.Chhatwani Smt. P.M.Zilpe (Course Experts)	Sign: Name: Shri.R.N.Shikari (Head of Department)
Sign: Name: Shri.R.N.Shikari (Program Head) (E & TC Department)	Sign: Name: ShriA.S.Zanpure (CDC)

Government Polytechnic, Pune

'180OB' – Scheme

Programme	Diploma in **Electronics&Telecommunication Engineering**
Programme code	01/02/**03**/04/05/06/07/08/15/16/**17**/18/19/21/22/**23**/24/26
Name of Course	**Instrumentation and Control**
Course Code	**ET4109**
Prerequisite course code and name	Electronic Instrumentation (ET3104) and Level 1 completed
Class Declaration	**YES**

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)		Examination Scheme				
					Theory		Practical		Total Marks
L	T	P	C		ESE	PA	$ ESE	PA	
03	01	02	06	Marks	80	20	25	25	150
				Exam Duration	3 Hrs	1 Hr	-	-	

($):OE (Oral Examination)

Legends: L-lecture, T-Tutorial/teacher guided theory practice, P-practical, ESE-End semester examination, PA- Progressive Assessment, # - Online theory exam

2. RATIONALE

The advancement of both knowledge and technique has resulted in the development of controls in process industry. The progression of human existence from a primitive state to the present complex technological world was paced by learning new and improved methods to control the environment. Control means methods to force parameters in the environment to have specific values.

Nature of controller action for systems with operation and variables is highlighted for continuous values. This subject is beneficial for process control variation in any process control industry which equips the student for maintenance and quality analysis.

3. COMPETENCY

The aim of this course is to attend following industry identified competency through various teaching learning experiences:

- **Maintain electronic automated system in process and manufacturing industries.**

4. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency**:**

1. Use of learned devices for measurement methods of physical quantity and DAS.
2. Identify different types of control system.
3. Determine the response of system for standard input signal
4. Analyze stability of the system
5. Test the performance of various types of controller.

5. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency**:**

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Relevant CO	Approximate Hours Required.
1.	2	Resistive Transducers	1	02
2.	2	Capacitive Transducer	1	02
3.	2	Test relation between linear displacement and output voltage of LVDT	1	02
4.	2	Use RTD to measure temperature of given liquid	1	02
5.	3	DC position control system	2	02
6.	3	DC servo motor	2	02
7.	3	Characteristics of potentiometer as error detector	2	03
8.	3	Signal conditioning	3	02
9.	3	Instrumentation Amplifier	3	03
10.	4	Proportional mode controller using op-amp	4	03
11.	4	Derivative controller using op-amp	4	03
12.	4	PID controller using op-amp	4	03
13.	4	Integral controller using op-amp	4	03
14.	All	Complete a Micro- project based on guidelines provided in sr.no. 11.	All	04
		Total Hrs		**32**

Note: Any 12 practicals from sr. no. 1 – 13 can be performed and 14 is compulsory.

S.No.	Performance Indicators	Weightage in %
a.	Arrangement of available equipment / test rig or model	20
b.	Setting and operation	20
c.	Safety measures	10
d.	Observations and Recording	10
e.	Interpretation of result and Conclusion	20
f.	Answer to sample questions	10
g.	Submission of report in time	10
Total		**100**

6. MAJOR EQUIPMENT/ INSTRUMENTSREQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practical, as well as aid to procure equipment by authorities concerned**.**

Sr.No.	Major Equipment/ Instruments Required	Experiment Sr. No.
1	Digital multimeter	1,3,6,9
2	LVDT kit	3
3	RTD,IC 741,R,POT component	4,9
4	DC position servo system	5
5	MATLAB software for simulation OR controller kit	10,11,12,13
6	Different types of cables and connectors	All

7. THEORY COMPONENTS

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
SECTION I	
Units 1 :Transducers(Weightage-12 , Hrs-6)	
1.a.Understand the fundamental principles of Resistive, Inductive, and Capacitive 1. b. Explain selection criteria for sensors. 1.c.Choose appropriate measurement methods for engineering tasks 1 .d. Describe working principle of various Transducers like Strain gauge, LVDT etc. 1. e. List advantages & limitation of various transducers.	1.1 Electrical Transducers, Selecting a transducers 1.2 Resistive Transducers & Resistive position Transducers Strain gauges 1.3 Inductive Transducers, Differential output Transducers, Linear Variable Differential Transducer (LVDT) 1.4 Capacitive Transducer, Capacitor pressure transducer

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit 2:Applications of sensors and transducers (Weightage-20, Hrs-12)	
2.a.Explain with sketches the working principle of given transducer 2.b.Select suitable transducer for given level measurement 2.c.Select the relevant sensor for the given range of temperature 2. d. Select the relevant sensor/transducer for the given application. 2. e. Describe working principle of various Transducers like Thermometer, LVDT, Piezo Electrical Transducer.	2.1 Level measurement: Need of level measurement, ultrasonic type, radiation type(working principle, construction of each) 2.2 Temperature measurement: Thermister, RTD, Thermocouple 2.3 Pressure measurement: Bourdon tube, Bellows, pressure measurement using Bourdon tube and LVDT 2.4:Flow measurement: Ultrasonic flow meter 2.5Piezo Electrical Transducer, Photo voltaic cell, Semiconductor Photo Diode, Photo - Transistor (working principle, construction of each)
Unit 3: Signal Conditioning & Data Acquisition System (Weightage-08, Hrs-04)	
. 3.a. Describe function of single & multichannel DAS 3.b.List importance of Computer Based DAS 3.c. Explain working principle of digital transducer	3.1 Need of Signal Conditioning 3.2 Introduction, Objectives of DAS 3.3Signal conditioning of the inputs 3.4 Single Channel, DAS, Multi channel DAS Computer Based DAS 3.5 Digital Transducers (Rotary encoder, shaft encoder)
SECTION II	
Unit 4: Overview of Control System(Weightage-10, Hrs-10)	
4.a.Define system with practical example 4. b. Differentiate between open loop & closed loop control system. 4.c.Develop differential equations of R-C and R-L-C electric circuits 4.d.List properties, advantages& limitation of transfer function 4.e.Calculate order ,type ,characteristic equation poles &zero's of system with practical examples 4. f. Determine Block diagram representation of a system using reduction rules.	4.1 System- definition & practical example. Control system – definition and practical example. Open loop & closed loop systems – definition, block diagram, practical example, and Comparison 4.2 Laplace transforms – Significance in control system, developing differential equations of R-C and R-L-C electric circuits. 4.3 Transfer function – definition, derivation of transfer function for close loop control system. 4.4 Order of a system – definition, 0, 1,2 order system standard equations, pole, zero, type of system definition and practical examples. 4.5 Block diagram representation of a system- need, reduction rules, problems.

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit 5: Dynamic Analysis of a System(Weightage-10, Hrs-10)	
5.a. Differentiate between time domain &frequency domain analysis. 5.b.Analyze Transient and steady state response 5.c.Evaluate all Time response specifications 5. d. Calculate corresponding Laplace representation of Standard test inputs.	5.1 Dynamic analysis of measurement systems- definition, time domain and frequency domain analysis. 5.2 Time domain analysis – Transient and steady state response, steady state error. 5.3 Standard test inputs - step, ramp, parabolic& impulse. Need of them, significance, and corresponding Laplace representation 5.4 Time response specifications (no derivations) ; problems on time response specifications
Unit 6: Stability & Introduction to servo system(Weightage-12, Hrs-12)	
6.a. Compare between different stability of system. 6.b.Evaluate relative stability of system with S-plane 6.c.Analyse different cases & conditions of Routh's stability criterion 6.d.List merits& demerits of of frequency response analysis 6.e. Evaluate system stability usingRouth'sHurwitzCriterion 6.f.Explain working principle of Servo system 6.g.Diffentiate between AC & DC servo systems	6.1 S-plane – Introduction 6.2 Stability - stable, unstable, critically stable & conditionally stable system; relative stability; Root locations in S-plane for stable and unstable systems 6.3 Routh's stability criterion-different cases & conditions (statement method); problems (Time response analysis) 6.4 Introduction, advantages & disadvantages of frequency response analysis; frequency response specifications 6.5 Servo system –definition, block diagram, 6.6 AC & DC servo systems- comparison, practical example, schematic diagram , concept and principle
Unit 7 :Control actions & process controllers(Weightage-8, Hrs-10)	
7.a.Explain block diagram of Process control system 7.b.List different control actions in control system 7.c. Derive mathematical equation of continuous modes & Composite controllers. 7.d. Analyze charactestic of controllers 7.e. Draw electronic controllers & state its equations	7.1 Process control system – block diagram , elements 7.2 Control actions: discontinuous & continuous modes; 7.3 On off controllers: neutral zone Proportional controllers (offset, proportional band) Integral & derivative controllers; 7.4 Composite controllers; PI, PD, PID controllers 7.5 Control actions of electronic controllers with circuits & equations (with op amp)

8. SUGGESTED SPECIFICATION TABLE FORQUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
SECTION I						
I	Transducers	06	04	00	08	12
II	Applications of sensors and transducers	12	00	08	12	20
III	Signal Conditioning & Data Acquisition System	04	04	04	00	08
	Total	22	08	12	20	40
SECTION II						
IV	Overview of Control System	10	02	04	04	10
V	Dynamic Analysis of a System	10	02	04	04	10
VI	Stability & Introduction to servo system	12	04	00	08	12
VII	Control actions & process controllers	10	00	04	04	08
	Total	42	08	12	20	40
	Total	64	**16**	**24**	**40**	**80**

9. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a. Prepare journals based on practical performed inlaboratory.
b. Study of datasheet of RTD, LVDT, and IC741 components.
c. Collect information of various DAS & Examples.
d. Prepare PPT on comparison between process controllers.
e. Give seminar on relevant topic

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
c. With respect to item No.9, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.

d. Guide student(s) in undertaking micro-projects.
e. Correlate subtopics with power plant system and equipments.
f. Use proper equivalent analogy to explain different concepts.
g. Use Flash/Animations to explain various components, operation and application.
h. Use open source simulation software to observe performance of Controllers.

11. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***
The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs.(Affective Domain Outcomes) .Each student will have to maintain activity chart consisting of individual contribution in the project work and give a seminar presentation of it before submission.. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.
A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

a. Prepare power point presentation on types of transducers and give presentation in classroom.
b. Prepare power point presentation on any one application of sensor and explain its working principle and construction.
c. Prepare power point presentation on any one application of transducer and explain its working principle and construction.
d. Survey of different types of sensors and transducers.
e. Prepare a report on various types of data acquisition system.
f. Prepare a table to show various signals and its laplace transform.
g. Prepare a chart of block diagram reduction rules.
h. Prepare a table indicating standard test signals, its graphical representation and Laplace transform.
i. Prepare a table indicating different cases of Routh's array.
j. Prepare a report on comparison of composite controllers.

12. SUGGESTED LEARNING RESOURCES

S.N.	Title	Author	Publisher, Edition ,Year of publication and ISBN Number
1	Control system engineering	Nagrath J J,Gopal M	New Age International (P) Ltd. ISBN 10: 8122422845 ISBN 13: 9788122422849
2	Process control instrumentation technology	Johnson C D	Prentice hall,8th edition(2014) ISBN-10: 0131194577 ISBN-13: 978-0131194571
3	Instrumentation	A K Sawheny,	Nineteenth edition, 2017, DhanpatRai publication ISBN :8177001006

13. SOFTWARE/LEARNING WEBSITES

1. www.nptel.com
2. www.scilab.com
3. www.mathwork.com
4. www.slideshare.com

14. PO - COMPETENCY- CO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	-	3	2	-	2	1
CO2	2	3	-	-	2	-	2
CO3	3	-	2	2	-	2	2
CO4	2	3	2	3	1	1	3
CO5	1	3	2	-	2	2	3

CO	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	2	-	2
CO3	1	3	2
CO4	-	2	3
CO5	1	2	3

Sign: Name: Smt. P.V.Lengare Smt.A.M.Kulkarn Smt.M.S.Datar (Course Experts)	Sign: Name: Shri.R.N.Shikari (Head of the Department) (Electronics &Telecommunication Dept.)
Sign: Name: Shri.R.N.Shikari (Program Head) (E & TC Department)	Sign: Name: ShriA.S.Zanpure (CDC)

Level 5 Curriculum

Government Polytechnic, Pune

'180OB' – Scheme

Programme	Diploma in **ET**/CE/EE//ME/MT/CM/IT/DDGM
Programme code	01/02/**03**/04/05/06/07/08/15/16/**17**/18/19/21/22/**23**/24/26
Name of Course	**Embedded System**
Course Code	**ET 5101**
Prerequisite course code and name	**ET3109 + L1**
Class Declaration	**YES**

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)		Examination Scheme				
					Theory		Practical		Total Marks
L	T	P	C		ESE	PA	*ESE	PA	
03	00	02	05	Marks	80	20	25	25	150
				Exam Duration	3 Hrs	1 Hr	-	-	

(*):POE (Practical&Oral Examination)

Legends: L-lecture, T-Tutorial/teacher guided theory practice, P-practical, ESE-End semester examination, PA- Progressive Assessment, # - Online theory exam

2. RATIONALE

The importance of embedded systems is continuously increasing considering the breadth of application fields where they are used... Our dependence on embedded systems requires development and adoption of new architectural and design techniques in order to meet the necessary performance requirements The importance of embedded systems has led to the emergence of a strong industry that develops and uses them. Their criticality for services on all fronts and for technological and thus economic growth has led to significant efforts to address the challenges placed by embedded systems development and deployment.
The study of embedded systems deals with hardware with software embedded in it. Therefore it's a necessity to impart knowledge of related technology to develop logical thinking and maintain electronics hardware based embedded systems

3. COMPETENCY

The aim of this course is to attend following industry identified competency through various teaching learning experiences:

- Maintain Embedded Systems.

4. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency**:**

1. Describe with sketch the Architecture and on chip peripherals of LPC2148 Micro-controller.
2. Develop the assembly language programs & verify it using simulation for given problem definition.
3. Select appropriate communication Protocols for various Applications.
4. Comprehend hardware and software architecture of embedded system.
5. Discuss concept of Device driver and interrupt service routine.
6. Recognize the features of RTOS, kernel, inter task communication, inter process Communication.

5. SUGGESTED PRACTICALS/ EXERCISES

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Relevant CO	Approximate Hours Required.
1.	2	Introduction to Keil Software	2	02
2.		Addition of 8 Bit number	2	02
3.		Subtraction of 8 Bit number	2	02
4.		Addition of 32 Bit number	2	02
5.	2	Subtraction of 32 Bit number	2	02
6.	2	Addition of 64 Bit number	2	02
7.		Subtraction of 64 Bit number	2	02
8.		Block transfer 1. Word transfer 2.half word transfer 3. Byte transfer	2	02
9.		Block Exchange 1. Word transfer 2.half word transfer 3. Byte transfer	2	02
10.		Multiplication of 32 bit number	2	02
11.	2	Addition of 1 to 10 Numbers	2	02
12.		Program based on Logical instruction	2	02
13.		Identification & observation of ARM7 system board on the kit.(LPC2148)	2	02
14.	1	Interfacing of LEDs with ARM	1	02
15.	**1**	Display message on LCD	1	02
16	**1**	UART communication.	1	02
17.	All	Complete a Micro- project based on guidelines provided in sr.no. 11.	All	04
		Total Hrs		**32**

Note: Any 12 practicals from sr. no. 1 – 16 can be performed and 17 is compulsory.

S.No.	Performance Indicators	Weightage in %
a.	Arrangement of available equipment / test rig or model	20
b.	Setting and operation	20
c.	Safety measures	10
d.	Observations and Recording	10
e.	Interpretation of result and Conclusion	20
f.	Answer to sample questions	10
g.	Submission of report in time	10
Total		**100**

6. MAJOR EQUIPMENT/ INSTRUMENTSREQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practical, as well as aid to procure equipment by authorities concerned**.**

Sr. No.	Major Equipment/ Instruments Required	Experiment Sr. No.
1	Keil software	1 to 12
2	ARM 7 Development Board & Keil.	13 to 16

7. THEORY COMPONENTS

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
SECTION-I	
UNIT 1. Introduction ARM controller:(Weightage-16 , Hrs-08)	
1. Explain the RISC design philosophy . 2. Explain the ARM Design Philosophy. 3. Draw the Embedded system Hardware. Also Explain the Arm bus Technology. 4. Discuss different ARM7 processor family. 5. Draw the block diagram of ARM7TDMI.explain it. 6. Explain the core diagram with neat diagram. 7. Draw ARM7TDMI programming model explain the 8. List different exception	1.1 RISC design philosophy,ARM design philosophy, 1.2 Embedded System Hardware: arm bus technology , Arm busprotocol 1.3 Pipelining In Arm, Comparison between pipelining 1.4 ARM7 processor family 1.5 Simplified view – ARM7TDMI block diagram, core diagram , Thumb Mode concept 1.6 ARM7TDMI programming model – Registers, Operation modes, Exceptions and Interrupts 1.7 On chip peripherals: - Internal memory, GPIOs, Timers, ADC,UART ,SPI,I2C, PWM, RTC,WDT (Consider **LPC 2148)** (check for pins, Block diagram, working of peripheral)

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
available in ARM7TDMA.Explain it. 9. Discuss the given on chip peripheral of LPC2148.	
UNIT 2. ARM 7 Instruction set and Programming(Weightage-12 , Hrs-10)	
1. Develop the algorithm, and C code or assembly language program based data transfer , arithmetic instructions. 2. Develop the algorithm, and C code or assembly language program based on logical, comparison, multiply, load store instruction, branching group of instructions. 3. Develop the algorithm, and C code or assembly language program based GPIO.(Led Blinking Programs)	2.1 Instruction Set : Data transfer, arithmetic group of instruction simple programs depending on above instruction set .Can go for assembly or 'C' programs. 2.2 logical, comparison, multiply, load store instruction, branching 2.3 Simple programs depending on above instruction set expected .Can go for assembly or 'C' programs. 2.4 Simple programs of led blinking for GPIO
UNIT 3 Communication Protocols : (Weightage- 12 , Hrs- 06)	
1. Describe the given serial communication Protocol with neat diagram. 2. Describe the given Network Protocol with neat diagram	Study of communication of protocols with their features , OSI layer diagram and working, applications, advantages ,disadvantages. 5.1 Serial protocols: USB,I2C Protocol 5.2 Network protocols: CAN,MODBUS, Ethernet, 5.3 Wireless protocols: IrDA, 5.4 Buses for Parallel Communication – ISA,PCI,PCI-X
SECTION-II	
UNIT 4. Overview of Embedded Software : (Weightage- 12 , Hrs-06)	
1. Describe the Categories &Requirements of embedded systems. 2. Explain Hardware & software architecture of embedded system. 3. Describe the System On chip(SOC). 4. Describe the given Embedded software development tool.	4.1 Categories of embedded systems 4.2 Requirements of embedded systems, and Applications of embedded Systems, characteristics of embedded Systems. 4.3 Hardware architectures for embedded systems. 4.4 System on chip (SOC) 4.5 Survey of software architecture 4.6 Embedded software tools. IDE, Compiler, Debugger, Simulator, Emulator, In circuit Emulator (ICE),Target Board, Device. 4.7 Embedded software development CYCLE.
UNIT 5 Device Driver & Interrupts Servicing Mechanism (Weightage- 12 , Hrs-06)	

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
1. Describe the Interrupt handling mechanism and interrupt sources. 2. Explain the Multiple Interrupt & context switching. 3. Explain the Parallel and serial Port device Driver. 4. Describe the Device driver with Internal Programmable timing devices.	5.1 ISR concept 5.2 Interrupt sources 5.3 Interrupt handling mechanism 5.4 Multiple interrupts, context switching 5.5 Device Drivers 5.6 Parallel port device driver 5.6 Serial port device driver 5.7 Internal Programmable timing devices
UNIT 6 : RTOS & Inter process Communication(Weightage- 16 , Hrs-12)	
1. Describe RTOS in embedded Systems. 2. Enlist the functions of RTOS. 3. Explain Inter process Communication and its Mechanism.	6.1 Operating System : General and Real time Operating System 6.2 Concepts of RTOS -Requirement, Need and Specification of RTOS in embedded Systems. 6.3 Kernel Architecture : Kernel Object. 6.4 Functions of RTOS: Task Management, Scheduling Resource. 6.5 Inter process Communication- Shared Resources, Task Multitasking ,Task Synchronization , Context Switching, Kernels, Pre-emptive and non pre-emptive Schedulers, Static and Dynamic Priorities, Priority Inversion, Mutual Exclusion ,Starvation, Deadlock, Problem of sharing data by Multiple task and routines , 6.6 Inter task communication mechanisms: Semaphores, Mailbox, Pipes.

8. SUGGESTED SPECIFICATION TABLE FORQUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
SECTION-I						
I	Introduction ARM controller	8	04	08	04	16
II	ARM 7 Instruction set and Programming	10	03	03	06	12
III	Communication Protocols	6	03	03	06	12
	Total	24	10	14	16	40
SECTION-II						
IV	Overview of Embedded Software	6	03	06	03	12

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
V	Device Driver & Interrupts Servicing Mechanism	6	03	04	05	12
VI	RTOS & Inter process Communication	12	03	06	07	16
	Total	24	09	16	15	40
	Total	**48**	**19**	**30**	**31**	**80**

9. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

Download datasheet of electronic components and devices used in practical

a. Study of datasheet and prepare a documentation along with their specifications.
b. Prepare power point presentation on applications of Microcontroller.
c. Undertake Market Survey of Different Microcontrollers.
d. Follow safety precautions.

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
c. With respect to item No.9, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
d. Guide student(s) in undertaking micro-projects.
e. Correlate subtopics with power plant system and equipments.
f. Use proper equivalent analogy to explain different concepts.
g. Use Flash/Animations to explain various components, operation and
h. Teacher should ask the students to go through instruction and Technical manuals

11. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***
The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs.(Affective Domain Outcomes) .Each student will have to maintain activity chart consisting of individual contribution in the project work and give a seminar presentation of it before submission.. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.
A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

a. Prepare a chart of various features using data sheets of 8051, AVR, PIC, AVR, ARM microcontroller and its derivative.
b. Build a data acquisition system to read analog and digital signals using inbuilt ADC and DAC of ARM7
c. Build Timer application of square wave generation with the help of in built timer of ARM7
d. Build 4_bit_lcd_Interfacing_With_ARM7
e. Build 7_Segment_Display_Interfacing With_ARM7
f. Build Digital Clock using Inbuilt RTC of LPC2148
g. Build an Interface for Buzzer with LPC2148
h. Build I2C_EEPROM_Interfacing_With_ARM7
i. Build Flashing LEDInterfacingwithARM7
j. Build PWMInterfacingwithARM7
k. Build Relay Interfacing With ARM
l. Build switchInterfacingwithARM7
m. Build TempSensorLM35InterfacingwithARM7

12. SUGGESTED LEARNING RESOURCES

S.N.	Title	Author	Publisher, Edition ,Year of publication and ISBN Number
1	ARM System developers Guide: Designing and Optimizing system Software.	Sloss Andrew N, Symes , Dominic , Wright Chris	Publication: Morgan Kaufmann; Illustrated edition (10 May 2004) ISBN-13: 9781558608740
2	Embedded System – Architecture :Programming and Design	Raj Kamal	Publication: McGraw-Hill Education (India) (1 January 2009) ISBN-13: 978-0070151253
3	ARM System –On chip Architecture.	Steve Furber	Publication: Addison-Wesley; 2nd edition (17

			August 2000) ISBN-13 :‎ 978-0201675191
4	Embedded system Design	Frank Vahid and Tony Givargis	Publication: Wiley; Student edition (1 January 2006) ISBN-13: ‏ 978-8126508372

13. SOFTWARE/LEARNING WEBSITES

1. www.nptel.com
2. The RISC design philosophy :https://bnmbiw.wordpress.com/2013/01/27/chapter-1-arm-embedded-systems/
3. https://www.electronicshub.org/arm-introduction/
4. http://infocenter.arm.com/help/index.jsp?topic=/com.arm.doc.ddi0084f/ch01s01s01.html
5. Difference between ARM state and Thumb state : http://infocenter.arm.com/help/index.jsp?topic=/com.arm.doc.dui0068b/ch02s02s09.html
6. Introduction to ARM 7
7. https://www.electronicshub.org/arm-tutorial/#Part_1_ARM_Introduction
8. http://binaryupdates.com/introduction-to-arm7-lpc2148-microcontroller/

14. PO - COMPETENCY- CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	2	2	-	-	2
CO2	3	3	3	3	-	-	2
CO3	3	3	3	2	2	1	2
CO4	2	2	2	-	-	-	2
CO5	3	3	2	2	-	-	2
CO6	3	3	3	1	-	-	2

	PSO1	PSO2	PSO3
CO1	3	3	2
CO2	3	3	-
CO3	3	3	-
CO4	3	3	1
CO5	3	3	-
CO6	3	3	-

Sign: Name: Smt.P.M.Zilpe Smt.S.S.Chhatwani (Course Experts)	Sign: Name: Shri..R.N.Shikari (Head of Department)
Sign: Name: Shri.R.N.Shikari (Program Head) (E & TC Department)	Sign: Name: Shri.A.S.Zanpure (CDC)

Government Polytechnic, Pune

'180OB' – Scheme

Programme	Diploma in **Electronics&Telecommunication Engineering**
Programme code	01/02/**03**/04/05/06/07/08/15/16/**17**/18/19/21/22/**23**/24/26
Name of Course	**Robotics**
Course Code	**ET5102**
Prerequisite course code and name	ET3109 Microcontroller and Applicationsand Level 1 completed
Class Declaration	**YES**

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)		Examination Scheme				
					Theory		Practical		Total Marks
L	T	P	C		ESE	PA	$ESE	PA	
03	00	02	05	Marks	80	20	25	25	150
				Exam Duration	3 Hrs	1 Hr	-	-	

($):OE (Oral Examination)

Legends: L-lecture, T-Tutorial/teacher guided theory practice, P-practical, ESE-End semester examination, PA- Progressive Assessment, # - Online theory exam

2. RATIONALE

Due to globalization and competition, industries are developing fast and incorporating automation in various sectors .The future trend indicates that 'Robots 'will be used to carry outactivities to improve the efficiency of the industry. This subject has been identified in technology area as an elective. So, it is very much important to teach robotics as the synergistic integration of mechanics, electronics, controls, and computer science. Knowledge of this subject will be helpful in the maintenance of robots. Contents of this subject will provide an opportunity to understand thebasic concepts of robotics,various types of end effectors and applications of robots.

3. COMPETENCY

The aim of this course is to attend following industry identified competency through various teaching learning experiences:

- **Maintain robotic system.**

4. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency**:**

1.Explain fundamentals of robotics.

2.Explainvarious types of robot end effector.

3. Explore the role of robots in different applications.

4. Identify the different type of Sensor of Firebird Robot and use it for different robotics applications.

5.Demonstrate the Interfacing of Various on chip Peripheral with Robot.

6. Develop the programming in Robot to perform the various Robotics applications.

5. SUGGESTED PRACTICALS/ EXERCISES

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Relevant CO	Approximate Hours Required.
1.	01	Study of robotics system.	01	02
2.	01	Study of various robotic configurations.	01	02
3.	01	Prepare a report on following points using searching of information through internet: 1. Robot Configurations 2. Manipulator 3. End effectors 4.Link 5. Joint 6. Robot Motion 7. Robot Programming methods	01	02
4.	01	Study of various types of robot simulation software.	01	02
5.	02	Study of various robotic end effectors along with specifications and their applications area	02	02
6.	02	Prepare a report on comparison and application of the various type of grippers mentioned in the syllabus by searching information through internet.	02	02
7.	03	Prepare a report on any one application of the robot by searching information through internet.	03	02
8.	03	Study different types of robots by arranging industrial visits.	03	02
9.	04	To Study the Firebird Robot kit , with Power Charging Procedure of Robot.	04	02
10.	04	Install the Visual AtmelStudio6 software.	05	02
11.	06	Turn On /off the LED in different fashion	05	02
12.	06	Display Information On LCD	05	02
13.	06	Turn on & Off Buzzer depending on various applications .	05	02
14	06	Take the any sensor data , and Display it on	05	02

		LCD.		
15.	06	Prepare program to Rotate the Robot in different direction and Load it in controller of Fire bird Robot. 1.forword 2.Backword 3.Left 4.Right.	06	02
16.	06	Rotate the Motor in different Speed.	06	02
17	All	Complete a Micro- project based on guidelines provided in sr.no. 11.	All	04
Total Hrs				**32**

Note: Any 12 practicals from sr. no. 1 – 16 can be performed and 17 is compulsory.

S.No.	Performance Indicators	Weightage in %
a.	Arrangement of available equipment / test rig or model	20
b.	Setting and operation	20
c.	Safety measures	10
d.	Observations and Recording	10
e.	Interpretation of result and Conclusion	20
f.	Answer to sample questions	10
g.	Submission of report in time	10
Total		**100**

6. MAJOR EQUIPMENT/ INSTRUMENTSREQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practical, as well as aid to procure equipment by authorities concerned**.**

Sr. No.	Major Equipment/ Instruments Required	Experiment Sr. No.
1	Personal Computer with latest configuration and internet facility	ALL
2	Firebird Robot with peripherals	8-15
3	Visual AtmelStudio6 software	8-15

7. THEORY COMPONENTS

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
SECTION I	
Unit 1: Basic Concepts of Robotics(Weightage-14, Hrs-08)	
1a.Define robotics. 1b.Identify robot anatomy. 1c.Identify various types of Robot configuration. 1d.Define features of precision of movement . 1e.Enlist types of robotic drive system. 1f.State types of robotic controls. 1g.Categorize types of robotics sensors. 1h.State various types of robot programming.	1.1 Basic concepts and definition 1.2 Robot anatomy and terminology used in robotics 1.3 Robot configurations 1.4 Axes nomenclature & Basic robot Motions. 1.5 Work Volume 1.6 Robot drive system and its types 1.7 Control System and dynamic performance 1.8 Precision of movement 1.9 Sensors in Robotics 1.10 Overview of robot programming methods& Work cell control.
Unit 2:Robot End Effectors (Weightage-16, Hrs-10)	
2a.State the types of end effector. 2b.Describe the operation of mechanical grippers. 2c.Describe the operation of vacuum cups. 2d.Describe the operation of magnetic grippers. 2e.Describe the working principle of adhesive grippers . 2f.State the use of Hooks, Scoops and other miscellaneous devices. 2g.Describe tools as end effector. 2h.State the factors in the selectionand design of grippers.	2.1 Introduction to End effectors 2.2 Types of end effectors 2.3 Mechanical Grippers 2.4 Vacuum Cups 2.5 Magnetic Grippers 2.6 Adhesive Grippers 2.7 Hooks, Scoops and other miscellaneous devices 2.8 Tools as end effectors 2.9 The robot end effectors interface 2.10 Consideration in gripper selection and design
Unit3:Applications of robot (Weightage-10, Hrs-06)	
3a.Enlist the applications of robot. 3b.Describe the use of robot in various applications.	3.1 Material transfer applications 3.2 Machine loading and unloading 3.3 Robots in spot welding 3.4 Robots in spray coating

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
SECTION II	
Unit Outcomes (UOs) (in cognitive domain)	**Topics and Sub-topics**
Unit 4: Introduction to Firebird Robot At mega 2560 Platform (Weightage-10, Hrs-06)	
4a.Enlist different component of Firebird Robot. 4b.Define the function of given sensor. 4c.Explain the working principle and Application of Given sensor	Components of Firebird Robot : 4.1 Controller : At Mega 2560 Microcontroller 4.2 Sensors : Sharp IR Range Sensors , Proximity Sensor , White Line Sensor , Accelerometer , Ultra sonic Sensor ,Motion sensor, Position Encoder, Infrared TSOP Receiver . 4.2 Actuators. 4.3 Power. 4.4 Communication
Unit 5: Programming Interfaces I (Weightage-14, Hrs-08)	
5a.State the features of At Mega 2560 Microcontroller 5b.Draw and Explain the Block 5c.Diagram of At Mega 2560 Microcontroller 5d.State different type of Timer with its resisters 5e.Explain working of ADC with its Register. 5f.Simple programme based on TIMER, ADC	5.1 At Mega 2560 Microcontroller : Features , Pin diagram ,Block diagram 5.2 Basics of Embedded C 5.2. Timer 5.3. ADC (Block diagram ,working, Registers, and simple Embedded C Programme Based on above)
Unit 6: Programming Interfaces II (Weightage-16, Hrs-10)	
6a.Interface LCD with Robot and display given information on LCD. 6b.Write an C program to Turn on and off the Buzzer Depending on status of switch. 6c.Write an C program to rotate Robot with different velocity. 6d.Write an C program to rotate Robot with different direction : forward ,backward , left ,right.	Simple Embedded CProgramming on: 6.1 LED Interfacing. 6.2 LCD interfacing 6.3 Switch&I/O Buzzer Control 6.4 DC motor control and PWM generation for velocity control 6.5 Motion control using Pulse Width Modulation in Firebird

8. SUGGESTED SPECIFICATION TABLE FORQUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
SECTION I						
1	Basic Concepts of Robotics	08	04	08	02	14
2	Robot End Effectors	10	04	08	04	16
3	Applications of robot	06	02	04	04	10
	Total	24	10	20	10	40
SECTION II						
4	Introduction to Firebird Robot At mega 2560 Platform	06	04	04	02	10
5	Programming Interfaces I	08	02	04	08	14
6	Programming interfaces II	10	02	04	10	16
	Total	24	08	12	20	40
	Total	**48**	**18**	**32**	**30**	**80**

9. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a. Preparation of power point slides which includesvideos, animations, pictures .graphics for better understating of theory.
b. Prepare a model of robotics.
c. Give seminar on relevant topic

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
c. Guide student(s) in undertaking micro-projects.
d. Use proper equivalent analogy to explain different concepts.
e. Use Flash/Animations to explain various components, operation and application.

11. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs.(Affective Domain Outcomes) .Each student will have to maintain activity chart consisting of individual contribution in the project work and give a seminar presentation of it before submission.. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

a. Prepare power point presentation on robot motions
b. Prepare power point presentation on types of robot end effectors.
c. Prepare a report of applications of robot.
d. Prepare a report of firebird robot Atmega 2560 platform.
e. Interface LCD with Robot and display given information on LCD.

12. SUGGESTED LEARNING RESOURCES

S.N.	Title	Author	Publisher, Edition ,Year of publication and ISBN Number
1	Industrial Robotics-Technology, Programming and Applications	MikellGroover Mitchell Weiss Roger Nagel Nicholas Ordey	Tata Mcgraw Hill publication(1986) ISBN: 0-07-100442-4
2	Introduction to Robotics	McKerrowPhillip.	Addison Wesley, Australia, 1991ISBN 13: 9780201182408.
3	Introduction to Robotics	S.K. Saha	Tata McGraw-Hill Education, 2008ISBN 9781259083204

13. SOFTWARE/LEARNING WEBSITES

1. https://www.robots.com/faq/show/what-is-an-industrial-robot
2. http://www.allonrobots.com/types-of-robots.html
3. http://nptel.ac.in/courses/112103174/module7/lec5/1.html
4. http://www.roboticsbible.com/anatomy-of-industrial-robots.html
5. https://en.wikipedia.org/wiki/Material_handling
6. http://www.mhi.org/fundamentals/material-handling
7. http://nptel.ac.in/courses/Webcourse-contents/IIT-ROORKEE/INDUSTRIAL ENGINERRING/part2/material%20handling/lecture1.htm
8. https://www.youtube.com/watch?v=Pb706BLc7gk
9. https://www.youtube.com/watch?v=EjC-C715RNs
10. https://www.youtube.com/watch?v=7iuEdX8G4go
11. https://www.youtube.com/watch?v=EB-lxpHmyi0

14. PO - COMPETENCY- CO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2	2	3	2	-	1	1
CO2	2	2	2	2	-	2	2
CO3	2	3	2	3	2	3	3
CO4	2	2	3	2	-	2	2
CO5	2	3	3	3	-	3	3
CO6	1	3	3	3	2	3	3

CO	PSO1	PSO2	PSO3
CO1	3	1	-
CO2	3	1	-
CO3	3	2	-
CO4	3	2	1
CO5	3	3	2
CO6	3	3	-

Sign: Name: Smt.P.V.Lengare Smt.R.P.More (Course Experts)	Sign: Name: Shri.R.N.Shikari (Program Head) (Electronics &Telecommunication Dept.)
Sign: Name: Shri.R.N.Shikari (Program Head) (E & TC Department)	Sign: Name: ShriA.S.Zanpure (CDC)

Government Polytechnic, Pune

'180OB' – Scheme

Programme	Diploma in **Electronics &Telecommunication Engineering**
Programme code	01/02/**03**/04/05/06/07/08/15/16/**17**/18/19/21/22/**23**/24/26
Name of Course	**Fibre Optic Communication**
Course Code	**ET5103**
Prerequisite course code and name	**ET3105 (Principles of communication)**
Class Declaration	**YES**

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)		Examination Scheme				
					Theory		Practical		Total Marks
L	**T**	**P**	**C**		**ESE**	**PA**	**$ESE**	**PA**	
03	00	02	05	**Marks**	80	20	25	25	150
				Exam Duration	3Hrs	1 Hr	-	-	

($):OE (Oral Examination)

Legends: L-lecture, T-Tutorial/teacher guided theory practice, P-practical, ESE-End semester examination, PA- Progressive Assessment, # - Online theory exam

2. RATIONALE

The deployment of fibre optic technology is enhancing at very fast pace. Cost trends for fibre versus copper, better transmission quality, and a reduction in fibre maintenance expense are the major reasons for using fibre optic technology for the present wired communication network. The fact that the fibre optic facilities, which are the most economical and efficient means of providing existing telecommunication service, also possess the capability of transporting video signals is naturally an additional reason supporting their use. This course will facilitate students to use the principles of optical communication systems.

3. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences

- **Maintain optical communication networks**

4. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency**:**

1. Interpret the functions of the various blocks of optical fibre communication system.
2. Measure the optical fibre cable parameters.
3. Measure the losses in optical fibre cable.
4. Identify suitable splicing, connectors and coupler for the given application.
5. Identify suitable optical sources &detectors for the given application.
6. Select appropriate architecture of optical networks and principle of optical Communication for given application.

5. SUGGESTED PRACTICALS/ EXERCISES

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Relevant CO	Approximate Hours Required.
1	2	Calculate numerical aperture (NA) and acceptance angle for the given fibre optic cable.	2	02
2		To study different types of Fibres	2	02
3		Measure attenuation losses for the given length of fibre cable.	3	02
4		Measure bending losses in a fibre optic cable.	3	02
5		Measurement of optical power using optical power meter.	3	02
6	4	Select the Fibre connectors for the given application.	4	02
7		To study different type of connector.	4	02
8		To study different type of optical couplers. (Virtual Lab or videos can be used in case of unavailability of the optical coupler in the lab.)	4	02
9		Join given fibre optic cables using Splicing machines. (Virtual lab or videos can be used in case of unavailability of the splicing machine in the lab)	4	02
10.	5	Measure wavelength of light emitted by LED using lux meter for different input current. (Plot the graph of current V sensitivity). .	5	02
11		Test performance of given photo- diode (Detector) using LED as optical source.	5	02
		Test performance of given photo- diode (Detector)	5	02

12		using LASER as optical source.		
13		Test the performance of the given LED	5	02
14		Test the performance of the given LASER	5	02
15	6	Setting of fibre optic analog links	6	02
16		Setting of fibre optic digital links	6	02
17	All	Complete a Micro- project based on guidelines provided in sr. no. 11.	All	04
		Total Hrs		**32**

Note: Any 12 practicals from sr. no. 1 – 16 can be performed and 17 is compulsory.

Sr.No.	Performance Indicators	Weightage in %
a.	Arrangement of available equipment / test rig or model	20
b.	Setting and operation	20
c.	Safety measures	10
d.	Observations and Recording	10
e.	Interpretation of result and Conclusion	20
f.	Answer to sample questions	10
g.	Submission of report in time	10
Total		**100**

6. MAJOR EQUIPMENT/ INSTRUMENTSREQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practical, as well as aid to procure equipment by authorities concerned**.**

Sr. No.	Major Equipment/ Instruments Required	Experiment Sr. No.
1	Variable DC Power supply 0-30V with display for voltage and current	9,10,11,12,13
2	Digital Multimeter	10,11,12,13
3	CRO	14,15
4	Function Generator	8,9,10,12,13
5	Different types of cables and connectors	6,7,8
6	Lux Meter	5,9
7	Fibre optic transmitter and receiver kit	1,3,4,5,14,15
8	Power meter	5,11,12,14
9	Splicing machine	8,9
10	OTDR	3,4,8,9,15,16

7. THEORY COMPONENTS

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
SECTION I	
Units 1 : Overview of optical fibre communication systems (Weightage-10, Hrs-02)	
1a. Compare Fibre optic communication with other wired communication 1b. Select proper optical band for the given application. 1c. Describe the functions of the given blocks in the Optical Fibre communication system. 1d. Describe use of Fibre optics communication for given application with justification.	1.1 Various wired communication mediums – copper wire and optical Fibre cable. 1.2 Electromagnetic spectrum: optical band and its range. 1.3 Optical windows. 1.4 Block diagram of Optical Fibre communication system 1.5 Advantages, disadvantages and application of Optical Fibre
UNIT 2 Fibre Optic Cables & Ray Theory(Weightage-16, Hrs- 12)	
2a. Explain the given terms related to optics theory. 2b. Explain propagation of light through two medium having different refractive index. 2c. Calculate acceptance angle, critical angle and numerical aperture of a given optical fibre cable. 2d. Compare the working of the optical fibre for the given index profiles.	2.1 Basic Optical Laws & Definition: Reflection, Refraction, Diffraction, Refractive index, Total internal reflection (TIR) and scattering of light ray 2.2Snell"s law, Numerical aperture, acceptance angle, acceptance cone, critical angle(Numerical on above concepts) 2.3 Construction of Fibre Optic Cable. 2.4 Modes of light propagation in fibre 2.5 Optical fibre classification based on mode and index profile: Single mode, multimode, step index and graded index fibre. 2.6. Fibre material
UNIT 3 Losses in Optical Fibre (Weightage-14 , Hrs- 08)	
3a. Explain various losses in optical fibre communication. 3b. Explain various types of Dispersion in optical fibre Communication. 3c. Explain operation of OTDR 3d. Calculate losses in given Key optical link	3.1 Attenuation 3.2 Absorption loss, scattering loss- Rayleigh scattering, Mie scattering. 3.3 Bending loss- Micro bending and macro bending. 3.4 core and cladding losses. 3.5 Dispersion-Material, chromatic and waveguide dispersion, Intramodal and Intermodal dispersion. 3.6 OTDR block diagram, working principle. Functions and applications. 3.7 Optical power meter

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
SECTION II	
UNIT 4 Splices and connectors (Weightage-12, Hrs-08)	
4a. Explain fibre alignment and joint losses. 4b. Explain the step by step procedure of the given Splicing techniques. 4c. To identify the type of connector for given application. 4d. To identify the type of coupler for given application.	4.1Fibre alignment and joint losses 4.2Splicing techniques- Fusion splicing, Mechanical splicing-V-grooved splicing and elastic tube splicing 4.3Fibre Connectors- Fibre connectors – Butt joint connector, Expanded beam connector, cylindrical ferrule connector 4.4Fibre Couplers. Classification – core interaction type, Surface interaction type, Three and four port coupler, star coupler,
UNIT 5 Optical Sources & Optical Detector.(Weightage-14, Hrs-10)	
5a. Describe with sketch working principle of the given type of light source. 5b. Describe with sketch construction of the given light source. 5c. Describe with sketch the working principle of the given photo detector 5d. Interpret labelled characteristics of the given photo detector. 5e.Describe the construction with sketch for the given photo detector. 5f. Compare the given photo detector s on the basis of the given performance parameters.	5.1 Characteristics of optical sources 5.2 Optical sources: - Principle of working, Constructions, technical parameters types of LED: Edge emitting LED and Surface emitting LED 5.3 LASER:- Principle of working, Constructions, types of LASER, Fabry-Perot (FP) Laser construction, working principle 5.4 Characteristics of optical detectors 5.5 Optical Detectors:- Photo diode : PN, PIN, avalanche ,construction and working principle
Unit 6: Fibre Optics Communication and Network System . (Weightage-14, Hrs-08)	
6a. Describe the functions of the given blocks in the Optical analog communication system. 6b. Describe the functions of the given blocks in the Optical digital communication system. 6c.State the need of optical network. 6c. Justify use of Optical network for the given application . 6d. Describe the architecture of DWDM and OTN.	6.1 Optical analog communication system - basic block diagram. 6.2 Optical digital communication systems - basic block diagram. 6.3Need for Optical network and its advantages 6.4Basic concept and classification of optical amplifiers 6.5Basic concept of WDM and DWDM 6.6 Architecture of DWDM Link 6.7 Basic concept and architecture of OTN.

8. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
SECTION I						
I	**Overview of optical fibre communication systems**	2	4	4	2	10
II	**Fibre Optic Cables & Ray Theory**	12	4	6	6	16
III	**Losses in Optical Fibre**	8	2	4	8	14
SECTION II						
IV	**Splices and connectors**	8	4	4	4	12
V	**Optical Sources & Optical Detector**	10	2	4	8	14
VI	**Fibre Optics Communication and Network System**	8	2	4	8	14
	Total	48	18	26	36	80

9. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a. Visit any industry nearby to your house/college and observe the use of optical devices.

b. Write the specification of various optical devices used in the industries.

c. Do internet survey for various optical fibre cables available in market.

d. Observe various splicing techniques used in industries.

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b. 'L' in item No. 1does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes
c. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
d. With respect to item No.9, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
e. Guide student(s) in undertaking micro-projects.
f. Correlate subtopics with application of instrumentation
g. Use proper equivalent analogy to explain different concepts
h. Use Flash/Animations to explain fibre optic transmission.
i. Use open source models to explain fibre optic connectors.

11. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***
The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs.(Affective Domain Outcomes) .Each student will have to maintain activity chart consisting of individual contribution in the project work and give a seminar presentation of it before submission.. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.
A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

a. Prepare survey report to compare technical specification of different types of optical sources and detectors
b. Undertake a survey for different type of optical cable give it specification and application
c. Undertake a survey for different types of OTDRs available in the market along with their specifications
d. Prepare report on splicing technique used at RailTel , reliance, BSNL, and Airtel or any other such organisation
e. Monitor optical networking for cable service provider (TV Or internet) and prepare report
f. Prepare a chart to represent step by step procedure to connect optical fibre cable with given instrument.
g. Visit any nearby industry nearby to your house/collage and observe the use of optical devices

12. SUGGESTED LEARNING RESOURCES

S.N.	Title	Author, Publisher, Edition and Year of publication	ISBN Number
1	Advance Electronic communication Systems	Tomasi Wayne.	Pearson Education, New Delhi ISBN 81 -297-0107-3
2	Optical Fibre Communications Principles and practice	Senior John M.	Pearson Education Limited, New Delhi ISBN: 978-0-13-032681-2
3	Fibre Optic Communication	Kieser Gerd	McGraw Hill Higher Education, New Delhi ISBN 0-07-236076-3
4	Fibre Optic Communication	Kolimbiris Harold	Pearson Prentice Hall, New Delhi,2004; ISBN 978-81-317 -1588- 8
5	The ABCs of Fibre Optic Communication	Warier Sudhir	ARTECH HOUSE , New Delhi ISBN 13:978 -1-63081 -414-4
6	Data communication and networking.	Forouzan BehrouzA	McGraw Hill Higher Education , New Delhi ISBN -13:978 -0 - 07-063414-5

13. SOFTWARE/LEARNING WEBSITES

1.http://www.bbcmag.com/2008issues/june08/BBP_June08_OtoL.pdf

2. For virtual lab :- http://iitg.vlab.co.in/?sub=59&brch=269

3. For virtual lab :- http://vlab.co.in/

4. LED data sheet:-
http://www1.futureelectronics.com/doc/EVERLIGHT%C2%A0/334-15__T1C1-4WYA.pdf

5. For Practical - https://www.pantechsolutions.net/fibre -optics

6. BW of Analog optical fibre link - https://www.pantechsolutions.net/fibre -optics-tutorials/user-manual -fibre -optic- analog -transmitter -and -receiver-module

7. https://www.slideshare.net/fibrecasa99/the-basic-principle-of-optical-power-meter

14. PO - COMPETENCY- CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2	1	-	2	2	-	2
CO2	2	3	2	3	1	-	2
CO3	2	2	2	3	1	-	2
CO4	2	2	2	2	1	-	2
CO5	2	2	2	2	1	-	2
CO6	2	1	1	2	1	-	2

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	2	-
CO3	3	2	-
CO4	3	2	-
CO5	3	3	1
CO6	3	2	-

Sign: Name: Shri. A.D.Vikhankar Smt. .M.V.Saraf Smt. R.S.Deulkar (Course Experts)	Sign: Name: Shri.R.N.Shikari (Head of Department)
Sign: Name: Shri. R. N. Shikari (Program Head) (E & TC Department)	Sign: Name: Shri A. S. Zanpure (CDC)

Government Polytechnic, Pune

'180OB' – Scheme

Programme	Diploma in **Electronics&Telecommunication Engineering**
Programme code	01/02/**03**/04/05/06/07/08/15/16/**17**/18/19/21/22/**23**/24/26
Name of Course	**Computer Networking And Data Communication**
Course Code	**ET5104**
Prerequisite course code and name	**CM2102 Fundamentals of ICT & Level 1 completed**
Class Declaration	**YES**

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)		Examination Scheme				
					Theory		Practical		Total Marks
L	T	P	C		ESE	PA	$ESE	PA	
03	00	02	05	Marks	80	20	25	25	150
				Exam Duration	3Hrs	1 Hr	-	-	

($):OE (Oral Examination)

Legends: L-lecture, T-Tutorial/teacher guided theory practice, P-practical, ESE-End semester examination, PA- Progressive Assessment, # - Online theory exam

2. RATIONALE

Data communication deals with the transmission of digital data through a network. Many applications like Airline Reservation, Railway Reservations, e-banking, e-governance, online shopping, e-learning can be managed by a single click. Diploma Engineers should be able to select, classify, install, troubleshoot and maintain different industrial data communication networks. This course gives the important concepts and techniques related to data communication and enable students to maintain troubleshoot computer networks.

3. COMPETENCY

The aim of this course is to attend following industry identified competency through various teaching learning experiences:

- **Maintain computer network systems.**

4. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency**:**

1. Maintain wired .computer network topology.
2. Understand the .concept of data link layer design issues.
3. Understand different multiple access protocol
4. Configure network component and assign IP address.
5. Understand different transport layer protocols
6. Analyze network security and services

5. SUGGESTED PRACTICALS/ EXERCISES

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Relevant CO	Approximate Hours Required.
1	1	Installation of Windows 10 operating system	1	02
2		Analyze the type of network topology used in your lab and prepare technical specification for it.	1	02
3		Connect computers in bus topology and transfer the data.	1	02
4		Prepare patch .rd and cross connection cables, use to connect the devices on the LAN.	1	02
5		Run TCP/IP utilities and networking commands.	1	02
6	2	Installation of shared devices. (for e.g. printer)	2	02
7		Sharing the file and folder in network.	2	02
8		To create a network cable using RJ-45 connector.	2	02
9	3	Use route command to test the performance of the given network.	3	02
10.	4	Configure/Test Internet connectivity.	4	02
11		To configure static and dynamic IP address of the PC connected to the internet.	4	04
12	5	To locate MAC address of computer.	5	02
13		To implement socket programming date and time display from client to server using TCP / UDP	5	02

		Sockets		
14	6	Use FTP protocol to transfer file from one system to another system.	6	02
15		Install and configure a firewall for the network security.	6	02
16	All	Visit to any one Industries to observe computer networking	ALL	02
17	All	Complete a Micro- project based on guidelines provided in sr.no. 11.	All	04
		Total Hrs		**32**

Note: Any 12 practicals from sr. no. 1 – 16 can be performed and 17 is compulsory.

S.No.	Performance Indicators	Weightage in %
a.	Arrangement of available equipment / test rig or model	20
b.	Setting and operation	20
c.	Safety measures	10
d.	Observations and Recording	10
e.	Interpretation of result and Conclusion	20
f.	Answer to sample questions	10
g.	Submission of report in time	10
Total		**100**

6. MAJOR EQUIPMENT/ INSTRUMENTSREQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practical, as well as aid to procure equipment by authorities concerned**.**

Sr.No.	Major Equipment/ Instruments Required	Experiment Sr. No.
1	Client Machines with Printer	All
2	Network Tool kit clamping, crimping tool, network tester, line tester	All
3	NetworkAccessories: RJ 45,UTP cable, T connector, Optical fiber, Coaxial Cable, Modem, various connector, 1000 Mbps NIC	All
4	UPS system 6KVA online	All
5	Computer Hub 8/ 16 node with console port	All
6	Ethernet Switch 4/8/16/24/32	All
7	LAN Cable (CAT6,CAT5)	All

8	Coaxial Cable,, UTP Cable, STP Cable	All
9	Firewall with high security and high storage	14
10	MS office latest version	All
11	Antivirus Software (online protection with firewall securities)	All

7. THEORY COMPONENTS

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
SECTION-I	
Units 1 : Introduction to computer Networks (Weightage-16, Hrs-10)	
1a.State need of computer network. 1b. Design computer network considering particular network topology. 1c. Classify networks on the basis of the given parameter. 1d.Describe the different type of communication 1e.Differentiate between OSI and TCP/IP. 1f. Compare different types of transmission medium on the basis of given parameter. 1g. Classify type of modems.	1.1 Need of computer networks, Network criteria, advantages of networking. 1.2 Network Topology-Bus, Star, Mesh, Ring, Tree and Hybrid topologies- Schematic diagram, working, advantages, disadvantages and applications. 1.3 Network Classification:Based on Transmission Technologies: Point to point, Multipoint, Broadcast Based on physical size(scale): LAN,MAN,WAN Based on Architecture: Peer to Peer, Client Server, advantages of Client Server over Peer to Peer Model 1.4 Types of communication-simplex, half duplex,full duplex 1.5 Connection Oriented & Connectionless services 1.6 Reference Models - OSI & TCP/IP, their comparison. 1.7The Physical Layer :Transmission Media – Guided and Wireless transmission 1.8 Physical layer design issues 1.9 Modems: classifications: Broadband modem, DSL – ADSL,HDSL, VDSL
UNIT 2 The Data Link Layer (Weightage-12, Hrs-08)	
2a. Describe the services provided by Data Link Layer. 2b. Explain with sketches the given type of flow control used in the data link layer with justification. 2c. Explain the service provided by PPP.	2.1 Data Link Layer Design issues. 2.2 Automatic Repeat Request. - Stop and Wait ARQ. 2.3 Sliding Window Protocols. - 1 bit sliding window protocol. 2.4 Go Back N ARQ. 2.5 Selective Repeat ARQ. 2.6 Point -To-Point protocol- Services provided by PPP, Frame format PPP and Transition phases of PPP.

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
2d.Describe the transition phases of PPP.	
UNIT 3 Medium Access Sub layer (Weightage-12 , Hrs- 06)	
3a. Describe channel allocation problem. 3b. Compare characteristics of given type of multiple accesses protocol. 3c. Classify collision free protocol. 3d. Explain function of given type of network device.	3.1 Channel Allocation Problem - Static & Dynamic. 3.2 Multiple Accesses protocols – Pure ALOHA and slotted ALOHA, CSMA-CSMA/CA AND CSMA/CD. 3.3 Classification of Collision Free Protocols. 3.4 Network Devices**:**Repeater, Hub, Switch, Bridges, Router, Gateway
SECTION-II	
UNIT 4 The Network Layer (Weightage- 16, Hrs- 10)	
4a. Describe the services provided by network layer. 4b. Select appropriate class for given network size. 4c. Differentiate between class full and class less addressing. 4d. Explain the roll of NAT in address depletion. 4e.Explain the function of given resolution protocol.	4.1 Network layer Design issues. 4.2 Circuit Switching, Packet Switching. 4.3 Routing Algorithms-Dijkstra's algorithm,Distance vector routing algorithm. 4.4 The network layer in the internet - the IP protocol, 4.5 Network layer Logical Addressing: IPv4 Addresses: address space notations, classful and classless addressing, Network address translation(NAT), IPv6 Addresses, Need of IPv6, structure and address space 4.6 Address Resolution Protocol.

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	4.7 Reverse Address Resolution Protocol.
UNIT 5 The Transport Layer(Weightage- 12, Hrs- 08)	
5a. Describe the services provided by transport layer. 5b. Explain different transport protocol. 5c. Describe process of TCP connection. 5d. Sketch the TCP segment header.	5.1 The transport service 5.2 Elements of Transport Protocols 5.3 The internet transport protocol 5.4 TCP Service model. 5.5 TCP Segment Header. 5.6 TCPConnection-Connection Establishment, Termination & Release. 5.7 User Datagram Protocol (UDP), RTP and SCTP: ports, format, operation and uses.
Unit 6: The Application Layer (Weightage- 12 , Hrs- 06)	
6a. Describe the services provided by application layer. 6b. . Explain given type application layer protocol. 6c. Describe the given type of network security technique. 6d. Describe the given type of security services.	6.1 Client -Server model. 6.2 Socket Interface. 6.3 Domain name system(DNS) . 6.4 Electronic mail (SMPT) and File Transfer. (FTP) 6.5 HTTP and World Wide Web. 6.6 Network Security-Cryptography: it's components 6.7 Symmetric-Key Cryptography: block diagram 6.8 Public-key Cryptography: block diagram 6.9 Security Services: concepts of message and security services,Firewall.

8. SUGGESTED SPECIFICATION TABLE FORQUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
SECTION-I						
I	**Introduction to computer Networks**	10	4	8	4	16
II	**The Data Link Layer**	08	4	4	4	12
III	**Medium Access Sub layer**	06	4	4	4	12
	Total	24	12	16	12	40
SECTION-II						
IV	**The Network Layer**	10	4	8	4	16
V	**The Transport Layer**	08	4	4	4	12
VI	**The Application Layer**	06	4	4	4	12
	Total	24	12	16	12	40
	Total	**48**	**24**	**32**	**24**	**80**

9. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a. Prepare journals based on practical performed inlaboratory.
b. Prepare specification of a given communication medium.
c. Test the performance of HUB, Switches, router and Servers.
d. Internet server of computer network and data communication.
e. Prepare PPT or animation for understanding different switching networks.
f. Prepare a presentation on TCP/IP reference model and the OSI reference network model.
g. Visit to any industry to observe the different networks.

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
c. With respect to item No.9, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
d. Guide student(s) in undertaking micro-projects.
e. Correlate subtopics with power plant system and equipment.
f. Use proper equivalent analogy to explain different concepts.
g. Use Flash/Animations to explain various components, operation and
h. Teacher should ask the students to go through instruction and Technical manuals

11. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***
The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs.(Affective Domain Outcomes) .Each student will have to maintain activity chart consisting of individual contribution in the project work and give a seminar presentation of it before submission.. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.
A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

a. Prepare a proposal to develop a network system that link two branch offices of an organization. The two branches are separated by a distance of 10 km.
b. Interconnect two PCs using RS232 cable. Write a step by step procedure to transfer a file from one computer to other computer through RS 232 link.
c. a hardware specification required to develop a wireless LAN for 20 users.
d. Develop a Bluetooth network of 5 devices namely mobile phone, speaker, laptop, keyboard and printer and transfer file from one device to other.
e. Prepare a detailed report for on application of computer network in railway reservation system.

12. SUGGESTED LEARNING RESOURCES

S.N.	Title	Author	Publisher, Edition ,Year of publication and ISBN Number
1	Computer Networks.	Tanenbaum, A.S ,	Pearson Education, New Delhi, India, Fourth Edition, 2011 ISBN : 9788131787571
2	Data Communication and Networking	Forouzan, Behrouz A,	McGraw Hill Education New Delhi, India, 2015 ISBN : 99780072967753
3	Introduction to Data Communication and Networking	Tomasi, W.	Pearson Education, New Delhi, India,2007 ISBN:9788131709306
4	Data and Computer Communications	Stallings, W. Prentice	Hall India 10th Edition,2013 ISBN : 9780133506488
5	Data Communication and Networks	Godbole, A.S; Kahate. A.	Tata McGraw Hill Education New Delhi, Second Edition , 2011 ISBN(13) : 9780071077705
6	Computer Networks	Kurose, James F : Ross Keith W.	Pearson Education, New Delhi,India Third Edition 2011ISBN : 9788177588781
7	Data Communication and Computer Networks	ISRD Group	Tata McGraw Hill Education New Delhi, First Edition 2006ISBN(13) : 9780070616820

13. SOFTWARE/LEARNING WEBSITES

a. *http://www.youtube.com/watch?v=hAopORgAcbQ*
b. *Nptel.ac.in/courses/106105081/2*
c. *http://www.ics.uci.edu/~magda/courses/netsys270/ch1_v1.pp*
d. *http://www.ics.uci.edu/~magda/courses/netsys270/ch2_v1.ppt*
e. *http://www.youtub.com/watch?v=gj5h4_0m11I*
f. *http://www.tutorialspoint.com/Principles_of_communications/principles_of_communications_multiplexing.html*
g. *http://www2.river.edu/faculti/vriabov/CS553_ST7_Ch08-multiplexing.pp*
h. *http://ics.uci.edu/~magda/Courses/netsys270/cj6_1_v1.ppt*
i. *http://ics.uci.edu/~magda/Courses/netsys270/cj7_1_v1.ppt*
j. *Nptel.ac.in/courses/106105082/19*
k. *Nptel.ac.in/courses/106105082/17*
l. *http://www.naptel.iitm.ac.in/courses*
m. *Nptel.ac.in/courses/106106157/52*

14. PO - COMPETENCY- CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	3	2	1	2	2
CO2	2	2	3	2	-	2	2
CO3	1	2	2	2	-	2	2
CO4	2	1	1	1	-	2	2
CO5	2	2	2	2	1	2	2
CO6	2	2	2	2	1	2	2

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-
CO6	3	-	-

Sign: Name: Smt. S.S.Chhatwani Smt. M.V.Saraf (Course Experts)	Sign: Name: Shri.R.N.Shikari (Head of Department)
Sign: Name: Shri.R.N.Shikari (Program Head) (E & TC Department)	Sign: Name: ShriA.S.Zanpure (CDC)

GOVERNMENT POLYTECHNIC, PUNE

'180OB' – Scheme

Programme	Diploma in **Electronics&Telecommunication Engineering**
Programme code	01/02/**03**/04/05/06/07/08/15/16/**17**/18/19/21/22/**23**/24/26
Name of Course	**Industrial Automation**
Course Code	**ET5105**
Prerequisite course code and name	Instrumentation & Control (ET4109) and Level 1 completed
Class Declaration	**YES**

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)		Examination Scheme				
					Theory		Practical		Total Marks
L	T	P	C		ESE	PA	*ESE	PA	
03	00	02	05	Marks	80	20	25	25	150
				Exam Duration	3 Hrs	1 Hr	--	--	

(*):OE (Oral Examination)

Legends: L-lecture, T-Tutorial/teacher guided theory practice, P-practical, ESE-End semester examination, PA- Progressive Assessment, # - Online theory exam

2. RATIONALE

In the present global scenario of manufacturing, industries are moving towards complete automation .small and medium scale industries are in the phase of switching to PLC and SCADA technology for the data acquisition and control. Therefore it is necessary for electronics/instrumentation engineers to have knowledge of these technologies to develop operational competency. Hence this course is foundation for the engineers who want to further specialize in the industrial automation field.

3. COMPETENCY

The aim of this course is to attend following industry identified competency through various teaching learning experiences:

- **Maintain Industrial Automation systems.**

4. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency**:**

1.Illustrate advance control strategies.

2. Identify different components of an automation system.

3. Interface the given I/O device with appropriate PLC module.

4. Interpret PLC programming instructions and languages.

5. Prepare a PLC ladder program for the given application.

6. Prepare a simple SCADA application.

5. SUGGESTED PRACTICALS/ EXERCISES

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Relevant CO	Approximate Hours Required.
1.	1	Experiment based on Concept of PID Tuning	1	02
2.	2	Identify various automation systems available in different appliances /devices/machines in day to day use.	2	02
3.	3	Identify various parts and front panel status indicators of the given PLC.	3	02
4.	3	Use PLC to test the START STOP logic for two input and one output system.	3	02
5.	4,5	Develop/Execute a ladder program for the given application using following: timer ,counter, logical, arithmetic instructions	3,4	04
6.	4,5	Use PLC to control lamp, push button switches ,motor	3,4	02
7.	4,5	Develop/test the ladder program to blink LED/lamp	4,5	02
8.	4,5	Develop and test ladder program for sequential control application of lamp/DC motors.	4,5	02
9.	4,5	Develop and test ladder program for traffic light control system	4,5	02
10.	4,5	Develop a ladder diagram for two lamps red and yellow for following conditions: 1. When start button is pressed then both lamps will be ON 2. When stop button is pressed then RED lamp will be OFF immediately but yellow lamp will be OFF after 15 sec.	4,5	02
11.	4,5	Develop a ladder program to count 50 items on a conveyor belt. The process must be started by normally open START push button and stopped any time by normally closed STOP push button.	4,5	02

12.	6	Use various functions of SCADA simulation editors to develop simple project	6	02
13.	6	Develop a SCADA mimic diagram for Flow control of the given system.	6	02
14.	6	Develop a SCADA mimic diagram tank level control.	6	02
15.	6	Simulate tank level control using available SCADA system.	6	02
16	All	Complete a Micro- project based on guidelines provided in sr.no. 11.	All	04
		Total Hrs		**32**

Note: Any 12 practicals from sr. no. 1 – 15 can be performed and 16 is compulsory.

S.No.	Performance Indicators	Weightage in %
a.	Arrangement of available equipment / test rig or model	20
b.	Setting and operation	20
c.	Safety measures	10
d.	Observations and Recording	10
e.	Interpretation of result and Conclusion	20
f.	Answer to sample questions	10
g.	Submission of report in time	10
Total		**100**

6. MAJOR EQUIPMENT/ INSTRUMENTSREQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practical, as well as aid to procure equipment by authorities concerned**.**

Sr.No.	Major Equipment/ Instruments Required	Experiment Sr. No.
1	PLC with programming software and interfacing hardware	1
2	Input output devices for PLC:lamp,leds,motors,switches	2-7
3	Ladder logic simulator, simple EDA tools	1-11
4	SCADA software: Ellipse/FTVSE/wonder ware	12-14
5	DMM	ALL

7. THEORY COMPONENTS

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
SECTION I	
Unit 1:Advanced Controllers (Weightage-12, Hrs-08)	
1a.Explain Lead-Lag control& Cascade control 1b.List Control strategies in Advanced Controllers. 1c.Describe Self tuning controllers 1d. Explain Digital controllers with merits & demerits. 1e.Explain Concept of Fuzzy Logic controller OR 1e. Explain the concept Artificial Intelligence in machine. 1f.Concept of Fuzzification and Defuzzification	1.1 Control strategies: Ratio Control, Lead-Lag control, Cascade Control,Feed-Forward Control. 1.2Self tuning controllers, Digital controllers 1.3Concept of Fuzzy Logic controller.
Unit 2: Introduction to Industrial Automation(Weightage- 08 , Hrs-04)	
2a.Descirbe the benefits of the given Industrial automation system. 2b.Describe functions of the given components of automation system. 2c.Compare the characteristic of the given type of automation system. 2d.Describe applications of the given automation system.	2.1Need and benefits of Industrial automation 2.2 Automation hierarchy, basic components of automation system, description of each components 2.3 Types of automation system : fixed,programmable,flexible 2.4 Different system for industrial automation : PLC,HMI,SCADA,DCS,Drivers
Unit 3: PLC Fundamentals(Weightage- 20, Hrs-12)	
3a.Explain with sketches the redundancy concept for the given PLC. 3b.Identify the specified parts of the given PLC along with its function. 3c.Describe with sketches the steps to interface appropriate input module of the given PLC with the given input device. 3d.Expalin the criteria to select appropriate module for the given I/O devices. 3e.Desribe with sketches the steps to interface appropriate output devices with the given output module of the given PLC. 3f. Difference between relay logic &PLC 3g. List manufacturers , advantages & limitations of PLC 3h. Explain PLC selection criteria.	3.1 Comparison between relay logic & PLC 3.2 Building blocks of PLC,CPU,Memory organization, Input-output modules(discrete and analog),Special I/O module, power supply 3.3 Concept of current sinking and sourcing in DC input module 3.4 Fixed and modular PLC and their types, Redundancy in PLC module 3.5 I/O devices (Analog & Digital):symbol, working Principle of - 1. Input Devices- Proximity switches, Flow switches ,Limit switches, Optical encoder, 2. Output Devices: Relay, Lamp, Contactor, Solenoid valve, control valve positioner 3.6 I/O module selection criteria Interfacing different I/O devices with appropriate I/O modules 3.7 Various Manufacturers, advantages & limitations of PLC. 3.8 PLC selection criteria

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
SECTION II	
Unit 4:PLC Programming Instructions(Weightage- 12 , Hrs-08)	
4a.Specify the proper I/O addressing format of the given PLC 4b.Explain the use of different relay type instruction for the given operation 4c.Explain various PLC programming languages. 4d. Explain ladder programming with suitable example.	4.1 PLC I/O addressing : Addressing data files, format of logical address, different addressing types 4.2 PLC programming Instructions: Relay type instructions, timer instructions: ON delay, off delay, retentive, counter instructions, UP, Down, High speed, Logical instructions, comparison instructions, Data handling instructions, Arithmetic instructions 4.3 PLC programming language –FBD(Functional Block diagram),Instruction List, Structural text, sequential Function chart(SFC), Ladder programming
Unit 5:PLC Programming and Applications(Weightage- 14 , Hrs-08)	
5a.Use timer and counter instructions to write a program to perform the given operation 5b.Use Logical and Comparison instruction to write a program to perform the given operation 5c.Describe with example the given type of data handling instructions. 5d.Describe the given elements of different programming languages used to program PLC. 5e.Develop PLC ladder program for the given simple application.	5.1Simple programming examples using ladder logic language based on relay, timer counter,logical,comparison,arithmetic and data handling instructions 5.2PLC based application: Motor sequence control, Traffic light control, Tank level control, conveyor system
Unit 6: Supervisory Control and Data Acquisition System(Weightage- 14 , Hrs- 08)	
6a. Describe the function of the given elements of SCADA 6b.Describe the steps to develop a simple SCADA screen for the given application. 6c.Interface the given PLC with the SCADA system using OPC. 6d.Describe the steps to develop SCADA system for the given industrial application.	6.1Introduction to SCADA,typical SCADA architecture/block diagram, benefits of SCADA 6.2Various editors of SCADA 6.3Interfacing SCADA system with PLC:Typical connection diagram, object linking and embedding for process control (OPC)architecture, steps in creating SCADA screen for simple object, Steps for Linking SCADA object with PLC ladder program using OPC 6.4 Applications of SCADA:Traffic light control, water distribution, pipeline control

8. SUGGESTED SPECIFICATION TABLE FORQUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
SECTION I						
I	Advanced Controllers	08	04	04	04	12
II	Introduction to Industrial Automation	04	02	02	04	08
III	PLC Fundamentals	12	04	08	08	20
	Total	24	10	14	16	40
SECTION II						
IV	PLC Programming Instructions	08	04	04	04	12
V	PLC Programming and Applications	08	02	04	08	14
VI	Supervisory control and Data Acquisition System	08	04	06	04	14
	Total	24	10	14	16	40
	Total	**48**	**20**	**28**	**32**	**80**

9. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a. Do the internet survey and make a list of leading manufactures of the PLC, SCADA, DCS,HMI and other industrial automation tools with their brand names.

b. Refer operating manual of the PLC of reputed manufactures and prepare a step by step procedure to use PLC for specified application.

c. Prepare a PPT on the troubleshooting technique of PLC.

d. Prepare a list of available analog input/output devices available in the market.

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.

b. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).

c. With respect to item No.9, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.

d. Guide student(s) in undertaking micro-projects.

e. Students can participate in the online industrial automation forums.

11. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs.(Affective Domain Outcomes) .Each student will have to maintain activity chart consisting of individual contribution in the project work and give a seminar presentation of it before submission.. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

a. Automatic Street light Controller: Prepare a PLC based system to control the street light as per the intensity of natural light.
b. Automatic agriculture irrigation system: Prepare a PLC based system to control drip irrigation.
c. Railway gate automation: Prepare a PLC and SCADA based system to open or close the prototype railway gate automatically.
d. Home Automation: Implement the versatile automation system for home that can automate any three home appliances.
e. Bottle filling station: Prepare a PLC and SCADA based system for proto type bottle filling station.
f. Troubleshoot the faulty equipment available in Automation Laboratory.

12. SUGGESTED LEARNING RESOURCES

S.N.	Title	Author	Publisher, Edition ,Year of publication and ISBN Number
1	Programmable logic controller	Jadhav V. R.	Khanna Publishers, New Delhi 2017 ISBN :9788174092281
2	Programmable logic controller	Petruzella F. D.	Tata –McGraw Hill India,New Delhi, Fourth edition 2010ISBN:9780071067386
3	SCADA	Boyar S.A.	SIA Publication, New Delhi, Fourth editionISBN:978-1936007097
4	Industrial automation and process control	Jon Stenerson	PHI Learning,New DelhiISBN:9780130618900
5	Practical SCADA for Industry	David Bailey, Edwin Wright,	Newnes International Edition,2003 ISBN:0750658053

13. SOFTWARE/LEARNING WEBSITES

1. http://www.youtube.com/watch?v=pPiXEfBO2qo
2. Software:www.fossee.com
3. Software:www.ellipse.com
4. Software:www.pletutor.com
5. PLC tutorial:http://users.ist.ist.utl.pt/-jag/aulas/api13/API_I_C3_3_ST.pdf
6. https://instrumentationtools.com/control-valve-positioner-working-principle

14. PO - COMPETENCY- CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	1	-	-	-	-	-	2
CO2	1	3	-	2	-	1	-
CO3	2	2	2	-	-	2	-
CO4	3	2	2	-	-	2	2
CO5	-	2	3	3	2	2	2
CO6	-	2	3	3	2	2	2

	PSO1	**PSO2**	**PSO3**
CO1	2	-	-
CO2	2	-	-
CO3	1	3	-
CO4	2	2	-
CO5	1	3	2
CO6	1	3	2

Sign: Name: Shri.N.D.Toradmal Smt.A.M.Kulkarni Smt.V.S.Sabnis (Course Experts)	Sign: Name: Shri.R.N.Shikari (Head of Department)
Sign: Name: Shri.R.N.Shikari (Program Head) (E & TC Department)	Sign: Name: Shri A.S.Zanpure (CDC)

Government Polytechnic, Pune

'180OB' – Scheme

Programme	**Diploma in Electronics and Telecommunication**
Programme code	01/02/**03**/04/05/06/07/08/15/16/**17**/18/19/21/22/**23**/24/26
Name of Course	**Python Programming**
Course Code	**ET 5106**
Prerequisite course code and name	**NA**
Class Declaration	**YES**

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)		Examination Scheme				
					Theory		Practical		Total Marks
L	T	P	C		ESE	PA	*ESE	PA	
03	00	02	05	Marks	80	20	25	25	150
				Exam Duration	3 Hrs	1 Hr	2 Hr		

(*):POE (Practical Examination)

Legends: L-lecture, T-Tutorial/teacher guided theory practice, P-practical, ESE-End semester examination, PA- Progressive Assessment, # - Online theory exam

2. RATIONALE

The Python programming language which is one of the most popular programming languages worldwide, these skills are increasingly of vital importance for future job and career prospects. Python is next generation multi-purpose programming language, that allows different users to create applications of various domains. The course shows you how to use the free open-source Python. This course covers the basics and advanced Python programming to harness its potential for modern computing requirements i.e. to write basic programs and high level applications using concepts such as class, functions, variables, If Else statements, For loops, While loops, iterative etc. Students will be able to learn primary fundamentals of python programming and potential of python is to achieve modern computing requirements.

3. COMPETENCY

The aim of this course is to attend following industry identified competency through various teaching learning experiences:

- Python programing for development.

4. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency.

1. Acquire Python programming basics and paradigm
2. Acquire programming skills of python using looping, control statements and string manipulations.
3. Determine the methods to create and manipulate Python programs by utilizing the data structures like lists, dictionaries, tuples and sets.
4. Apply core programming concepts of file handling, exception handling.
5. Apply programming concepts for database connectivity.
6. Acquire concepts of GUI controls and design GUI applications.

5. SUGGESTED PRACTICALS/ EXERCISES

Sr.No.	NameofExperiment/Assignment	COs	Hrs
1	Installation of Python and configuration of Python IDE	1	02
2	a. Write python program to print Hello World b. Write python program to print Hello World using string variable	1	
3	Create a program that asks the user to enter their name and their age. Print out a message addressed to them that tells them the year that they will turn 100 years old.	1	02
4	a. Write a function that takes a character (i.e. a string of length 1) and returns True if it is a vowel, False otherwise. b. Define a function that computes the length of a given list or string.	2	02
5	a. Write simple Python program to implement arithmetic and logical operators (any two programs) b. Write a program to display all prime numbers within a range	2	02
6	Write a Python program to count the number of even and odd numbers from a series of numbers.	2	
7	Write Python program to demonstrate use of conditional statements a. if…..else statement b. if…elseif….else statement c. Nested if statement (any two programs for all conditions)	2	02
8	Write Python program to demonstrate use of looping statements a. while loop b. while …. Break c. while….continue d. Nested loops (any two programs for all conditions)	2	02
9	Write Python program to demonstrate use of for loop and nested loops	2	02
10	Write Python program which takes two digits m (row) and n (column) as input and generates a two-dimensional array. The element value in the i-th row and j-th column of the array should be i*j.	3	02

11	Write Python program to perform operations on list such as create, access, delete, update etc.	3	02
12	Write Python program to perform operations on Tuples such as create, access, delete, update etc.	3	02
13	Write Python program to perform operations on Dictionaries such as create, access, delete, update etc.	3	02
14	Write a Python script to concatenate following dictionaries to create a new one. Sample Dictionary: dic1={1:10, 2:20} dic2={3:30, 4:40} dic3={5:50,6:60} Expected Result: {1: 10, 2: 20, 3: 30, 4: 40, 5: 50, 6: 60}	3	02
15	a) Write Python program to demonstrate math built- in functions (Any 2 programs) b) Write Python program to demonstrate string built – in functions (Any 2 programs)	3	02
16	Develop user defined Python function for given problem: a) Function with minimum 2 arguments b) Function returning values	3	02
17	Write Python program to demonstrate use of: a) Built in module (e.g. keyword, math, number, operator) b) user defined module	4	02
18	Write Python program to demonstrate use of: a) built-in packages (e.g. NumPy, Pandas) b) user defined packages	6	02
19	Write a test code for testing of a project developed in Exp. 18	All	02
20	Complete a Micro- project based on guidelines provided in sr.no. 11.	All	04
			32

Note: Any 12 practicals from sr. no. 1 – 19 can be performed and 20 is compulsory.

S.No.	Performance Indicators	Weightage in %
a.	Installation of Python IDE	20
b.	Setting and operation	20
c.	Safety measures	10
d.	Observations and Recording	10
e.	Interpretation of result and Conclusion	20
f.	Answer to sample questions	10
g.	Submission of report in time	10
Total		**100**

6. MAJOR EQUIPMENT/ INSTRUMENTSREQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practical, as well as aid to procure equipment by authorities concerned**.**

Sr.No.	Major Equipment/ Instruments Required	Experiment Sr. No.
1	Python IDE software	1 to 20

7. THEORY COMPONENTS

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
SECTION-I	
UNIT 1. Basics of Python: (Weightage-08 , Hrs-06)	
1a. Install the given Python IDE and editor 1b. Identify the given variables, Keywords and constants in Python 1c. Use indentation, comments in the given program. 1d. Develop the Python program to display the given text.	1.1 Features of Python – Interactive, object oriented, interpreter, platform independent 1.2 Get familiar and introduction of python 1.3 Python Installation and Working of it 1.4 Python building blocks- variables, basic Operators, understanding python blocks 1.5 Python Data Types, Declaring and using Numeric data types: int, float etc.
UNIT 2. Flow Statements (Weightage-16 , Hrs-08)	
2a. Write simple Python program to evaluate the given arithmetic expression 2b. Use different types of operators for writing arithmetic expressions. 2c. Write a Python program using conditional statements for two way branching to solve given problem. 2d. Write a Python program using while loop for multiway branching to solve the given problem.	2.1 Basic operators : Arithmetic, comparison, relational, assignment, logical, bitwise, etc… 2.2 Python Program Flow Control Conditional blocks 2.3 Conditional Statements(if, if else,…. nested if). 2.4 Simple for loops in python, For loop using ranges, string, list and dictionaries. 2.5 Use of while loops in python, Loop manipulation using pass, continue, break and else. Programming using Python conditional and loop blocks.
UNIT 3. Dictionaries: (Weightage- 16 , Hrs- 10)	
3a. Write python program to use and manipulate string for the given problem. 3b. Write python program to use and manipulate lists for the given problem. 3c. Write python program to use and manipulate tuples for the given problem. 3d. Write python program to use and Dictionaries lists for the given problem.	3.1 Python Complex data types: Using string data type and string operations. 3.2 Lists : Defining list and list slicing, accessing values in list, deleting values in lists, updating lists. Basic list operations. Built in list functions. 3.3Tuples : Defining Tuples and Tuple slicing, accessing values in Tuples,deleting values in Tuples, updating Tuples. Basic Tuplesoperations. Built in Tuplesfunctions. 3.4 Dictionaries:Defining Dictionary, accessing values in Dictionary, deleting values in Dictionary, updating Dictionary. Basic Dictionary operations. Built in Dictionary functions. 3.5 Python Functions, Organizing python codes using functions.
SECTION-II	

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
UNIT 4. Files: (Weightage- 16 , Hrs-08)	
4a. Write Python program to read the values from given data file. 4b. Write Python program to write the values on a given data file. 4c. Write Python program to read the values from given word file. 4d. Write Python program to write the values on a given word file.	4.1 Python File Operations: Types of files. 4.2 Creating and Reading text from data files. 4.3 Writing files in python. 4.4 Understanding read functions, read(), readline(), readlines(). 4.5 Understanding write functions, write() and writelines() Manipulating file pointer using seek Programming, using file operations.
UNIT 5 Database Handling (Weightage- 12 , Hrs-08)	
5a. Write a python program to create database. 5b. Write a python program to Import the SQL interface 5c. Write a python program to Establish a connection with the SQL database 5d. Write a program to get list of doctors from the given database/ xls file.	5.1 Database Programming: Connecting to a database. 5.2 Creating Tables,INSERT, UPDATE, DELETE and READ operations. 5.3 Transaction Control,Disconnecting from a database. 5.4 Exception Handling in Databases.
UNIT 6 : Python Packages(Weightage- 12 , Hrs-8)	
6a. Write a Python program to import the package and use it in the example. 6b. Write a python code to import matplotlib package and use it in the given example. 6c. Write a python code to import numpy package and use it in the given example. 6d. Write a python code to import pandas package and use it in the given example.	6.1 Python packages 6.2 Simple programs using the built-in functions of packages matplotlib, 6.3 Simple programs using the built-in functions of packagesnumpy. 6.4 Simple programs using the built-in functions of packages pandas etc. 6.5 GUI Programming. Python programming with IDE.

8. SUGGESTED SPECIFICATION TABLE FORQUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
SECTION-I						
I	Basics of Python	06	04	02	02	08
II	Flow Statements	08	06	04	06	16
III	Dictionaries	10	06	04	06	16
	Total	24	16	10	14	40
SECTION-II						
IV	Files	08	04	06	06	16
V	Database Handling	08	04	04	04	12
VI	Python Packages	08	04	04	04	12
	Total	24	12	14	14	40
	Total	**48**	**28**	**24**	**28**	**80**

9. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a. Prepare journal of practicals.
b. Study of python project.
c. Develop a microproject.
d. Prepare power point presentation on application developed using python.

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations.
c. With respect to item No.9, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
d. Guide student(s) in undertaking micro-projects.
e. Correlate subtopics with power plant system and equipments.
f. Use proper equivalent analogy to explain different concepts.
g. Use Flash/Animations to explain various components, operation and
h. Teacher should ask the students to go through instruction and Technical manuals

11. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs.(Affective Domain Outcomes).Each student will have to maintain activity chart consisting of individual contribution in the project work and give a seminar presentation of it before submission.. The student sought to submit micro-project by the end of the semester to develop the industry oriented COs.

12. SUGGESTED LEARNING RESOURCES

S.N.	Title	Author	Publisher, Edition ,Year of publication and ISBN Number
1	Fundamentals of Python – First Programs	Kenneth A. Lambert	CENGAGE Publication, 2015 ASIN : 133756009X
2	Core Python Programming	R. Nageswara Rao	Dreamtech ISBN : 938605230X
3	Introduction to Computation and Programming Using Python	John V Guttag	Prentice Hall of India ASIN :8120352920

4	Introduction to Computing and Problem Solving with PYTHON	Jeeva Jose & P.SojanLal	Khanna Publishers, New Delhi, 2016 ASIN :B01NBADZVS
5	Python Programming	R. Nageswara Rao	Scitech Publications (India0 Pvt. Ltd. 9789385983450

13. SOFTWARE/LEARNING WEBSITES

1. https://www.learnpython.org/
2. https://www.programiz.com/python-programming
3. https://www.codecademy.com/learn/learn-python
4. Turtle - https://docs.python.org/2/library/turtle.html
5. PyLab - https://scipy.github.io/old-wiki/pages/PyLab
6. Dictionaries : https://www.youtube.com/watch?v=daefaLgNkw0
7. Tuples and Sets : https://www.youtube.com/watch?v=W8KRzm-HUcc

14. PO - COMPETENCY- CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2	3	3	3	-	3	3
CO2	2	3	3	3	-	3	3
CO3	2	3	3	3	-	3	3
CO4	2	3	3	3	-	3	3
CO5	1	3	3	3	-	3	3
CO6	1	3	3	3	-	3	3

	PSO1	PSO2	PSO3
CO1	3	3	-
CO2	3	3	-
CO3	3	3	-
CO4	3	3	-
CO5	3	3	-
CO6	3	3	-

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Course Expert & H.O.D.(E&TC)	Program Head & H.O.D.(E&TC)	C. D. C

Government Polytechnic, Pune

'180OB' – Scheme

Programme	Diploma in **Electronics&Telecommunication Engineering**
Programme code	01/02/**03**/04/05/06/07/08/15/16/**17**/18/19/21/22/**23**/24/26
Name of Course	**Microwave and Radar Communication**
Course Code	**ET5107**
Prerequisite	ET3105 (Principle of Communication)
Class Declaration	**NO**

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)		Examination Scheme				
					Theory		Oral		Total Marks
L	T	P	C		ESE	PA	$ESE	PA	
03	00	02	05	Marks	80	20	25	25	150
				Exam Duration	3 Hrs	1 Hr	-	-	

($):OE (Oral Examination)

Legends: L-lecture, T-Tutorial/teacher guided theory practice, P-practical, ESE-End semester examination, PA- Progressive Assessment, # - Online theory exam

2. RATIONALE

Microwave communication is back bone of terrestrial communication and also the sole of mobile communication. To provide communication at difficult geographical locations and for specific task microwave links and RADAR are established telecommunication solution. This course has been designed to develop skills in diploma engineers to maintain microwave and RADAR based telecommunication systems.

3. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Maintain microwave and RADAR based communication systems.

4. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented Cos associated with above mentioned competency:

1. Use specified waveguides in microwave communication systems.
2. Maintain passive microwave components and devices.
3. Maintain active microwave components and devices.
4. Interpret RADAR based systems for range detection.
5. Maintain various types of RADAR systems for specified application.

5. SUGGESTED PRACTICALS/ EXERCISES

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Relevant CO	Approximate Hours Required
1.	1	Use the frequency meter with the microwave test bench setup determine the frequency and wavelength of waveguide to TE10 mode.	1	02
2.		Use freeware /open source simulation tools to perform practicals related to microwave waveguide.	1	02
3	2	Measure attenuation of the given attenuator.	2	02
4.		Use microwave test bench setup to ensure power division in microwave tees E-plane , H-plane, and E-H plane.	2	02
5		Determine coupling factor and insertion loss for the given circulator.	2	02
6		Measure VSWR for the given Microwave load.	2	02
7		Determine the directivity, insertion lows and coupling factor for the given multi- hole directional coupler.	2	02
8		Use given microwave test bench setup to measure the gain of the horn antenna.	2	02
9				
10	3	Use given microwave test bench setup to test the performance of the given Reflex Klystron tube.	3	02
11		Test the performance of Gunn Diode for the following aspects i. V-I characteristics ii. Output power and frequency as a function of voltage	3	02
12		Test the performance parameter of given type of microwave active components on freeware/open source simulation tools.	3	02
13	4	Use Doppler RADAR to detect the maximum range.		02

14		Determine the velocity of the moving object with the help of RADAR range.	4	02
15		Use RADAR system to measure the distance traveled by any object.		02
16	5	Use freeware/open source simulation tools to performance Practical related to RADAR communication.	5	02
17	All	Complete a Micro- project based on guidelines provided in sr.no. 11.	All	04
		Total Hrs		**32**

Note: Any 12 practicals from sr. no. 1 – 16 can be performed and 17 is compulsory.

S.No.	Performance Indicators	Weightage in %
a.	Preparation of experimental set up	20
b.	Setting and operation	20
c.	Safety measures	10
d.	Observations and Recording	10
e.	Interpretation of result and Conclusion	20
f.	Answer to sample questions	10
g.	Submission of report in time	10
Total		**100**

6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practical, as well as aid to procure equipment by authorities concerned**.**

Sr.No.	Major Equipment/ Instruments Required	Experiment Sr. No.
1	Microwave test bench-X Band (klystron based)	1 to 10
2	Microwave test bench-X Band(GUNN Diode)	11
3	RADAR trainer	12,13,14
4	List of Software/learning Websites List of software RF Tool box: MATLAB and SIMULINK or any other open source software, EZNEC,HFSS-CST, V sim, Microwave office	15,16

7. THEORY COMPONENTS

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
UNIT 1FUNDAMENTALS OF MICROWAVE COMMUNICATION AND WAVEGUIDES (Weightage- 14 , Hrs-08)	
1a. Summarize the range and application of the given microwave frequency band. 1b Compare the given parameters of waveguide and transmission line. 1c. Explain the properties of the given parameters for the circular waveguide with example 1d. Calculate the cut off wavelength, cut off frequency, group and phase velocity of the given rectangular waveguide. 1e. Describe with relevant sketch the field pattern of the given mode of rectangular waveguide. 1f. Compare the feature of circular and rectangular waveguide for the given parameters	1.1 microwave frequency spectrum, Microwave region and bands 1.2 Introduction to microwave and applications 1.3comparison of waveguide with two wire transmission line Types of waveguides: Rectangular, Circular, Propagations of waves in rectangular waveguides. Reflection of waves from a conducting plane, dominant mode, parallel plane waveguide, cut off wavelength, cut off frequency, group and phase velocity (simple numerical) 1.4 Introduction to TEM/TE/TM wave Propagation of TE/TM waves in rectangular waveguide, field patterns of TE_{10}, TE_{20}, TE_{11} modes. 1.5 Circular waveguide: Advantages, disadvantages and application of circular waveguide.
UNIT 2 MICROWAVE PASSIVE COMPONENTS (Weightage-12 , Hrs- 08)	

2a. Describe with relevant sketches, operation of the given microwave passive component. 2b. Describe with relevant sketches the working principle of given Ferrites components. 2c. Describe the procedure to build/prepare the microwave test bench setup with the help of given microwave accessories and components. 2d. Explain the function of the given parameters for a directional coupler.	2.1 Multiple junctions: Working principle and application of H-plane, E-plane, Magic tee. 2.2 Ferrites components: Isolator, circulator and Gyrator Accessories: Flanges, Rotating coupling, Bends and corners, Taper and Twist 2.3Directional coupler: Two hole directional coupler-Working principle and applications, directivity, coupling factor and isolation. 2.4 basic microwave antenna (Horn and Dish)
UNIT3 MICROWAVE ACTIVE COMPONENTS (Weightage- 20 , Hrs- 16)	
3a. Describe with relevant sketch the concept of velocity modulation and bunching effect for the given microwave tube. 3b. Prepare /Draw the apple gate diagram for the given parameters of the microwave tube. 3c. Describe the applications of the given microwave tube. 3d. Compare the performance of Klystron, Magnetron and TWT on the given parameters. 3e. Describe with relevant sketch the transfer electron effect for the given energy level diagram of Gunn Diode. 3f. Describe with relevant sketch the operation of the given active microwave component.	3.1 Microwave tubes classification: Two cavity, Reflex Klystron i. Construction ii. Modulation iii. Bunching process iv. Principle of operation 3.2 Magnetron: construction, operation principle and application 3.3 Slow wave devices: Helix TWT construction and principle of operation and applications 3.4 Compare the performance of Klystron, Magnetron and TWT. 3.5 TED (Transferred Electron Devices): Gunn diode-construction, operation principle, modes and application of Gunn diode as an oscillator 3.6 Avalanche transit time device: IMPATT diode-construction, operation and applications 3.7 PIN diode –construction, operation and applications Esaki diode: Tunnel diode-VI Characteristics, equivalent circuit, application as an oscillator and as an amplifier

UNIT 4 RADAR FUNDAMENTALS (Weightage-18 , Hrs- 08)	
4a. Describe with relevant sketch function of the given component of the RADAR system. 4b. Calculate the maximum RADAR range for the given parameters. 4c. State the effect on the RADAR range for given parameters. 4d. Explain with relevant sketch the given type of scanning and tracking methods used for RADAR communication. 4e. Describe with relevant sketch the construction and working of the given microwave antenna	4.1 Basic block diagram of RADAR system 4.2 RADAR performance factors: RADAR range equation, factors influencing range, effect of noise 4.3 Basic pulse RADAR system: Block diagram and applications 4.4 Antenna Scanning (types and principle) : Horizontal, vertical, helical, spiral antenna tracking (types and principle) Sequential, conical and mono pulse 4.5 Antenna feed Mechanism: Horn and cassegrain feed antenna
UNIT 5 RADAR SYSTEMS (Weightage-16 , Hrs-08)	
5a. Explain with relevant sketch working principle of the given type of RADAR. 5b. Describe the application of the given type of RADAR. 5c. Describe with relevant sketch the working principle of the given type of display used with RADAR system. 5d. Compare CW and Pulsed RADAR for the given parameters. 5e. Describe with relevant sketch application of SONAR system.	5.1 Doppler effect 5.2 CW Doppler RADAR: Block diagram, operation and application FM CW RADAR: Block diagram. operation and application 5.3 MTI: Block diagram, operation concept of blind speed. Application, Automatic target detection RADAR. Display Method: A-Scope, PPI Beacons. Concept of phased array RADAR. 5.4 SONAR system: working principle and application.

8. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Fundamental of microwave communication and waveguides	08	04	04	06	14
II	Microwave Passive components	08	04	04	04	12
III	Microwave Active components	16	06	08	06	20
IV	RADAR Fundamentals	08	06	08	04	18
V	RADAR Systems	08	04	04	08	16
Total		48	**24**	**28**	**28**	**80**

9. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a. Prepare chart showing various microwave components.
b. Prepare / download an animation and share with the class to illustrate the working principle of the following
   i. Microwave Tubes
   ii. EM wave propagation.
c. Visit a place where waveguides are used for microwave communication (such as earth station, Radio station, telephone exchange, airport, TV broadcast, navigation center) and prepare the report.
d. Conduct a library/Interest based survey of microwave components.
e. Interpret the various BIS Code for microwave communication.
f. Compare specifications of at least two different types of RADAR system.

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/subtopics.
b. About ***15-20% of the topics/subtopics*** which are relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
c. With respect to item No.9, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
d. Guide student(s) in undertaking micro-projects.
e. Correlate subtopics with power plant systems and equipment.
f. Use the proper equivalent analogy to explain different concepts.

g. Use Flash/Animations to explain various microwave components, tubes and RADAR systems.
h. Use open source / MATLAB models to explain different concepts of microwave devices.

11. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs.(Affective Domain Outcomes) .Each student will have to maintain activity chart consisting of individual contribution in the project work and give a seminar presentation of it before submission.. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

a. Market survey of consumer microwave equipment with respect to working principle, manufacturer, technical specification and submit the detail report of it.
b. Prepare power point presentation to explain various types of wave guides and microwave antennas used in any transmitter station.
c. Prepare survey report on mobile van used for live telecast of any event.
d. Prepare are port on the applications of RADAR for Defense and Air navigation.
e. Prepare power point presentation to explain working of various microwave components and Microwave tubes.
f. Prepare chart showing various microwave components.
g. Conduct a Library/Internet based survey of microwave components.
h. Compare specifications of at least two different types of RADAR system
i. Prepare power point presentation to explain working of sonar system with examples.
j. Prepare chart showing various microwave diodes and their applications.

12. SUGGESTED LEARNING RESOURCES

S.N.	Title	Author	Publisher, Edition ,Year of publication and ISBN Number
1	RADAR systems and radio aids to navigation.	Sen A.K. and Bhattacharya A. B.	Mercury Learning & Information. PVT, LTD. New Delhi ,2017 ISBN:978-1683921189
2	Microwave Engineering.	Das Annapurna and Das S.K.	Mc Graw Hill ,New Delhi (3rd edition 2017 ISBN: 978-9332902879
3	Microwave Engineering.	Gupta Sanjeev	Khanna Publication, Naisadak Delhi (3rd edition 2015 ISBN:9788174090878
4	Microwave and RADAR Engineering	Gautam A.K.	S.K. Kataria Publication, Delhi 2012, ISBN: 978-9350141519
5	Fundamental of Microwave and RADAR Engneering	Sharma K.K.	S. chand and comply PVT,LTD New Delhi 2011,ISBN:9788121935371
6	Electronics Communication System	Kennedy ,George; Davis, Brendan	Mc Graw Hill ,New Delhi (5th edition 2011,ISBN: 978-0071077828

13 SOFTWARE/LEARNING WEBSITES

1. Microwave component: www.youtube.com/microwave component and devices
2. RADAR: www.youtube.com/RADARS
3. Microwave fundamentals: www.nptelvideos.in/microwave engineering
4. Waveguide: www.academic.edu/waveguide
5. Microwave engineering Book – monitor:westrenfriend.org/microwave-engineering-by-sanjeev-gupta.pdf

14. PO - COMPETENCY- CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	-	2	1	-	2	2
CO2	3	-	2	2	-	-	1
CO3	-	2	2	1	1	-	2
CO4	1	-	-	3	-	-	2
CO5	3	2	3	2	1	-	2

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	-	2	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-

Sign: Name :Smt. N.S.Bakde Smt. P.C.Mitkari Smt. M. S. Datar (Course Experts)	Sign: Name: Shri.R.N.Shikari (Head of Department)
Sign: Name: Shri.R.N.Shikari (Program Head) (E & TC Department)	Sign: Name:ShriA.S.Zanpure (CDC)

Government Polytechnic, Pune

'180OB' – Scheme

Programme	Diploma in **Electronics&Telecommunication Engineering**
Programme code	01/02/**03**/04/05/06/07/08/15/16/**17**/18/19/21/22/**23**/24/26
Name of Course	**Satellite Communication**
Course Code	**ET5108**
Prerequisite course code and name	ET3105(PRINCIPLES OF COMMUNICATION)
Class Declaration	**NO**

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)		Examination Scheme				
					Theory		Practical		Total Marks
L	T	P	C		ESE	PA	$ESE	PA	
03	00	02	05	Marks	80	20	25	25	150
				Exam Duration	3 Hrs	1 Hr	-	-	

($):OE (Oral Examination)

Legends: L-lecture, T-Tutorial/teacher guided theory practice, P-practical, ESE-End semester examination, PA- Progressive Assessment, # - Online theory exam

2. RATIONALE

Today in different communication scenarios satellite applications plays important role. The knowledge of satellite communication systems and equipment is very essential. The course aims to understand the basics of satellite communications, antennas used for satellite communication, various losses in satellite channel, Link analysis, satellite transponder and various methods of satellite access. This course will also facilitate students to apply the basic principles of satellite communication system to maintain different types of applications based on it.

3. COMPETENCY

The aim of this course is to attend following industry identified competency through various teaching learning experiences:

- **Maintain Satellite Communication System.**

4. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency**:**

1. Explain basic concepts, principle and operation of various components of Satellite as well as satellite orbit.
2. Use relevant type of antenna for satellite communication application and Interpret various losses in satellite channel.
3. Analyze satellite communication link and depolarization.
4. Elaborate the electronic hardware systems associated with the earth station and Satellite transponder
5. Apply various communication techniques for satellite applications..
6. Explain role of satellite in various recent applications.

5. SUGGESTED PRACTICALS/ EXERCISES

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Relevant CO	Approximate Hours Required.
1	1	Understanding the basic concepts of satellite communication	1	02
2	1	Develop a program using a relevant simulation tool to calculate the time period of a satellite for the given velocity and altitude based on Kepler's third law.	1	02
3	2	Study of channel specifications and different network transmission technologies.	2	02
4	2	Study of various types of losses in satellite link.	2	02
5	3	To setup a communication link between uplink transmitter and downlink receiver using Satellite.	3	02
6	3	Test the performance of audio satellite link for the specified uplink and downlink frequency.	3	02
7	3	Detect the satellite link fail operations and re-establish the link.	3	02
8	3	Establish a link to transmit and receive three separate signals (audio, video, tone) simultaneously through satellite link.	3	02
9	3	To communicate voice & Video signal through satellite link.	3	02
10.	3	To study rain attenuation(in dB) for horizontal polarization, vertical polarization	3	02

		for satellite wavepropagation		
11	4	Study of Satellite earth station(faculty may arrange visit).	4	02
12	4	Study of transponders.	4	02
13	5	Study of FDMA, TDMA and CDMA with respect to satellite communication .	5	02
14	6	Study of Global Positioning Satellite System (GPS)	6	02
15	6	Demonstrate working of home television	6	02
16	6	Prepare report on any recent application of satellite.	6	02
17	All	Complete a Micro- project based on guidelines provided in sr.no. 11.	All	04
Total Hrs				**32**

Note: Any 12 practicals from sr. no. 1 – 16 can be performed and 17 is compulsory.

S.No.	Performance Indicators	Weightage in %
a.	Arrangement of available equipment / test rig or model	20
b.	Setting and operation	20
c.	Safety measures	10
d.	Observations and Recording	10
e.	Interpretation of result and Conclusion	20
f.	Answer to sample questions	10
g.	Submission of report in time	10
Total		**100**

6. MAJOR EQUIPMENT/ INSTRUMENTSREQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practical, as well as aid to procure equipment by authorities concerned**.**

Sr.No.	Major Equipment/ Instruments Required	Experiment Sr. No.
1	Satellite Trainer Kit (ST2272)/ (STC 24):Uplinking frequency 2414/2432/2450/2468 MHz,4MHz clock frequency,PIC 16F84-8 bit RISC processor based on PLL,16MHz bandwidth,FM Modulation of audio and video 5/5.5/8 MHz audio and video modulation,detachable dish antenna,radiated power 25milli watt approximately, 4 downlink frequencies 2414/2432/2450/2468 MHz	3-9
2	Spectrum analyser frequency range 2.4-2.495 GHz,Resolution 26KHZ-3MHz,resolution bandwidth 58.036 to 812.500 KHz	3-9
3	Personal computer with latest configuration and internet facility	ALL

7. THEORY COMPONENTS

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Units 1 :Overview of Satellite Systems and Satellite Orbits(Weightage-16 , Hrs-10)	
1a.Describe with sketches the working principles of the given type of satellite. 1b.Understand basic terminologies used in satellite communication 1c.Explain Kepler's law of planetary motion with respectto the givencriteria. 1d.Explain the parameters with respect to the given type of satellite orbit.	1.1 Historical background, basic components of Satellite system Earth segment, Space segment, active and passive satellite, geostationary and geosynchronoussatellites, Frequency allocations for satellite services. 1.2 Basic terminologies used in satellite communication: latitude, longitude, look angle, Azimuth angle elevation angle, station keeping, propagation delay time , velocity and footprint 1.3 Orbital mechanics: Kepler's First Law, Kepler's Second Law, Kepler's Third Law 1.4 i) Communication Satellite orbits and its types: LEO, MEO, elliptical orbit and GEO. ii) Parameters and characteristics of variousOrbits iii) Orbitals effects in communication system performance, Apogee and Perigee Heights, Orbit Perturbations iv) Effects of a non-spherical earth.
Unit 2:Satellite Channel & types of Antenna (Weightage- 10, Hrs- 06)	
2a.Understand different satellite channels 2b.Learn various types of antenna and its propagation patternsfor satellite communication 2c.Understand various losses in satellite channel 2d.Learn comparison of various transmission technologies	2.1 Satellite channel and Electromagnetic field propagation, power flow 2.2 Types of antenna for satellite communication and propagation patterns 2.3 Losses in satellite channel :.Atmospheric losses, power loss, rainfall effects, Receiver noise, temperature noise, noise figure 2.4 Comparison of Network Transmission technologies
Unit 3:Satellite Link(Weightage- 14, Hrs-08)	
3a.Analyse different links for satellite 3b.Describepolarization and depolarization	3.1 Satellite link analysis: satellite uplink, satellite down link, direct broadcasting, up down link analysis and satellite cross-links. 3.2 Frequency, polarization and depolarization of spot beams,

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
3c.Understand concept of frequency reuse.	satellite down links, Frequency reuse with spot beams, Multiple beams. 3.3 IonosphericDepolarization,RainDepolarization, Ice Depolarization
Unit 4: Satellite Transponder(Weightage-14, Hrs-08)	
4a.Describewithsketch the functions of the givensub-systemof the satellite earth station. 4b. Describe the given type of control systems associated with the Satellite. 4c.Describe with sketches Transponder model of satellite. 4d.Explain nonlinear satellite amplifier.	4.1 Satellite earth station:Block, diagram; Antenna subsystem, LNA, Power subsystem, Telemetry Tracking and Command (TTAC) subsystem. 1.2 The transponder model, The satellite front end, front end noise, Front-end filter, front-end wave forms. 1.3 Filtering of digital carriers, satellite signal processing. Transponder Limitations 1.4 Nonlinear satellite Amplifiers AM/AM conversion, AM/PM conversion on nonlinear amplifier model, Effect of nonlinear amplification of digital carrier.
Unit 5:Satellite Access(Weightage-10, Hrs-06)	
5a.Understand different Satellite single access. 5b.Describe FDMA for satellite 5c.Explain different coding techniques of signal access for satellite communication.	5.1 Introduction Single access 5.2 Preassigned FDMA, Demand-Assigned FDMA, 5.3 Spade System 5.4 TDMA,Pre-assigned TDMA, Demand-assigned TDMA, Satellite-Switched TDMA 5.5 CDMA
Unit 6:Satellite Applications (Weightage16-, Hrs-10)	
6a.Describe with sketch home satellite TV applications with frequency band 6b.Explain architecture and working principle of VSAT. 6c.Describe GPS system 6d.Explain recent applications	6.1 C-Band and Ku-Band Home Satellite TV 6.2 Digital DBS TV, DBS-TV System Design 6.3 Satellite Mobile Services:VSATs(Overview, architecture and working principle) 6.4 Global Positioning Satellite System (GPS): concept, working principle, transmitter and receiver

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
of satellite	6.5 Orbcomm,Iridium, Radar SAT

8. SUGGESTED SPECIFICATION TABLE FORQUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Overview of Satellite Systems and Satellite Orbits	10	4	8	4	16
2	Satellite Channel & types of Antenna	06	4	6	-	10
3	Satellite Link	08	4	6	4	14
4	Satellite Transponder	08	2	8	4	14
5	Satellite Access	06	4	4	2	10
6	Satellite Applications	10	4	4	8	16
Total		**48**	**22**	**36**	**22**	**80**

9. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a. Visit ISRO website and collect the information related to satellite launching and submit report on it.
b. Collect the information related to Indian satellites program.
c. Prepare report on satellite applications.

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
c. Guide student(s) in undertaking micro-projects.
d. Use proper equivalent analogy to explain different concepts.
e. Use Flash/Animations to explain various components, operation and application.

11. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs.(Affective Domain Outcomes) .Each student will have to maintain activity chart consisting of individual contribution in the project work and give a seminar presentation of it before submission.. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

a. Prepare an internet based report on the different types of launch vehicals used for satellite launching
b. Prepare chart to indicate applications of various frequency bands (L,S,C,X,Ku, and KA Band)
c. Prepare a survey report on the different types of antennas used for satellite communication
d. Conduct an internet survey and and prepare a detailed report on GPS and its applications
e. Prepare a report on VSAT communication based on visit and internet survey
f. Visit a satellite center /pool Lab having satellite setup and prepare a report on all the components and its functions
g. Prepare a report on different types of satellite
h. Prepare a chart of basic terminologies used in satellite communication with definitions
i. Prepare a chart of various types of antenna and its propagation patternsfor satellite communication
j. Prepare a report on different coding techniques of signal access for satellite communication

12. SUGGESTED LEARNING RESOURCES

S.N.	Title	Author, Publisher, Edition and Year of publication	ISBN Number
1	Satellite Communications	Timothy Pratt Charles Bostian Jeremy Allnutt	Wiley Publications, second edition ,2014 ISBN-13**:** 978-81-265-0833-4
2	Satellite Communications	Roddy Dennis	Tata McGraw-Hill, New Delhi, fourth edition ,2017 ISBN-13: 978-0070077850
3	Satellite Communication	Katiyar, Sapna	Katson publications, 3rd edition 2013ISBN-978-93-5014-481-7

4	Satellite communication concepts and applications	Rao Raja K. N	PHI learning Private limited ,New Delhi , second edition, 2012 ISBN-978-81 -203-4725-0
5	Satellitecommunicatio n systems, techniques and technology	GerardMaral, Bousquet Michel, Zhili Sun	Wiley publication, New Delhi 5th Edition,2009 ISBN: 978-0-470-71458-4

13. SOFTWARE/LEARNING WEBSITES

1. www.nptel.com
2. https://recommendedforyou.xyz/books/g4/25739?q=Sate1lite%20communication%201 ab%20manual
3. http://istc.co.in
4. https://www.isro.gov.in/
5. https://www.nasa.gov/
6. http://www.satcoms.org.uk/satellite/vsat-tutorials.asp?

14. PO - COMPETENCY- CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	-	2	3	2	-	3
CO2	3	-	2	3	2	-	3
CO3	3	-	3	3	2	-	3
CO4	3	-	3	3	2	-	3
CO5	3	-	3	3	2	-	3
CO6	3	-	2	3	2	-	3

CO	PSO1	PSO2	PSO3
CO1	3	2	-
CO2	3	2	-
CO3	3	2	-
CO4	3	2	-
CO5	3	2	-
CO6	3	-	-

Sign: Name: Smt.P.P.Rajhans Smt.P.V.Lengare (Course Experts)	Sign: Name: Shri.R.N.Shikari (Program Head) (Electronics &Telecommunication Dept.)
Sign: Name: Shri.R.N.Shikari (Program Head) (E & TC Department)	Sign: Name: ShriA.S.Zanpure (CDC)

GOVERNMENT POLYTECHNIC, PUNE

'180OB' – SCHEME

Programme	Diploma in **Electronics & Telecommunication Engineering**
Programme code	01/02/**03**/04/05/06/07/08/15/16/**17**/18/19/21/22/**23**/24/26
Name of Course	**Bio Medical Instrumentation**
Course Code	**ET5109**
Prerequisite course code and name	**ET3104 (ELECTRONIC INSTRUMENTATION)**
Class Declaration	**NO**

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)		Examination Scheme				
					Theory		Practical		Total Marks
L	T	P	C		ESE	PA	$ESE	PA	
03	00	02	05	Marks	80	20	25	25	150
				Exam Duration	3 Hrs	1 Hr	-	-	

($):OE (Oral Examination)

Legends: L-lecture, T-Tutorial/teacher guided theory practice, P-practical, ESE-End semester examination, PA- Progressive Assessment, # - Online theory exam

2. RATIONALE

Today in different communication scenarios satellite applications plays important role. The knowledge of satellite communication systems and equipment is very essential. The course aims to understand the basics of satellite communications, antennas used for satellite communication, various losses in satellite channel, Link analysis, satellite transponder and various methods of satellite access. This course will also facilitate students to apply the basic principles of satellite communication system to maintain different types of applications based on it.

3. COMPETENCY

The aim of this course is to attend following industry identified competency through various teaching learning experiences:

- Understand working of biomedical instruments to Maintain Biomedical Instrumentation System.

4. COURSE OUTCOMES (COs)

The theory, psychomotor/ practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency**:**

1. Understand basic concepts of biomedical
2. Identify the functions of anatomy and physiology of human body.
3 . Maintain the biomedical instruments /electrodes for relevant applications.
4 .Select the relevant biomedical instruments for biomedical parameters measurement.
5 . Maintain life support biomedical instruments for specified applications.
6. Demonstrate the principles of electronics used in various diagnostic Equipment
7.Maintain biomedical imaging instrument for specified applications.

5. SUGGESTED PRACTICALS/ EXERCISES

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Relevant CO	Approximate Hours Required.
1	1	Study of Different Biomedical Signals and classification of equipment	1	02
2	2	Use video programs to identify the parts and working of cardiovascular system	2	02
3	2	Use video programs to identify the parts and working of Respiratory system.	2	02
4	2	Use video programs to identify the parts and working of excretory system.	2	02
5	3	Use video programs to identify the parts and working of different types of electrodes.	3	02
6	3	Use ECG machine safely to measure electrocardiogram.	2	02
7	3	Study of EMG machine to obtain the Electromyogram with the help of virtual lab.	7	02
8	4	Use Multi-parameter Monitor for observing various parameters.	4	02
9	4	Use Pulse-Oxymeter to measure respiration rate	4	02
10.	4	Use sphygmomanometer to measure blood pressure.	5	02
11	5	Use video programs for study of Defibrillator machine to defibrillate the fibrillated heart with the help of virtual lab.	5	02
12	5	Use video programs for study of artificial Pacemaker to simulate heart with the help of virtual lab	5	02
13	5	Use video programs for study of Hemodialysis Machine to dialyze the kidney with the help of virtual lab	5	02
14	6	Use video programs to identify the parts and the working of MRI machine	7	02
15	6	Use video programs to identify the parts and	7	02

		working of X-RAY machine.		
16	6	Use video programs to identify the parts and the working of CAT machine	7	02
17	All	Complete a Micro- project based on guidelines provided in sr.no. 11.	All	04
Total Hrs				**32**

Note: Any 12 practicals from sr. no. 1 – 16 can be performed and 17 is compulsory.

S.No.	Performance Indicators	Weightage in %
a.	Arrangement of available equipment / test rig or model	20
b.	Setting and operation	20
c.	Safety measures	10
d.	Observations and Recording	10
e.	Interpretation of result and Conclusion	20
f.	Answer to sample questions	10
g.	Submission of report in time	10
Total		**100**

6. MAJOR EQUIPMENT/ INSTRUMENTSREQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practical, as well as aid to procure equipment by authorities concerned**.**

Sr. No.	Major Equipment/ Instruments Required	Experiment Sr. No.
1	Video Simulation Programs for study of different Physiological Systems.	02 to 05
2	ECG Machine.	06
3	EMG machine	07
4	Multi-parameter Monitor	08
5	Pulse-Oxymeter	09
6	Sphygmomanometer	10
7	Video Simulation Programs for study of different Bio-Medical Instruments.	11 to 16

7. THEORY COMPONENTS

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit 1: Need of Biomedical Instrumentation (Weightage-10 , Hrs-06)	
1a. Describe Primary signal characteristic of given device 1b. Identify required biomedical signal for the given application 1c.Identify the relevant type of medical instrument for the given specific application	1.1 Role of engineers in health care industry Source of biomedical signal, bioelectric, bio acoustic, biomechanical, biochemical, bio magnetic, bio optical, bio impedance signal. **1.2** Equipment classification based on: Analytical equipment, diagnostic equipment, intensive care equipment, therapeutic equipment, medical imaging equipment

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Units 2 : Fundamentals of Physiology (Weightage-16 , Hrs-10)	
2a. Describe the function of given components of Man instruments instrument system with sketch. 2b. Describe with sketches the function of the given human physiology of cardio-vascular system, Respiratory System 2c. Explain the given parameter related to Excretory System.	**2.1** Man Instrument System : Block Diagram ; Elements **2.2** Cardiovascular System : Structure of Heart; Cardiovascular circulation; electrical conduction system of heart ; generation of heart sound ; importance of cardiac output. 2.3 Respiratory System: Physiology of Respiratory System, Mechanism of breathing ; lung volume capacities 2.4 Excretory System: Kidney, Nephron , Structure, Function and Operation.
Unit 3:Bioelectric Signals and Electrode System(Weightage- 14, Hrs- 08)	
3a. Describe with sketches the use of the given bioelectric potential of human body. 3b.Select the relevant bioelectric electrodes to measure the given situation with justification. 3c.Explain with sketches the working of the given bioelectric instrument to measure potentials of human body. 3d. Explain the relevant ECG lead system to for the given situation with justification 3e.Interpret the specification of given instrument/electrode. 3f. Describe the procedure to maintain the given bioelectric instrument used to measure bioelectric signals.	**3.1 Bio-Electric Potential:** Resting and Action Potentials-Concepts, schematic diagrams, waveform, Electrode Theory- Electrode electrolyte interface with schematic diagram. **3.2 Bio-Electrode**: Construction and diagrams of various electrodes used for measuring ECG, EEG and EMG. 3.3 Microelectrodes **3.4** Surface Electrodes: Suction cup electrode, Disposable Electrode, Floating type electrode, Metal Disk electrode. **3.5** Needle Electrode**.** **3.6 ECG System:** Block Diagram, Working leads – uni-polar, bipolar, Enthoven-Triangle, Electrocardiogram-waveform, interpretation. **3.7 EMG System :** Electromyography-Concept, Block diagram and working. **3.8 EEG :**Electroencephalogram, block diagram, working, waveforms and description of various stages of sleep.

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit :4Biomedicals Parameters measurement(Weightage-14, Hrs-08)	
4a.Describe with sketches the origin of heart sound. 4b.Describe with sketches the construction of the give biomedical instrument for measuring the given parameter. 4c.Explain with sketches the working of given biomedical instrument for measuring the given parameter. 4d.Interpret the specification of the given biomedical instrument. 4e.Describe the procedure to maintain the give biomedical instrument used to measure the given parameters	**4.1Measurement of heart sound:** Phonocardiograph-block diagram, working **4.2Blood Pressure measurement:** Principle, list the types of direct and indirect method of blood pressure measurement. Sphygmomanometer: Construction, working of Sphygmomanometer. Blood pressure measurement using Sphygmomanometer. **4.3Blood flow measurement:** Diagram, Construction and working – plethysmograph, electromagnetic, ultrasound method. **4.4Respiration rate measurement:** Diagram, Construction and working of Spirometer. **4.5Audiometer:** Construction, Working and applications. **4.6Multi-Parameter Monitor.** Diagram, Construction and working of Multi-Parameter Monitor.
Unit 5:Life Support Instruments and Electric Supply(Weightage-10, Hrs-06)	
5a.Describe with sketches the construction of the given life support system. 5b.Explain with sketches the construction of the given life support system. 5c.Interpret with specification of given life support instruments. 5d.State the patient safety precautions to be taken for the given electric shock and leakage current. 5e.Describe the procedure to maintain the given life support system.	**5.1Defibrillator:** Concept of fibrillation, defibrillation, Types of Defibrillator. DC defibrillation-diagram. Working, Output, Waveforms. Electrodes used – Paddle electrodes. **5.2Pacemaker:** Concept of Pacemaker, Types of Pacemaker- Internal and External. Working of various facing modes. Block diagram of Pacemaker and its working. **5.3 Haemodialysis :** Need, Function, block diagram , Working. **5.4Biotelemetry:** Block diagram, working ,concept of Telemedicine **5.5Micro Shock and Macro Shock:** Effect of leakage current on human body. Types of leakage current.Precautions to minimize electric shock hazards and leakage current**.**
Unit 6: Imaging Systems (Weightage16-, Hrs-10)	
6a.Describe with sketches the construction of given imaging system. 6b.Explain with sketches the Working of given imaging system 6c.Describe the given modes of ultrasonography. 6dInterpret the specifications of give imaging system. 6e.Describe the procedure to maintain the give instrument used to measure imaging system.	**6.1 X-Ray**: Principal of X-Ray., X-Ray Machine-block diagram, working, application, specifications. Image intensifier- Schematic diagram and working. **6.2 CAT**: Principal of CT Scan, block diagram, working, application, specifications. **6.3 Ultra-Sonography**: Principal, Block diagram, working application, specification. Various modes of ultrasonography – A, B and M mode. **6.4 MRI**: Construction, Working, application, specification. **6.5 Tomography (PET) :**Single Photon Emission

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	Computer Tomography (SPECT) - Construction, Working, application, specification.

8. SUGGESTED SPECIFICATION TABLE FORQUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Need of Biomedical Instrumentation	6	4	4	2	10
2	Fundamentals of Physiology	10	8	8	-	16
3	Bioelectric Signals and Electrode System	8	4	10	-	14
4	Biomedicals Parameters measurement	8	4	6	4	14
5	Life Support Instruments and Electric Supply	6	4	4	2	10
6	Imaging Systems	10	4	4	8	16
Total		48	28	36	16	80

9. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a. Visit The nearby Hospitals and observe the working of the Bio-Medical Instruments they have studied.
b. Collect the information related to Bio-Medical Instruments they have studied .
c. Prepare report on Installation, working and applications of Bio-Medical Instruments.

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
c. Arranging Visits to Hospitals for demonstrations of the Bio-Medical Instruments.

d. Use proper Video / Simulation Software and Virtual Labs to explain different concepts.

11. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs.(Affective Domain Outcomes) .Each student will have to maintain activity chart consisting of individual contribution in the project work and give a seminar presentation of it before submission.. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

a. Make a survey of different types of Biomedical electrodes and prepare a report.
b. Prepare a report on different types and applications of Digital ECG machines.
c. Collect the videos / Animations on working of ECG machines and prepare a report.
d. Collect the videos / Animations on working of De-fibrillators and prepare a report.
e. Collect the videos / Animations on working of Multi-Para Monitors and prepare a report.
f. Collect the videos / Animations on working of Tread Mill Test and prepare a report.
g. Collect the videos / Animations on working of dialysis machine and prepare a report.
h. Find out specifications of Digital ECG Machines and prepare a report of comparison.
i. Find out specifications of Digital Blood Pressure Meter and prepare a report of comparison.
j. Find out specifications of Digital X-Ray Machines and prepare a report of comparison.
k. Find out specifications of De-fibrillators and prepare a report of comparison.
l. Find out specifications of Multi-Para Monitors and prepare a report of comparison.
m. Prepare a report on calibration of Mercury based Blood Pressure Apparatus.
n. Prepare a report on calibration of Digital Weighing Machines used in Paediatric applications.
o. Visit to Hospital and prepare preventive maintenance chart of Oxygen supply system.

12. SUGGESTED LEARNING RESOURCES:

S.N.	Title	Author	Publisher, Edition ,Year of publication and ISBN Number
1	Biomedical Instrument and measurements	Leslie Cromwell , Fred J. Weibell ,Erich A. Pfeiffer	Prentice hall of India, second Edition(2004) ISBN-10 0130764485
2	Handbook of biomedical instrumentation	R. S. Khandpur	McGraw Hill New Delhi 2014 ISBN:9789339205430
3	Introduction to biomedical	Can, Joseph J, Brown	J.M Pearson education, New Delhi 2002

	equipment Technology		ISBN: 9788177588835
4	Medical instrumentation application and design	Webster, John G.	John Wiley and Sons, New Delhi 2009, ISBN:978-0-471-676003

13. SOFTWARE/LEARNING WEBSITES

1. https://bmsp-coep.vlabs.ac.in/PulseMissingDetector/index.html
2. https://bmsp-coep.vlabs.ac.in
3. https://www.youtube.com/watch?v=CkGqp5tr-Qk
4. https://www.youtube.com/watch?v=HnKMBllih2o
5. https://www.youtube.com/watch?v=xIZQRjkwV9Q
6. https://www.youtube.com/watch?v=m6SC7hOnAEI
7. https://www.youtube.com/watch?v=QD1PaKSBUmw
8. https://www.youtube.com/watch?v=S2EEixdkL8A

14. PO - COMPETENCY- CO MAPPING :

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2	-	-	1	3	-	3
CO2	2	--	-	1	3	-	3
CO3	2	2	-	3	-	-	3
CO4	1	2	-	3	3	-	2
CO5	1	-	-	3	2	-	3
CO6	1	-	-	3	3	-	3
CO7	1	-	-	3	3	-	3

COs	PSO1	PSO2	PSO3
CO1	1	1	0
CO2	1	1	0
CO3	3	2	0
CO4	3	2	0
CO5	3	2	0
CO6	3	2	0
CO7	3	2	0

Sign: Name: Shri G.W.Sonone: Smt.P.P.Rajhans (Course Experts)	Sign: Name: Shri.R.N.Shikari (Program Head) (Electronics &Telecommunication Dept.)
Sign: Name: Shri.R.N.Shikari (Program Head) (E & TC Department)	Sign: Name: Shri A.S.Zanpure (CDC)

Other department Curriculum

Government Polytechnic, Pune

'180OB'– Scheme

Programme	Diploma in ET/CE/EE//**ME**/MT/CM/IT/DDGM
Programme code	01/02/03/**04**/05/06/07/08/16/17/**18**/21/22/23/**24**/26
Name of Course	**Elements of Electronics Engineering**
Course Code	**ET2105**
Prerequisite course code and name	**NA**
Class Declaration	**NO**

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)		Examination Scheme				
					Theory		Practical		Total Marks
L	T	P	C		ESE	PA	ESE	PA	
03	--	02	05	**Marks**	80	20	-	25	125
				Exam Duration	3 Hrs	1 Hr			

Legends: L-lecture, T-Tutorial/teacher guided theory practice, P-practical, ESE-End semester examination, PA- Progressive Assessment, # - Online theory exam

2. RATIONALE

In today's world most of the consumer appliances are based on electronic circuits and devices. The foundation for working of computer or any of its peripherals are based on electronics. This course has been designed to develop skills to understand and test simple electronic components and circuits. After studying this course students will develop an insight to identify, build and troubleshoot simple electronic circuits.

3. COMPETENCY

The aim of this course is to attend following industry identified competency through various teaching learning experiences:

- **Maintain electronic circuits comprising of discrete electronic components**.

4. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency**:**

1: Plot the characteristics of semiconductor devices.

2. Interpret working of oscillators.

3. Verification of logic gates and relevant application.
4. Use OP-AMP IC in circuits.
5. Operate CRO and Function generator.
6. Select appropriate transducers for relevant applications

5. SUGGESTED PRACTICALS/ EXERCISES

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Relevant CO	Approximate Hours Required.
1.	1	Calculate the values of different resistors by color coding method	1	02
2.		Plot V-I characteristics of P-N junction diode.	1	02
3.		Test performance of diode as Half wave and Full wave rectifier with and without filter.	1	04
4.		Plot the input and output characteristics in CE configuration.	1	04
5.	2	Calculate frequencyof oscillations for Hartley and Colpitts oscillator.	2	02
6.	3	Verification of truth table for logic gates.	3	02
7.	4	Observe input-output waveforms of Inverting Amplifier.	4	02
8.		Observe input-output waveforms of Non Inverting Amplifier.	4	02
9.		Observe input/output waveforms of Integrator.	4	02
10.		Observe input/output waveforms of Differentiator	4	02
11.	5	Study of front panelof C.R.O.	5	02
12.		Study of front panel of Function generator.	5	02
13.		Measure amplitude, Time period of sine, triangular and square wave with the help of CRO.	5	02
14.	6	Test performance of inductive transducer LVDT.	6	02
15	All	Complete a Micro- project based on guidelines provided in sr.no. 11.	All	04
		Total Hrs		**32**

Note: Any 12 practicals from sr. no. 1 – 14 can be performed and 15 is compulsory.

S.No.	Performance Indicators	Weightage in %
a.	Arrangement of available equipment / test rig or model	20
b.	Setting and operation	20
c.	Safety measures	10
d.	Observations and Recording	10
e.	Interpretation of result and Conclusion	20
f.	Answer to sample questions	10
g.	Submission of report in time	10
Total		**100**

6. MAJOR EQUIPMENT/ INSTRUMENTSREQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practical, as well as aid to procure equipment by authorities concerned**.**

Sr. No.	Major Equipment/ Instruments Required	Experiment Sr. No.
1	Variable DC Power supply 0-30V with display for voltage and current	2,3,4,5,7,8,9,10
2	Digital Multimeter	1,2,4,14
3	CRO	3,5,7,8,9,10,11,12,13
4	Function Generator	3,5,7,8,9,10,12,13
5	Different types of cables and connectors	All

7. THEORY COMPONENTS

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
UNIT 1. SEMICONDUCTOR DEVICES (Weightage-20 , Hrs- 15)	
1a. Plot V-I characteristics of PN Diode 1b. Define and Measure parameters of diode 1c. Implement Zener diode as voltage regulator. 1d. Compare salient features of the given type of rectifiers. 1e. Explain with sketches the working principle of the given transistor configuration. 1f. Analyze and differentiate between CE, CB, CC configurations	**1.1 Introduction to basic components** Resistors- Colour coding, values and types Capacitor- Colour coding values and types Inductors- Colour coding values and types **1.2 Semiconductor Theory** **Types** : 1] intrinsic Semiconductor 2] Extrinsic semiconductor**-** P – type and N - type semiconductor. **P-N junction diode:** Diode symbol, Working, Barrier voltage, depletion region, Junction Capacitance, Forward & reverse Characteristics **1.3 Zener diode :** Diode symbol, Working, Forward & reverse Characteristics Avalanche & Zener breakdown. Introduction to LED **:** symbol, working **1.4Rectifier :** Definition, Classification Half wave and Full wave Rectifier circuit diagram, working, comparison, merits and demerits. Filters, necessity, types, comparison, merits, demerits. **1.5 Transistor :** construction, symbol, operating principle, characteristics, configurations, comparison between CB, CE, CC , applications as switch and amplifier.
UNIT 2 OSCILLATORS(Weightage- 12 , Hrs- 07)	

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
2a. State Barkhausen criteria for oscillator. 2b.Classify oscillators. 2c. Draw circuit and explain working of Different types of oscillators.	2.1 Block diagram, Barkhausen Criteria for sustained oscillations, Oscillations in LC tank circuit; 2.2 Classification: LC and RC. Classification of RC Oscillator: Working of RC Phase shift and Wein Bridge Oscillator. 2.3 Classification of LC Oscillator: Working of Hartley , Colpitts , 2.4 Crystal Oscillator
UNIT 3 DIGITAL FUNDAMENTALS(Weightage- 12 , Hrs- 07)	
3a. Understand different numbering system with numerical examples 3b. Draw symbols for different logic gates with truth tables. 3c.Implement different Boolean laws using different gates. 3d. Verify De Morgan's theorem .	3.1Number systems: Decimal, Binary, Hexadecimal, Octal. 3.2Basic logic gates: AND, OR, NOT, NAND, NOR, EXOR symbols, IC numbers and Truth Table. 3.3Boolean Algebra: Fundamentals of Boolean algebra, Basic laws 3.4 De Morgan`s theorem,.
UNIT 4 LINEAR ICS (Weightage- 12 , Hrs- 07)	
4a. Draw symbol and pin diagram of IC 741. 4b. Define various parameters related to OP-AMP. 4c. Derive expression for various mathematical operation of OP-AMP.	4.1 OP AMP. IC 741, symbol, pin diagram, ideal and typical characteristics, 4.2 Applications such as Inverting , Non Inverting amplifier, Difference amplifier, adder, substractor, Integrator, differentiator. (using closed loop system)
UNIT 5 INSTRUMENTATION (Weightage- 12 , Hrs- 05)	
5a. Draw and explain blocks of CRT, CRO and Function generator. 5b. State applications & specifications of CRO and Function generator.	5.1 CRO: Cathode Ray Tube, Oscilloscope Block diagram, operation, oscilloscope specifications, Applications. 5.2 Function generator, Block diagram, operation, specifications,

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
UNIT 6SENSORS AND TRANSDUCERS(Weightage- 12 , Hrs- 07)	
6a. Differentiate between sensor and transducer. 6b. Define and classify transducers. 6c. State selection criteria of transducer. 6d. Differentiate between Active- Passive, Primary-Secondary, and Analog- Digital transducers. 6e. Interpret working principle and application of Resistive, Capacitive, Inductive, Transducers (LVDT), photodiode, phototransistor, Piezoelectric Transducers	6.1 Definition, classification: Active, Passive, Primary, Secondary, Analog, Digital 6.2 Selection criteria for transducer 6.3 Classification: Active, Passive, Primary, Secondary, Mechanical, Electronic, Analog, Digital, Resistive, Capacitive, Inductive Transducers. 6.4Construction, Operation, Applications : LVDT, RTD, Thermocouple , Photoelectric, Piezoelectric Transducers,

8. SUGGESTED SPECIFICATION TABLE FORQUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Semiconductor Devices	15	08	08	04	20
II	Oscillators	07	04	06	02	12
III	Digital Fundamentals	07	04	04	04	12
IV	Linear ICs	07	04	04	04	12
V	Instrumentation	05	02	04	06	12
VI	Sensors and Transducers	07	04	06	02	12
Total		48	**24**	**32**	**24**	**80**

9. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a. Prepare journals based on practical performed inlaboratory.
b. Study of datasheet of electronic components.
c. Prepare charts of symbols of Electronic components.
d. Search information about Ratings and specifications of Regulator, diodes, transistors, CRO, function generator.
e. Collect information of passive transducers and prepare charts of the same.
f. Prepare posters to illustrate the use of photoelectric sensors in remote controls.

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
c. With respect to item No.9, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
d. Guide student(s) in undertaking micro-projects.
e. Correlate subtopics with power plant system and equipments.
f. Use proper equivalent analogy to explain different concepts.
g. Use Flash/Animations to explain various components, operation and
h. Teacher should ask the students to go through instruction and Technical manuals

11. SUGGESTED MICRO-PROJECTS

Only one Micro Project is planned to be undertaken by a student assigned to him/her in the beginning of the semester. She/He ought to submit it by the end of semester to develop industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs. The Micro-Project could be industry application based, internet based, workshop based, laboratory based or field based. The assessment of micro-project is to be done under Practical (PA) Assessment. The Micro Project preferably assign to the group of (4-6) students or an individual taking into the considerations the capabilities and circumstances at the time .

A suggested list is given here. Similar micro-project could be added by the concerned faculty.

a. Prepare a chart of different types of Resistors showing their specifications and applications.
b. Prepare chart of different types of Capacitors showing their specifications and applications.
c .Prepare a chart of different types of Inductors showing their specifications and applications.
d. Prepare a chart of different types of Diodes showing their specifications and applications.
e. Prepare a chart of different types of Inductors showing their specifications and applications.
f. Prepare a chart of different types of Rectifiers showing their specifications and applications.
g. Prepare a chart of different types of Logic Gates and their truth tables.
h. Prepare a chart of different types of Sensors & Transducers showing their specifications and applications

12. SUGGESTED LEARNING RESOURCES

S.N.	Title	Author, Publisher, Edition and Year of publication	ISBN Number
1	Basic Electronics.	Albert Malvino, 8th Edition,Tata McGraw Hill,2015	ISBN10:1259200116ISBN13:9781259200113
2	Basic Electronics.	J.S.Katre. Edition 2017, Techmax Publishers	ISBN-10: 9350779641 ISBN-13: 978-9350779644
3	Basic Electronics.	B.L.Theraja, S Chand Publishing, 2007	ISBN 10: 8121925568 ISBN 13: 9788121925563
4	Linear Integrated Circuits	Ramakant Gaikwad,4TH EDITION, PHI Publication,	ISBN 10: 8120320581 ISBN 13: 9788120320581
5	Modern Digital Electronics	R P Jain, McGraw Hill Education Pvt. Ltd, 4th Edition,2012	ISBN 10: 0070669112 ISBN 13: 9780070669116
6	Instrumentation	A K Sawheny, Nineteenth edition, 2017, DhanpatRai publication	ISBN : 8177001006

13. SOFTWARE/LEARNING WEBSITES

1. www.nptel.com
2. http://www.electronics-tutorials
3. https://en.wikipedia.org/wiki/P%E2%80%93n_junction
4. https://learn.sparkfun.com/tutorials/transistors
5. http://www.pitt.edu/~qiw4/Academic/ME2082/Transistor%20Basics.pdf
6. http://faculty.cord.edu/luther/physics225/Handouts/transistors_handout.pdf
7. http://www.technologystudent.com/elec1

14. PO - COMPETENCY- CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	-	2	2	-	-	2
CO2	2	3	1	-	-	-	2
CO3	3	-	-	3	-	-	3
CO4	3	3	2	2	-	-	2
CO5	1	-	-	3	1	-	2
CO6	3	2	1	3	-	3	3

	PSO1	PSO2
CO1	3	-
CO2	3	-
CO3	3	-
CO4	3	-
CO5	3	-
CO6	2	-

Sign: Name:Shri.M.J.Deshpande Smt.M.S.Datar (Course Experts)	Sign: Name: Shri.R.N.Shikari (Head of Department)
Sign: Name: Prof. N.G. Kulkarni (Program Head) (Mechanical Engineering Dept.)	Sign: Name: Shri A. S. Zanpure (CDC)

Government Polytechnic, Pune

'180OB'– Scheme

Programme	Diploma in Metallurgical Engineering
Programme code	01/02/03/04/**05**/06/07/08/15/16/17/18/**19**/21/22/23/24/26
Name of Course	**Principles of Electronics.**
Course Code	**ET2106**
Prerequisite course code and name	**NA**
Class Declaration	**NO**

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)		Examination Scheme				
					Theory		Practical		Total Marks
L	T	P	C		ESE	PA	ESE	PA	
03	--	02	05	**Marks**	80	20	-	25	125
				Exam Duration	3 Hrs	1 Hr	-	-	

Legends: L-lecture, T-Tutorial/teacher guided theory practice, P-practical, ESE-End semester examination, PA- Progressive Assessment, # - Online theory exam

2. RATIONALE

In today's world most of the consumer appliances are based on electronic circuits and devices. The foundation for working of computer or any of its peripherals are based on electronics. This course has been designed to develop skills to understand and test simple electronic components and circuits. After studying this course students will develop an insight to identify, build and troubleshoot simple electronic circuits.

3. COMPETENCY

The aim of this course is to attend following industry identified competency through various teaching learning experiences:

- **Maintain electronic circuits comprising of discrete electronic components**.

4. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency**:**

1. Plot the characteristics of semiconductor devices.
2. Interpret working of oscillators.
3. Verification of logic gates and relevant application.
4. Use OP-AMP IC in circuits.
5. Operate CRO and Function generator.
6. Select appropriate transducers for relevant applications

5. SUGGESTED PRACTICALS/ EXERCISES

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Relevant CO	Approximate Hours Required.
1.	1	Calculate the values of different resistors by colour coding method	1	02
2.		Plot V-I characteristics of P-N junction diode.	1	02
3.		Test performance of diode as Half wave and Full wave rectifier with and without filter.	1	04
4.		Plot the input and output characteristics in CE configuration.	1	04
5.	2	Calculate frequencyof oscillations for Hartley and Colpitts oscillator.	2	02
6.	3	Verification of truth table for logic gates.	3	02
7.	4	Observe input-output waveforms of Inverting Amplifier.	4	02
8.		Observe input-output waveforms of Non Inverting Amplifier.	4	02
9.		Observe input/output waveforms of Integrator.	4	02
10.		Observe input/output waveforms of Differentiator	4	02
11.	5	Study of front panelof C.R.O.	5	02
12.		Study of front panel of Function generator.	5	02
13.		Measure amplitude, Time period of sine, triangular and square wave with the help of CRO.	5	02
14.	6	Test performance of inductive transducer LVDT.	6	02
15	All	Complete a Micro- project based on guidelines provided in sr.no. 11.	All	04
		Total Hrs		**32**

Note: Any 12 practicals from sr. no. 1 –14 can be performed and 15 is compulsory.

S.No.	Performance Indicators	Weightage in %
a.	Arrangement of available equipment / test rig or model	20
b.	Setting and operation	20
c.	Safety measures	10
d.	Observations and Recording	10
e.	Interpretation of result and Conclusion	20
f.	Answer to sample questions	10
g.	Submission of report in time	10

S.No.	Performance Indicators	Weightage in %
Total		100

6. MAJOR EQUIPMENT/ INSTRUMENTSREQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practical, as well as aid to procure equipment by authorities concerned**.**

Sr.No.	Major Equipment/ Instruments Required	Experiment Sr. No.
1	Variable DC Power supply 0-30V with display for voltage and current	2,3,4,5,7,8,9,10
2	Digital Multimeter	1,2,4,14
3	CRO	3,5,7,8,9,10,11,12,13
4	Function Generator	3,5,7,8,9,10,12,13
5	Different types of cables and connectors	All

7. THEORY COMPONENTS

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
UNIT 1. SEMICONDUCTOR DEVICES (Weightage-20 , Hrs- 15)	
1a. Plot V-I characteristics of PN Diode 1b. Define and Measure parameters of diode 1c. Implement Zener diode as voltage regulator. 1d. Compare salient features of the given type of rectifiers. 1e. Explain with sketches the working principle of the given transistor configuration. Analyze and differentiate between CE, CB, CC configurations	**1.1 Semiconductor Theory** **Types** : 1] intrinsic Semiconductor 2] Extrinsic semiconductor- P – type and N - type semiconductor. **P-N junction diode:** Diode symbol, Working, Barrier voltage, depletion region, Junction Capacitance, Forward & reverse Characteristics **1.2 Zener diode :** Diode symbol, Working, Forward & reverse Characteristics Avalanche & Zener breakdown. Introduction to LED **:** symbol, working **1.3 Rectifier :** Definition, Classification Half wave and Full wave Rectifier : circuit diagram, working, comparison, merits and demerits. Filters, necessity, types, comparison, merits, demerits. **1.4 Transistor :** construction, symbol, operating principle, characteristics, configurations, comparison between CB, CE, CC , applications as switch and amplifier.
UNIT 2 OSCILLATORS(Weightage- 12 , Hrs- 07)	

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
2a. State Barkhausen criteria for oscillator. 2b.Classify oscillators. 2c. Draw circuit and explain working of Different types of oscillators.	2.1 Block diagram, Barkhausen Criteria for sustained oscillations, Oscillations in LC tank circuit; 2.2 Classification: LC and RC. Classification of RC Oscillator: Working of RC Phase shift and Wein Bridge Oscillator. 2.3 Classification of LC Oscillator: Working of Hartley , Colpitts , 2.4 Crystal Oscillator
UNIT 3 DIGITAL FUNDAMENTALS(Weightage- 12 , Hrs- 07)	
3a. Understand different numbering system with numerical examples 3b. Draw symbols for different logic gates with truth tables. 3c.Implement different Boolean laws using different gates. 3d. Verify De Morgan's theorem .	3.1Number systems: Decimal, Binary, Hexadecimal, Octal. 3.2Basic logic gates: AND, OR, NOT, NAND, NOR, EXOR symbols, IC numbers and Truth Table. 3.3Boolean Algebra: Fundamentals of Boolean algebra, Basic laws 3.4 De Morgan`s theorem,.
UNIT 4 LINEAR ICS (Weightage- 12 , Hrs- 07)	
4a. Draw symbol and pin diagram of IC 741. 4b. Define various parameters related to OP-AMP. 4c. Derive expression for various mathematical operation of OP-AMP.	4.1 OP AMP. IC 741, symbol, pin diagram, ideal and typical characteristics, 4.2 Applications such as Inverting, Non Inverting amplifier, Difference amplifier, adder, subtractor, Integrator, differentiator. (using closed loop system)
UNIT 5 INSTRUMENTATION (Weightage- 12 , Hrs- 05)	
5a. Draw and explain blocks of CRT, CRO and Function generator. 5b. State applications & specifications of CRO and Function generator.	5.1 CRO: Cathode Ray Tube, Oscilloscope Block diagram, operation, oscilloscope specifications, Applications. 5.2 Function generator, Block diagram, operation, specifications,

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
UNIT 6 TRANSDUCERS(Weightage- 12 , Hrs- 07)	
5a. Differentiate between sensor and transducer. 5b. Define and classify transducers. 5c. State selection criteria of transducer. 5d. Differentiate between Active- Passive, Primary-Secondary, and Analog- Digital transducers. 5e. Interpret working principle and application of Resistive, Capacitive, Inductive, Transducers (LVDT), photodiode, phototransistor, Piezoelectric Transducers	5.1 Definition, classification: Active, Passive, Primary, Secondary, Analog, Digital 5.2 Selection criteria for transducer 5. 3 Classification: Active, Passive, Primary, Secondary, Mechanical, Electronic, Analog, Digital, Resistive, Capacitive, Inductive Transducers. 5.4Construction, Operation, Applications : LVDT, RTD, Thermocouple , Photoelectric, Piezoelectric Transducers, PLC, Digital Readout Introduction (flow chart)

8. SUGGESTED SPECIFICATION TABLE FORQUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Semiconductor Devices	15	08	08	04	20
II	Oscillators	07	04	06	02	12
III	Digital Fundamentals	07	04	04	04	12
IV	Linear ICs	07	04	04	04	12
V	Instrumentation	05	02	04	06	12
VI	Sensors and Transducers	07	04	06	02	12
Total		48	24	32	24	80

9. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a. Prepare journals based on practical performed inlaboratory.
b. Study of datasheet of electronic components.
c. Prepare charts of symbols of Electronic components.
d. Search information about Ratings and specifications of Regulator, diodes, transistors, CRO, function generator.
e. Collect information of passive transducers and prepare charts of the same.
f. Prepare posters to illustrate the use of photoelectric sensors in remote controls.

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
c. With respect to item No.9, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
d. Guide student(s) in undertaking micro-projects.
e. Correlate subtopics with power plant system and equipments.
f. Use proper equivalent analogy to explain different concepts.
g. Use Flash/Animations to explain various components, operation and
h. Teacher should ask the students to go through instruction and Technical manuals

11. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs.(Affective Domain Outcomes) .Each student will have to maintain activity chart consisting of individual contribution in the project work and give a seminar presentation of it before submission.. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

a. Prepare a chart of different types of Resistors showing their specifications and applications
b. Prepare chart of different types of Capacitors showing their specifications and Application.
c. Prepare a chart of different types of Inductors showing their specifications and applications
d. Prepare a chart of different types of Diodes showing their specifications and applications
e. Prepare a chart of different types of Inductors showing their specifications and applications
f. Prepare a chart of different types of Rectifiers showing their specifications and applications
g. Prepare a chart of different types of Logic Gates and their truth tables.
h. Prepare a chart of different types of Sensors & Transducers showing their specifications and applications

12. SUGGESTED LEARNING RESOURCES

S.N.	Title	Author	Publisher, Edition , Year of publication and ISBN Number
1	Basic Electronics.	Albert Malvino	8th Edition,Tata McGraw Hill,2015ISBN10:1259200116ISBN13:9781259200113
2	Basic Electronics.	J.S. Katre	Edition 2017, Techmax PublishersISBN-10: 9350779641 ISBN-13: 978-9350779644
3	Basic Electronics.	B.L. Theraja	S Chand Publishing, 2007ISBN 10: 8121925568ISBN 13: 9788121925563
4	Linear Integrated Circuits	Ramakant Gaikwad	4TH EDITION, PHI Publication,ISBN 10: 8120320581ISBN 13: 9788120320581
5	Modern Digital Electronics	R P Jain	McGraw Hill Education Pvt. Ltd, 4th Edition, 2012ISBN 10: 0070669112ISBN 13: 9780070669116
6	Instrumentation	A K Sawheny	Nineteenth edition, 2017, Dhanpat Rai publication ISBN : 8177001006

13. SOFTWARE/LEARNING WEBSITES

1. www.nptel.com
2. http://www.electronics-tutorials
3. https://en.wikipedia.org/wiki/P%E2%80%93n_junction
4. https://learn.sparkfun.com/tutorials/transistors
5. http://www.pitt.edu/~qiw4/Academic/ME2082/Transistor%20Basics.pdf
6. http://faculty.cord.edu/luther/physics225/Handouts/transistors_handout.pdf
7. http://www.technologystudent.com/elec1

14. PO - COMPETENCY- CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	-	2	2	-	-	2
CO2	2	3	1	-	-	-	2
CO3	3	-	-	3	-	-	3
CO4	3	3	2	2	-	-	2
CO5	1	-	-	3	1	-	2
CO6	3	2	1	3	-	3	3

	PSO1	PSO2	PSO3	PSO4
CO1	-	-	-	1
CO2	-	-	-	1
CO3	-	-	-	1
CO4	-	-	-	1
CO5	-	-	-	1
CO6	-	-	-	1

Sign: Name: Shri.M .J. Deshpande Smt. M. S. Datar (Course Experts)	Sign: Name: Shri.R.N.Shikari (Head of Department)
Sign: Name: Prof. Namita Kadam (Program Head) (MetallurgyEngineering Dept.)	Sign: Name: ShriA.S.Zanpure (CDC)

GOVERNMENT POLYTECHNIC, PUNE

'180OB' – Scheme

Programme	Diploma in Computer Engineering
Programme code	01/02/03/04/05/**06**/07/08/15/16/17/18/19/21/22/23/24/**26**
Name of Course	**Fundamental of Electronics**
Course Code	**ET2107**
Prerequisite course code and name	**NA**
Class Declaration	**NO**

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)		Examination Scheme				
					Theory		Practical		Total Marks
L	T	P	C		ESE	PA	$ESE	PA	
03	--	02	05	Marks	80	20	25	25	150
				Exam Duration	3 Hrs	1 Hr	-	--	

($):OE (Oral Examination)

Legends: L-lecture, T-Tutorial/teacher guided theory practice, P-practical, ESE-End semester examination, PA- Progressive Assessment, # - Online theory exam

2. RATIONALE

In today's world most of the consumer appliances are based on electronic circuits and devices. The foundation for working of computer or any of its peripherals are based on electronics. This course has been designed to develop skills to understand and test simple electronic components and circuits. After studying this course students will develop an insight to identify, build and troubleshoot simple electronic circuits.

3. COMPETENCY

The aim of this course is to attend following industry identified competency through various teaching learning experiences:

- **Maintain electronic circuits comprising of discrete electronic components**.

4. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency**:**

1. Plot the characteristics of semiconductor devices.
2. Interpret working of oscillators.
3. Use OP-AMP IC in circuits.
4. Operate CRO and Function generator.
5. Select appropriate transducers for relevant applications

5. SUGGESTED PRACTICALS/ EXERCISES

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Relevant CO	Approximate Hours Required.
1.	1	Plot V-I characteristics of P-N junction diode.	1	02
2.		Plot V-I characteristics of the given Zener diode.	1	02
3.		Test performance of diode as Half wave and Full wave rectifier with and without filter.	1	04
4.		Plot the input and output characteristics of NPN transistor in CE configuration.	1	04
5.	2	Plot the characteristics of n-channel JFET.	1	02
6.	3	Calculate frequencyof oscillations for Crystal Oscillator.	2	02
7.		Observe input-output waveforms of Inverting Amplifier.	3	02
8.		Observe input-output waveforms of Non Inverting Amplifier.	3	02
9.		Observe input/output waveforms of Integrator.	3	02
10.		Observe input/output waveforms of Differentiator	3	02
11.	4	Study of front panelof C.R.O.	4	02
12.		Study of front panel of Function generator.	4	02
13.		Measure amplitude, Time period of sine, triangular and square wave with the help of CRO.	4	02
14.	5	Test performance of inductive transducer LVDT.	5	02
15	All	Complete a Micro- project based on guidelines provided in sr.no. 11.	All	04
		Total Hrs		**32**

Note: Any 12 practical's from sr. no. 1 – 14 can be performed and 15 is compulsory.

Sr.No.	Performance Indicators	Weightage in %
a.	Arrangement of available equipment / test rig or model	20
b.	Setting and operation	20
c.	Safety measures	10
d.	Observations and Recording	10
e.	Interpretation of result and Conclusion	20
f.	Answer to sample questions	10
g.	Submission of report in time	10
Total		**100**

6. MAJOR EQUIPMENT/ INSTRUMENTSREQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practical, as well as aid to procure equipment by authorities concerned**.**

Sr.No.	Major Equipment/ Instruments Required	Experiment Sr. No.
1	Variable DC Power supply 0-30V with display for voltage and current	3,4
2	Digital Multimeter	7,8
3	CRO	1,2,3,4,5,6,7,8,9,10,11,12,13
4	Function Generator	12,13
5	Different types of cables and connectors	All

7. THEORY COMPONENTS

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
UNIT 1. SEMICONDUCTOR DEVICES (Weightage-22 , Hrs- 14)	
1a. Plot V-I characteristics of PN Diode 1b. Define and Measure parameters of diode 1c. Implement Zener diode as voltage regulator. 1d. Compare salient features of the given type of rectifiers. 1e. Explain with sketches the working principle of the given transistor configuration. 1f. Analyze and differentiate between CE, CB, CC configurations	1.1 Rectifying diode: Review of P - type and N - type semiconductor, PN junction, Barrier voltage, depletion region, Junction Capacitance, Forward biased & reversed biased junction. Diode symbol , forward & reversed Characteristics of PN junction diode Specifications : Forward voltage drop , Reverse saturation current, maximum forward current , power dissipation ,Package view of diodes of different power ratings (to be shown during practical hours) 1.2 Zener diode : Construction ,Symbol ,characteristics (forward & reversed) Avalanche &Zener breakdown

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
1g. Derive relation between alpha and beta.	Specifications: Zener voltage , power dissipation , break over current, dynamic resistance & maximum reverse current (to be shown during practical hours) 1.3Rectifier : Half wave, Full wave and Bridge Rectifier, working principle, circuit diagram, performance parameters PIV, ripple factor, efficiency Need for filters: circuit diagram and working of 'L', 'C' and 'π'' filter. 1.4 Working principle and block diagram of regulated power supply. 1.5 Symbol, construction and working principle of LED 1.6 Transistor : construction, symbol, operating principle, characteristics, applications, rating and specifications, configurations, comparison between CB, CE, CC. Transistor as a switch and amplifier. Transistor parameters – alpha, Beta , input and output resistance and relation between alpha and beta
UNIT 2 FIELD EFFECT TRANSISTORS(Weightage- 14 , Hrs- 08)	
2a. Explain with sketches the working principle of the given transistor configuration. 2b. Determine the FET parameters from the given FET characteristics curve. 2c. Describe the specified JFET parameter. 2d. Describe the specified MOSFET parameter.	2.1 FET-Types: JFET and MOSFET 2.2 Classification of JFET 2.3 Symbol, construction and working principle of N-channel and P channel JFET, Drain and transfer characteristics of JFET 2.4 JFET parameters: DC and AC drain resistance, Transconductance, amplification factor 2.5 Symbol, construction and working principle of MOSFET.

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
UNIT 3 OSCILLATORS & LINEAR ICS (Weightage- 16 , Hrs- 10)	
3a. State Barkhausen criteria for oscillator. 3b.Classify oscillators. 3c. Describe how oscillations are produced in LC tank circuit. 3d. Explain with circuit diagram working of LC oscillators. 3e. Draw circuit and explain working of Crystal oscillator. 3f. Draw symbol and pin diagram of IC 741. 3g. Define various parameters related to OP-AMP. 3h. Derive expression for various mathematical operation of OP-AMP.	3.1 Block diagram, Barkhausen Criteria for sustained oscillations, classification of oscillator. Oscillations in LC tank circuit, Working of - Hartley,Colpitts, Clapp Oscillators Crystal oscillator : Diagram, Working principle 3.2 OP AMP. IC 741, symbol, pin diagram, ideal and typical characteristics, Applications such as Inverting , Non Inverting amplifier, Difference amplifier, adder , substractor , Integrator, differentiator.
UNIT 4 INSTRUMENTATION(Weightage- 12 , Hrs- 06)	
4a. Draw and explain blocks of CRT, CRO and Function generator. 4b. State applications & specifications of CRO and Function generator.	4.1 CRO: Cathode Ray Tube, Oscilloscope Block diagram, operation, oscilloscope specifications, Applications. 4.2 Function generator: Block diagram, operation, specifications, applications
UNIT 5 SENSORS & TRANSDUCERS(Weightage- 16 , Hrs- 10)	
5a. Differentiate between sensor and transducer. 5b. Define and classify transducers. 5c. State selection criteria of transducer. 5d. Differentiate between Active- Passive, Primary-Secondary, and Analog- Digital transducers. 5e. Interpret working principle and application of Resistive, Capacitive, Inductive, Transducers (LVDT), photodiode, phototransistor, Piezoelectric Transducers, proximity sensor transducers.	5.1 Definition, classification: Active, Passive, Primary, Secondary, Analog, Digital 5.2 Selection criteria for transducer 5.3 Construction, Operation, One example of -Resistive, Capacitive, Inductive, Transducers(LVDT), photodiode and phototransistor , Piezoelectric Transducers 5.4 Thermocouple, proximity sensor and its applications

8. SUGGESTED SPECIFICATION TABLE FORQUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Semiconductor Devices	14	08	08	06	22
II	Field Effect Transistors	08	04	06	04	14
III	Oscillators & Linear ICs	10	04	08	04	16
IV	Instrumentation	06	04	04	04	12
V	Sensors & Transducers	10	04	06	06	16
Total		48	**24**	**32**	**24**	**80**

9. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a. Prepare journals based on practical performed inlaboratory.
b. Study of datasheet of electronic components.
c. Prepare charts of symbols of Electronic components.
d. Search information about Ratings and specifications of Regulator, diodes, transistors, CRO, function generator.
e. Collect information of passive transducers and prepare charts of the same.
f. Prepare posters to illustrate the use of photoelectric sensors in remote controls.

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
c. With respect to item No.9, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
d. Guide student(s) in undertaking micro-projects.
e. Correlate subtopics with power plant system and equipment.
f. Use proper equivalent analogy to explain different concepts.
g. Use Flash/Animations to explain various components, operation and
h. Teacher should ask the students to go through instruction and Technical manuals

11. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs.(Affective Domain Outcomes) .Each student will have to maintain activity chart consisting of individual contribution in the project work and give a seminar presentation of it before submission.. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

a. Rectifier: Build a half wave rectifier for 5V, 500mA output current on general purpose PCB.
b. Rectifier: Build a full wave rectifier with filter capacitor for 5V, 500mA output current on general purpose PCB.
c. BJT: Build a circuit to switch ON and OFF the LED by using BJT as a switching component.
d. Oscillator: Build a LC tank circuit to generate 650Hz frequency.
e. Build adder circuit using OP-AMP 741 and implement it on PCB.
f. Build subtractor circuit using OP-AMP 741 and implement it on breadboard.
g. Build a circuit on breadboard to turn the relay ON and OFF by using Photodiode.
h. Prepare Display boards consisting of electronic components: Prepare display boards / models/ charts / posters to visualize the appearance of electronics active and passive components.
i. Use of sensors for driving relays / output devices: Build /test circuit on breadboard / General purpose PCB. Verify output of designed circuit by applying different inputs.

12. SUGGESTED LEARNING RESOURCES

S.N.	Title	Author	Publisher, Edition ,Year of publication and ISBN Number
1	Basic Electronics.	Albert Malvino	8thEdition,Tata McGraw Hill,2015 ISBN10:1259200116ISBN13:9781259200113
2	Basic Electronics.	J.S. Katre	Edition 2017, Techmax PublishersISBN-10: 9350779641 ISBN-13: 978-9350779644
3	Basic Electronics.	B.L. Theraja	S Chand Publishing, 2007 ISBN 10: 8121925568ISBN 13: 9788121925563
4	Linear Integrated Circuits	Ramakant Gaikwad	4TH EDITION, PHI Publication, ISBN 10: 8120320581ISBN 13: 9788120320581
5	Modern Digital Electronics	R P Jain	McGraw Hill Education Pvt. Ltd, 4th Edition,2012 ISBN 10: 0070669112ISBN 13: 9780070669116
6	Instrumentation	A K Sawheny	Nineteenth edition, 2017, DhanpatRai publication ISBN : 8177001006

13. SOFTWARE/LEARNING WEBSITES

1. www.nptel.com
2. http://www.electronics-tutorials
3. https://en.wikipedia.org/wiki/P%E2%80%93n_junction
4. https://learn.sparkfun.com/tutorials/transistors
5. http://www.pitt.edu/~qiw4/Academic/ME2082/Transistor%20Basics.pdf
6. http://faculty.cord.edu/luther/physics225/Handouts/transistors_handout.pdf
7. http://www.technologystudent.com/elec1
8. www.slideshare.net/manash234/classification-of-transducers
9. http://www.electrical4u.com/linear-variable-differential-transformer/

14. PO - COMPETENCY- CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	-	2	2	-	-	2
CO2	3	-	2	2	-	-	2
CO3	3	3	2	2	-	-	2
CO4	1	-	-	3	-	-	2
CO5	3	2	2	2	1	-	3

	PSO1	PSO2
CO1	3	--
CO2	3	--
CO3	3	--
CO4	3	--
CO5	3	--

Sign: Name: Shri. N. D. Toradmal Smt.V.S.Sabnis (Course Experts)	Sign: Name:Shri.R.N.Shikari (Head of Department)
Sign: Name:Smt.S.B.Nikam (Program Head) (Computer Engineering Dept.)	Sign: Name:Shri A.S.Zanpure (CDC)

GOVERNMENT POLYTECHNIC, PUNE

'180OB' – Scheme

Programme	**Diploma in Information Technology**
Programme code	01/02/03/04/05/06/**07**/08/15/16/17/18/19/21/22/23/24/26
Name of Course	**Fundamental of Electronics**
Course Code	**ET2107**
Prerequisite course code and name	**NA**
Class Declaration	**NO**

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)		Examination Scheme				
					Theory		Practical		Total Marks
L	T	P	C		ESE	PA	$ESE	PA	
03	--	02	05	Marks	80	20	25	25	150
				Exam Duration	3 Hrs	1 Hr	--	--	

($):OE (Oral Examination)

Legends: L-lecture, T-Tutorial/teacher guided theory practice, P-practical, ESE-End semester examination, PA- Progressive Assessment, # - Online theory exam

2. RATIONALE

In today's world most of the consumer appliances are based on electronic circuits and devices. The foundation for working of computer or any of its peripherals are based on electronics. This course has been designed to develop skills to understand and test simple electronic components and circuits. After studying this course students will develop an insight to identify, build and troubleshoot simple electronic circuits.

3. COMPETENCY

The aim of this course is to attend following industry identified competency through various teaching learning experiences:

- **Maintain electronic circuits comprising of discrete electronic components**.

4. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency**:**

1. Plot the characteristics of semiconductor devices.
2. Interpret working of oscillators.
3. Use OP-AMP IC in circuits.
4. Operate CRO and Function generator.
5. Select appropriate transducers for relevant applications

5. SUGGESTED PRACTICALS/ EXERCISES

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Relevant CO	Approximate Hours Required.
1.	1	Plot V-I characteristics of P-N junction diode.	1	02
2.		Plot V-I characteristics of the given Zener diode.	1	02
3.		Test performance of diode as Half wave and Full wave rectifier with and without filter.	1	04
4.		Plot the input and output characteristics of NPN transistor in CE configuration.	1	04
5.	2	Plot the characteristics of n-channel JFET.	1	02
6.	3	Calculate frequencyof oscillations for Crystal Oscillator.	2	02
7.		Observe input-output waveforms of Inverting Amplifier.	3	02
8.		Observe input-output waveforms of Non Inverting Amplifier.	3	02
9.		Observe input/output waveforms of Integrator.	3	02
10.		Observe input/output waveforms of Differentiator	3	02
11.	4	Study of front panelof C.R.O.	4	02
12.		Study of front panel of Function generator.	4	02
13.		Measure amplitude, Time period of sine, triangular and square wave with the help of CRO.	4	02
14.	5	Test performance of inductive transducer LVDT.	5	02
15	All	Complete a Micro- project based on guidelines provided in sr.no. 11.	All	04
		Total Hrs		**32**

Note: Any 12 practicals from sr. no. 1 – 14 can be performed and 15 is compulsory.

S.No.	Performance Indicators	Weightage in %
a.	Arrangement of available equipment / test rig or model	20
b.	Setting and operation	20
c.	Safety measures	10
d.	Observations and Recording	10
e.	Interpretation of result and Conclusion	20
f.	Answer to sample questions	10
g.	Submission of report in time	10
Total		**100**

6. MAJOR EQUIPMENT/ INSTRUMENTSREQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practical, as well as aid to procure equipment by authorities concerned**.**

Sr.No.	Major Equipment/ Instruments Required	Experiment Sr. No.
1	Variable DC Power supply 0-30V with display for voltage and current	3,4
2	Digital Multimeter	7,8
3	CRO	1,2,3,4,5,6,7,8,9,10,11,12,13
4	Function Generator	12,13
5	Different types of cables and connectors	All

7. THEORY COMPONENTS

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
UNIT 1. SEMICONDUCTOR DEVICES (Weightage-22 , Hrs- 14)	
1a. Plot V-I characteristics of PN Diode 1b. Define and Measure parameters of diode 1c. Implement Zener diode as voltage regulator. 1d. Compare salient features of the given type of rectifiers. 1e. Explain with sketches the working principle of the given transistor configuration. 1f. Analyze and differentiate between CE, CB, CC configurations	1.1 Rectifying diode: Review of P - type and N - type semiconductor, PN junction, Barrier voltage, depletion region, Junction Capacitance, Forward biased & reversed biased junction. Diode symbol , forward & reversed Characteristics of PN junction diode Specifications : Forward voltage drop , Reverse saturation current, maximum forward current , power dissipation ,Package view of diodes of different power ratings (to be shown during practical hours) 1.2 Zener diode : Construction ,Symbol ,characteristics (forward & reversed) Avalanche &Zener breakdown

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
1g. Derive relation between alpha and beta.	Specifications: Zener voltage , power dissipation , break over current, dynamic resistance & maximum reverse current (to be shown during practical hours) 1.3Rectifier : Half wave, Full wave and Bridge Rectifier, working principle, circuit diagram, performance parameters PIV, ripple factor, efficiency Need for filters: circuit diagram and working of 'L', 'C' and 'π'' filter. 1.4 Working principle and block diagram of regulated power supply. 1.5 Symbol, construction and working principle of LED 1.6 Transistor : construction, symbol, operating principle, characteristics, applications, rating and specifications, configurations, comparison between CB, CE, CC. Transistor as a switch and amplifier. Transistor parameters – alpha, Beta , input and output resistance and relation between alpha and beta
UNIT 2 FIELD EFFECT TRANSISTORS(Weightage- 14 , Hrs- 08)	
2a. Explain with sketches the working principle of the given transistor configuration. 2b. Determine the FET parameters from the given FET characteristics curve. 2c. Describe the specified JFET parameter. 2d. Describe the specified MOSFET parameter.	2.1 FET-Types: JFET and MOSFET 2.2 Classification of JFET 2.3 Symbol, construction and working principle of N-channel and P channel JFET, Drain and transfer characteristics of JFET 2.4 JFET parameters: DC and AC drain resistance, Transconductance, amplification factor 2.5 Symbol, construction and working principle of MOSFET.
UNIT 3 OSCILLATORS & LINEAR ICS (Weightage- 16 , Hrs- 10)	

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
3a. State Barkhausen criteria for oscillator. 3b.Classify oscillators. 3c. Describe how oscillations are produced in LC tank circuit. 3d. Explain with circuit diagram working of LC oscillators. 3e. Draw circuit and explain working of Crystal oscillator. 3f. Draw symbol and pin diagram of IC 741. 3g. Define various parameters related to OP-AMP. 3h. Derive expression for various mathematical operation of OP-AMP.	3.1 Block diagram, Barkhausen Criteria for sustained oscillations, classification of oscillator. Oscillations in LC tank circuit, Working of - Hartley, Colpitts, Clapp Oscillators Crystal oscillator : Diagram, Working principle 3.2 OP AMP. IC 741, symbol, pin diagram, ideal and typical characteristics, Applications such as Inverting , Non Inverting amplifier, Difference amplifier, adder , substractor , Integrator, differentiator.
UNIT 4 INSTRUMENTATION(Weightage- 12 , Hrs- 06)	
4a. Draw and explain blocks of CRT, CRO and Function generator. 4b. State applications & specifications of CRO and Function generator.	4.1 CRO: Cathode Ray Tube, Oscilloscope Block diagram, operation, oscilloscope specifications, Applications. 4.2 Function generator: Block diagram, operation, specifications, applications
UNIT 5 SENSORS & TRANSDUCERS(Weightage- 16 , Hrs- 10)	
5a. Differentiate between sensor and transducer. 5b. Define and classify transducers. 5c. State selection criteria of transducer. 5d. Differentiate between Active- Passive, Primary-Secondary, and Analog- Digital transducers. 5e. Interpret working principle and application of Resistive, Capacitive, Inductive, Transducers (LVDT), photodiode, phototransistor, Piezoelectric Transducers, proximity sensor transducers.	5.1 Definition, classification: Active, Passive, Primary, Secondary, Analog, Digital 5.2 Selection criteria for transducer 5.3 Construction, Operation, One example of -Resistive, Capacitive, Inductive, Transducers(LVDT), photodiode and phototransistor , Piezoelectric Transducers 5.4 Thermocouple, proximity sensor and its applications

8. SUGGESTED SPECIFICATION TABLE FORQUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Semiconductor Devices	14	08	08	06	22
II	Field Effect Transistors	08	04	06	04	14
III	Oscillators & Linear ICs	10	04	08	04	16
IV	Instrumentation	06	04	04	04	12
V	Sensors & Transducers	10	04	06	06	16
Total		48	**24**	**32**	**24**	**80**

9. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a. Prepare journals based on practical performed inlaboratory.
b. Study of datasheet of electronic components.
c. Prepare charts of symbols of Electronic components.
d. Search information about Ratings and specifications of Regulator, diodes, transistors, CRO, function generator.
e. Collect information of passive transducers and prepare charts of the same.
f. Prepare posters to illustrate the use of photoelectric sensors in remote controls.

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
c. With respect to item No.9, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
d. Guide student(s) in undertaking micro-projects.
e. Correlate subtopics with power plant system and equipments.
f. Use proper equivalent analogy to explain different concepts.
g. Use Flash/Animations to explain various components, operation and
h. Teacher should ask the students to go through instruction and Technical manuals

11. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs.(Affective Domain Outcomes) .Each student will have to maintain activity chart consisting of individual contribution in the project work and give a seminar presentation of it before submission.. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

a. Rectifier: Build a half wave rectifier for 5V, 500mA output current on general purpose PCB.
b. Rectifier: Build a full wave rectifier with filter capacitor for 5V, 500mA output current on general purpose PCB.
c. BJT: Build a circuit to switch ON and OFF the LED by using BJT as a switching component.
d. Oscillator: Build a LC tank circuit to generate 650Hz frequency.
e. Build adder circuit using OP-AMP 741 and implement it on PCB.
f. Build subtractor circuit using OP-AMP 741 and implement it on breadboard.
g. Build a circuit on breadboard to turn the relay ON and OFF by using Photodiode.
h. Prepare Display boards consisting of electronic components: Prepare display boards / models/ charts / posters to visualize the appearance of electronics active and passive components.
i. Use of sensors for driving relays / output devices: Build /test circuit on breadboard / General purpose PCB. Verify output of designed circuit by applying different inputs.

12. SUGGESTED LEARNING RESOURCES

S.N.	Title	Author	Publisher, Edition ,Year of publication and ISBN Number
1	Basic Electronics.	Albert Malvino	8thEdition,Tata McGraw Hill,2015ISBN10:1259200116ISBN13:9781259200113
2	Basic Electronics.	J.S.Katre	. Edition 2017, Techmax PublishersISBN-10: 9350779641 ISBN-13: 978-9350779644
3	Basic Electronics.	B.L.Theraja	S Chand Publishing, 2007 ISBN 10: 8121925568 ISBN 13: 9788121925563
4	Linear Integrated Circuits	RamakantGaikwad	4TH EDITION, PHI Publication, ISBN 10: 8120320581ISBN 13: 9788120320581
5	Modern Digital Electronics	R P Jain	McGraw Hill Education Pvt. Ltd, 4th Edition,2012 ISBN 10: 0070669112ISBN 13: 9780070669116
6	Instrumentation	A K Sawheny	Nineteenth edition, 2017, DhanpatRai publication ISBN : 8177001006

13. SOFTWARE/LEARNING WEBSITES

1. www.nptel.com
2. http://www.electronics-tutorials
3. https://en.wikipedia.org/wiki/P%E2%80%93n_junction
4. https://learn.sparkfun.com/tutorials/transistors
5. http://www.pitt.edu/~qiw4/Academic/ME2082/Transistor%20Basics.pdf
6. http://faculty.cord.edu/luther/physics225/Handouts/transistors_handout.pdf
7. http://www.technologystudent.com/elec1
8. www.slideshare.net/manash234/classification-of-transducers
9. http://www.electrical4u.com/linear-variable-differential-transformer/

14. PO - COMPETENCY- CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	-	2	2	-	-	2
CO2	3	-	2	2	-	-	2
CO3	3	3	2	2	-	-	2
CO4	1	-	-	3	-	-	2
CO5	3	2	2	2	1	-	3

	PSO1	PSO2	PSO3
CO1	3	--	1
CO2	3	--	1
CO3	3	--	1
CO4	3	--	1
CO5	3	--	1

Sign: Name: Shri. N. D. Toradmal Smt.V.S.Sabnis (Course Experts)	Sign: Name:Shri.R.N.Shikari (Head of Department)
Sign: Name:Smt.M.U.Kokate (Program Head) (Information& Technology Dept.)	Sign: Name:Shri A.S.Zanpure (CDC)

GOVERNMENT POLYTECHNIC, PUNE

'180OB' – SCHEME

Programme	Diploma in Electrical Engineering
Programme code	01/**02**/03/04/05/06/07/08/15/**16**/17/18/19/21/**22**/23/24/26
Name of Course	**Electronic Components and Circuits**
Course Code	**ET2108**
Prerequisite	**NA**
Class Declaration	**NO**

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)		Examination Scheme				
					Theory		Practical		Total Marks
L	T	P	C		ESE	PA	$ESE (OE)	PA	100
02	-	02	04	Marks	40	10	25	25	
				Exam Duration	2 Hrs	1 Hr	-	-	

($):OE (Oral Examination)

Legends: L-lecture, T-Tutorial/teacher guided theory practice, P-practical, ESE-End semester examination, PA- Progressive Assessment, # - Online theory exam

2. RATIONALE

Diploma engineers have to deal with the various electronic components while maintaining various electrical systems. The basic operating principles of various electronics devices will help them to troubleshoot electronics equipments used in electrical system. This course is developed in such a way that, students will be able to recognize broad electronic engineering application in electrical engineering field.

3. COMPETENCY

The aim of this course is to attend following industry identified competency through various teaching learning experiences:

- **Use electronic components and circuits in electrical equipments.**

4. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency**:**

1. Use relevant diode in different electronic circuits.
2. Utilization of diode in rectifiers and filters.
3. Use BJT in electronics circuits

4. Build the DC regulated power supply using Zener diode & transistor.

5. SUGGESTED PRACTICALS/ EXERCISES

S. No.	Unit No.	Practical Exercises (Learning Outcomes in Psychomotor Domain)	Relevant CO	Approx. Hrs. required
1	1	Test the performance of PN junction diode	1	2
2	1	Test the performance of Zener diode	1	2
3	1	Test the performance of photo diode by varying the light intensity as well as the distance of the light source.	1	2
4	2	Build/ Test the half wave rectifier on bread board with and without filter	2	2
5	2	Build/ Test the full bridge rectifier using IC DF10 or any other suitable IC.	2	4
6	2	Use π filter with bridge rectifier to measure ripple factor	2	4
7	3	Test the performance of BJT working in CE mode	3	2
8	3	Test the performance of BJT working in CB mode	3	2
9	4	Test the performance of transistorized series voltage regulator for the given load regulation.	4	2
10	4	Build and Test regulated dc power supply using Zener diode.	4	2
11	4	Observe the regulation parameters such as line and load of voltage regulator IC78XX/79XX	4	2
12	4	Find out faults at different stages of regulated dc power supply.	4	2
13	All	Complete a Micro- project based on guidelines provided in sr.no. 11.	All	4
		Total Hrs		32

Note: All practicals are compulsory.

S.No.	Performance Indicators	Weightage in %
a.	Arrangement of available equipment / test rig or model	20
b.	Setting and operation	20
c.	Safety measures	10
d.	Observations and Recording	10
e.	Interpretation of result and Conclusion	20
f.	Answer to sample questions	10
g.	Submission of report in time	10
Total		**100**

6. MAJOR EQUIPMENT/ INSTRUMENTSREQUIRED

The major equipment with broad specification mentioned here will used in uniformity in conduct of practicals, as well as aid to procure equipment by authorities concerned**.**

S. No.	Equipment Name with Broad Specifications	Experiment Sr.No.
1	Variable DC power supply 0-30V, 2A, SC protection, display for voltage and current	1,2,3,7,6,10,11,12

S. No.	Equipment Name with Broad Specifications	Experiment Sr.No.
2	CRO Dual Trace 20MHz, 1MegaOhm, Input Impedance	4,5,6
3	Function Generator 0-2MHz with sine ,square and triangular output with variable frequency and amplitude	4,5,6
4	Digital Multimeter: 3 ½ digit display, 9999 counts digital multimeter. Measure Vac , Vdc ,Aac,Adc	All
5	Different types of cables and connectors	All

7. THEORY COMPONENTS

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
UNIT 1. Semiconductor Diode(Weightage-08 , Hrs- 06)	
1a .Describe the construction & working of principle of semiconductor diode 1b. Differentiate between conductor, Insulator, semiconductor 1c. Describe working principle, characteristics, and application of the given type of diode 1d. Describe effect of temperature on the given type of diode	1.1Difference between conductor, insulator, semiconductor 1.2 N type material, P type material 1.3 Different types of Semiconductor 1.4 Construction, Symbol, working principle , applications, Forward & reverse biasing & V-I characteristics of following diodes P-N junction diode & Zener diode, 1.5 Special diodes : LED, Photo diode, LASER diode, power diode
UNIT II. Rectifier and Filter(Weightage-10 , Hrs- 08)	
2a. Describe working of given Type of rectifier 2b.Calculate ripple factor, PIV, and efficiency of the given type of filter. 2c. Describe the need and working of rectifier filter 2d. Select clipper or clamper for obtaining the given waveform.	2.1 Types of Rectifier : Half wave, Full Wave, Bridge rectifier circuit and operation, Input-output waveform for voltage & current. 2.2 Parameters of rectifier: Average DC value, value of current & voltage, ripple factor, ripple frequency, PIVof diode, TUF. Efficiency of Rectifier 2.3 Types of Filters: Shunt capacitor, Series inductor, LC and CLC filter
UNIT III. Bipolar Junction Transistor(Weightage-14 , Hrs- 12)	
3a.Describe the working principle of the given type of transistor 3b.Compare configuration of transistors. 3c. Justify the need of biasing method. 3d. Describe the procedure to minimize the thermal runaway effect for the given type of transistor biasing circuit.	3.1 Different types of transistors construction and working : PNP, NPN transistor 3.2 Transistor configurations: CB, CE, CC Transistor characteristics (input, output,) in different transistor configuration 3.3 Transistor as a switch 3.4 Concept of power transistor
UNIT IV. Regulator and Power Supply(Weightage-08 , Hrs- 06)	
4a. Describe working of the given transistorized regulator 4b. Describe the working of the given	4.1 Basic block diagram of DC regulated power supply 4.2 Load and Line regulation

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
block of the DC regulated power supply in the block diagram. 4c.Calculate output voltage of the given Zener voltage regulator circuit. 4d. Calculate load and line regulation of the given transistorized regulator.	4.3 Zener diode voltage regulator 4.4 Transistorized series and shunt regulator - circuit diagram and working

8. SUGGESTED SPECIFICATION TABLE FORQUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Semiconductor Devices	06	2	4	2	08
II	Rectifier and Filter	08	2	4	4	10
III	Bipolar Junction Transistor	12	4	6	4	14
IV	Regulator and Power Supply	06	2	2	4	08
Total		**32**	**10**	**16**	**14**	**40**

9. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a. Prepare Journals based on Practical performed in laboratory.
b. Test different diodes using CRO.
c. Give seminar on any relevant topic.
d. Library survey regarding different data books and manuals.
e. Undertake a market survey of different semiconductor components.
f. Trace various electronics components in electrical equipment.

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
c. With respect to item No.9, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
d. Guide student(s) in undertaking micro-projects.
e. Correlate subtopics with power plant system and equipments.

f. Use proper equivalent analogy to explain different concepts.
g. Use Flash/Animations to explain various components, operation and
h. Teacher should ask the students to go through instruction and Technical manuals

11. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs.(Affective Domain Outcomes) .Each student will have to maintain activity chart consisting of individual contribution in the project work and give a seminar presentation of it before submission.. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

a. Build a circuit to clip a positive half cycle at 1.5v of a waveform with input signal 5Vpp. And prepare the report.
b. Build a circuit to clamp a waveform at 3.0V using photo diaode and passive component.
c. Build a circuit to turn the relay on and off by using photo diode.
d. Build a circuit for half wave rectifier with capacitor filter.
e. Build a circuit for full wave rectifier with capacitor filter.
f. Build a circuit of DC regulated power supply.
g. Build a circuit of simple water level controller.
h. Build a rain alarm circuit.
i. Build a circuit for inverter using transistors.
j. Build a simple LED flash light circuit.

12. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publisher, Edition ,Year of publication and ISBN Number
1	Applied Electronics	R.S.Sedha	S.Chand Publishing, 2008 ISBN -8121927838
2	Electronic Devices and Circuit Theory	Robert L. Boylestad, LouisNashelsky	Pearson Education ISBN – 978-0-13-262226-4
3	Principle of Electronics	V.K.Mehta	S.Chand Publishing ISBN -9789352838363
4	Basic Electronic Engineering	Sunil T. Gaikwad Vijay Baru, R. Kaduskar,	Dreamtech Press ISBN 978-9350040126

13. SOFTWARE/LEARNING WEBSITES

1. www.nptel.iitm.ac.in
2. www.khanacademy.com
3. www.williamson-labs.com
4. www.datasheetcafe.com

14.PO - COMPETENCY- CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2	--	--	2	--	1	--
CO2	--	2	3	2	2	1	2
CO3	2	--	2	2	--	1	--
CO4	--	3	3	2	3	3	2

	PSO1	PSO2	PSO3	PSO4
CO1	--	1	--	1
CO2	1	1	2	2
CO3	--	1	--	1
CO4	1	1	2	2

Sign: Name: Dr.V.K.Jadhav Smt. P.G.Gahukar Smt.V.S.Sabnis (Course Experts)	Sign: Name:Shri.R.N.Shikari (Head of Department)
Sign: Name:Smt.M.A.Chigteri (Program Head) (Electrical Dept.)	Sign: Name: Shri A.S.Zanpure (CDC)

Government Polytechnic, Pune

'180OB' – Scheme

Programme	**Diploma in Electrical Engineering**
Programme code	01/**02**/03/04/05/06/07/08/15/**16**/17/18/19/21/**22**/23/24/26
Name of Course	**Digital Techniques and Applications**
Course Code	**ET3101**
Prerequisite course code and name	**ET2108 Electronics components Circuits**

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)		Examination Scheme				
					Theory		Practical		Total Marks
L	T	P	C		ESE	PA	*ESE	PA	
03	00	02	05	Marks	80	20	25	25	150
				Exam Duration	3 Hrs	1 Hr	-	-	

(*):OE/POE (Oral Examination/Practical&Oral Examination mention whichever is applicable)

Legends: L-lecture, T-Tutorial/teacher guided theory practice, P-practical, ESE-End semester examination, PA- Progressive Assessment, # - Online theory exam

2. RATIONALE

Now a day's application of digital circuits like computers,mobiles, automation and control circuits are extensively used in the field of electrical engineering and electrical power systems. The knowledge of basic logic gates, combinational and sequential logic circuits using discrete gates as well as digital ICs will enable the students to interpret the working of equipment and maintain them .So the digital technique has been introduced as a subject in electrical engineering curriculum. This course covers digital circuits logic gates, Flip-flop, data converter, memory and their applications. After completion of the course,students will be able to develop digital based application.

3. COMPETENCY

The aim of this course is to attend following industry identified competency through various teaching learning experiences:

- **Maintain electronic circuits comprising of discrete electronic components**.

4. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency**:**

1.Use number system and codes for interpreting working of digital system.
2. Use Boolean expressions to realize logic circuits.
3. Build simple combinational and sequential circuits.
4. Describe architecture and operation of microprocessor 8085
5.Understand the functions of various data converters and memories

5. SUGGESTED PRACTICALS/ EXERCISES

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Relevant CO	Approximate Hours Required.
1	2	To check different IC's using IC tester	All	2
2		Verify Truth table of basic logic gates ,universal gate	2	2
3		Verify NAND and NOR gate as universal logic gate.	2	2
4		Verify De Morgan's Theorem	2	2
5	3	Design half Adder & half subtractor	3	2
6		Verify the operation of Multiplexer IC 74151	3	2
7		Verify the operation of Demultiplexer IC 74155	3	2
8		Construct and test BCD to seven segment decoder using IC 7447/7448	3	4
9		Verify truth table of Encoder &Decoder	3	2
10	4	Realize and verify RS flip flop using NAND gate	3	2
11		Test function of master slave JK Flip-Flop using IC 7476	3	2
12		Realize T and D flip flop and verify its truth table.	3	2
13	6	Implement 3 bit R-2R D/A converter	5	4
14		Verify the operational features of ADC – IC 0809/IC 0808 and DAC 0800	5	2
15	All	Complete a Micro- project based on guidelines provided in sr.no. 11.	All	04
		Total Hrs		**32**

Note: Any 12 practicals from sr. no. 1 – 14 can be performed and 15 is compulsory.

S.No.	Performance Indicators	Weightage in %
a.	Arrangement of available equipment / testing or model	20
b.	Setting and operation	20
c.	Safety measures	10
d.	Observations and Recording	10
e.	Interpretation of result and Conclusion	20
f.	Answer to sample questions	10
g.	Submission of report in time	10

S.No.	Performance Indicators	Weightage in %
Total		100

6. MAJOR EQUIPMENT/ INSTRUMENTSREQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practical, as well as aid to procure equipment by authorities concerned**.**

Sr.No.	Major Equipment/ Instruments Required	Experiment Sr. No.
1	**Digital IC Tester**	All
2	Variable DC Power supply 0-30V with display for voltage and current	All
3	Digital Multimeter	1,2,4,14
4	CRO	10,11,12,13,14
5	Function Generator	13,14
6	Pulse Generator	10,11,12,13,14
7	Different types of cables and connectors	All

7. THEORY COMPONENTS

Unit Outcomes Os) (in cognitive domain)	Topics and Sub-topics
UNIT 1.Number System and Codes(Weightage-14, Hrs- 08)	
1a.Recognize andconvert the given number into the specified number system. 1b. Perform the binary arithmetic operation on the given binary numbers 1c. Find 1's compliments and 2's compliment of given no. 1d Add the given two decimal numbers using BCD code.	• 1.1Analog signal Vs Digital signal • 1.2Number system: Decimal, Binary,octal, hexadecimal conversion of onessystem into other • 1.3 Binary Arithmetic: - Addition, Subtraction(1's and 2's complement) Multiplication, Division, • 1.4 BCD Arithmatic: BCD addition • 1.5Codes:BCD,GreyCode,Excess-3,ASCIIcodes
UNIT 2Logic Gates and Logic Families(Weightage-12, Hrs- 06)	

Unit Outcomes Os) (in cognitive domain)	Topics and Sub-topics
2a Design the basic gate using NAND and NOR gate. 2b. Simplify the given expression using Boolean laws. 2c. Design logic circuits using the given Boolean Expression. 2d. Compare the silent characteristics of given digital logic families.	• 2.1 Logic Gates:Symbol ,logical expression,truth table, pin diagram of TTL logic gates ICs of basic logic gate (AND,OR,NOT), Universal gates(NAND and NOR),Special purpose gates(EX-OR,EX-NOR) • 2.2 Boolean algebra: Laws of Boolean algebra,Duality Theorem, De Morgan's theorems. • 2.3 Logic families:Characteristics of logic families(Noise Margin,power dissipation,figure of merit,Fan-in& fan -out , speed of operation,Comparison between different logic families.TTL NAND gate – Totem pole output,CMOS Inverter
UNIT 3Combinational Logic Circuits(Weightage- 18 , Hrs- 12)	
3a. Design logic circuits in standard SOP/POS forms for given logical expression. 3b. Minimize the given logic expression using K-map. 3c. Draw MUX/DEMUX tree for the given number of input and output lines. 3d. Design code converter using k map	• 3.1 Standard Boolean representation:Sum of product(SOP) & product of sum(POS),Min term and Maxterm conversion between SOP and POS forms. Realization using NAND /NOR gates • 3.2K-map reduction techniques: minimization of Boolean functions upto 4 variable using SOP & POS Forms • 3.3 Design of arithmetic circuits using K-maps: Half and Full Adder, Half and Full Subtractor • 3.4 Encoder&Decoder : Basic of Encoder and decoder , Decimal to BCD Encoder , IC 7447 as BCD to 7 segmentdecoder • 3.5 Multiplexers(MUX) and Demultiplexers (DEMUX): study of IC 74151 ,MUX tree, study of IC 74155 as DEMUX ,DEMUX Tree, DEMUX as decoder
UNIT 4 Sequential Logic circuit(Weightage- 16 , Hrs- 10)	
4a. Use relevant triggering technique for the given digital circuit. 4b.Use the given Flip flop to construct the specific type of counter.	• 4.1Basic memory cell: RS latch – using NAND & NOR. • 4.2 Triggering methods: Edge and level trigger • 4.3 S R Flip flop: SR- Flip flop ,Clocked SR flip flop with preset and clear, Drawbacks of SR Flip flop • 4.4 JK Flip flops: Clocked JK Flip flop with preset & clear, Race around condition in JK flip-flop,Master slave JK flip flop.

Unit Outcomes Os) (in cognitive domain)	Topics and Sub-topics
4c. Design synchronous and Asynchronous counter using excitation table . 4d.Design ring /twisted ring counter using the given flip-flop. 4e. Design 4 bit shift register using given flip flop.	D and T type flip flop. Excitation table of flip flops • 4.5 Shift Register: Logic diagram of 4 bit shift registers –Serial input serial output, Serial input parallel output, Parallel input serial output, Parallel input parallel output. • 4.6 Counters : Asynchronous counter: 4 bit Ripple counter , 4 bit up/down Counter, modulus of counter, Synchronous counter: Design of 4 bit synchronous up/down counter • 4.7 Applications of Shift Register: Ring counter, Twisted ring counter(Logic Diagram with waveforms)
UNIT 5Introduction to Microprocessor(Weightage-08, Hrs- 04)	
5a.Explain with sketches the architechure and pin diagram of the Intel 8085 Microprocessor 5b. Define BUS and explain different type of bus.	• 5.1 Microprocessor as Physical system, pin diagram & Pin configuration of Intel 8085 Microprocessor. • 5.2 Architecture and organization of INTEL 8085. • 5.3 Data bus, Control bus, Address bus, CPU, ALU, accumulator.
UNIT 6Data converter &Memories(Weightage-12, Hrs- 08)	
6a. Calculate the output voltage of R-2R ladder for the given specified digital input. 6b. Calculate the output voltage of the weighted resistor DAC for the given specified digital input. 6c. Explain with sketches the working principle of the given type of ADC and DAC 6d. State classification of Memory. 6e. Explain with sketches the working principle of memories. 6f. Compare different types of memories	• 6.1Digital to Analog converter: Types of DAC: Weighted resistor method and R-2R Method (along with Mathematical derivation) • 6.2Analog to Digital converter :Single slope ADC, Dual slope ADC,SAR ADC(Block diagram &working) • 6.3Classification of memory and Principle of operation :Types of memory RAM (Static, Dynamic), Volatile and Non-Volatile,ROM (PROM, EPROM, EEPROM),Flash memory, • 6.4Comparison: Comparison between RAM (Static, Dynamic), Volatile and Non-Volatile, ROM (PROM, EPROM, EEPROM), Flash memory

8. SUGGESTED SPECIFICATION TABLE FORQUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	**Number System and Codes**	08	04	08	02	14
II	**Logic Gates and Logic Families**	06	02	04	06	12
III	**Combinational Logic Circuits**	12	04	08	06	18
IV	**Sequential Logic circuit**	10	04	08	04	16
V	**Introduction to Microprocessor**	04	04	04	00	08
VI	**Data converter &Memories**	08	06	04	02	12
Total		48	**20**	**38**	**22**	**80**

9. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a. Prepare the survey report on the applications of different types of number system and code converters used in the design of digital system.
b. Test digital IC's using various testing equipment like digital IC tester, digital multi-meter etc.
c. Prepare charts of symbols, truth table, pin diagram of different logic gates.
d. Give seminar on any course relevant topic
e. Conduct library/internet survey regarding different data sheet and manuals.
f. Prepare power point presentation on digital circuits and their application.
g. Undertake a market survey of different digital IC's and different microprocessors IC's required for different applications
h. Search for video / animation / power point presentation on internet for complex topic related to the course and make a presentation.

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
c. 'L'in item No 1 does not mean only the traditional lecture method but different types of teaching methods and media that are to be employed to develop the outcomes
d. Use proper equivalent analogy to explain different concepts.
e. Use Flash/Animations to explain various components, operation and
f. Teacher should ask the students to go through instruction and Technical manuals

11. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs.(Affective Domain Outcomes) .Each student will have to maintain activity chart consisting of individual contribution in the project work and give a seminar presentation of it before submission.. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

a. Built a circuit to test 7 segment display
b. Build a circuit to add 4 bit adder
c. Build a circuit for LED Flasher
d. Generate a triangular wave using Microprocessor
e. Design a memory map to interface 8 bit 2K ROM & 4K to 8085 Microprocessor
f. Any project related to topics in curriculum given by course teacher

12. SUGGESTED LEARNING RESOURCES

S.N.	Title	Author	Publisher, Edition ,Year of publication and ISBN Number
1	Modern Digital Electronics	R P Jain	McGraw Hill Education Pvt. Ltd, 4th Edition,2012ISBN 10: 0070669112 ISBN 13: 9780070669116
2	Digital circuits and Design	Salivahanan S.;Arivazhagan S.	ISBN-10: 9789325960411
3	Digital Electronics	Puri V.K.	ISBN :97800746331751
4	Digital Principles	MalvinA.P.;Leach D.P.;SahaG.	ISBN :9789339203405
5	Digital Design	Mano,Morris;Ciletti,Michael D	ISBN :9780131989245
6	Digital Electronics,Principles and Integrated circuit	Maini,Anil K	ISBN :9780470032145
7	Microprocessor Architecture,Programming,and application with the 8085	Ramesh S.Gaonkar	ISBN-10:8187972092,ISBN-13:9788187972099

13. SOFTWARE/LEARNING WEBSITES

1. www.cse.yorku.ca/~mack/1011/01.NumberSystems.ppt
2. www.people.sju.edu/~ggrevera/arch/slides/binary-arithmetic.ppt
3. www.mathsisfun.com/binary-number-system.html
4. www.codesandtutorials.com/hardware/electronics/digital_codes-types.php
5. www.ee.surrey.ac.uk/Projectys/Labview/gatesfunc/
6. www.ee.surrey.ac.uk/Projectys/Labview/boolalgebra/
7. www.eng.auburn.edu/~strouce/class/elec2200/elec2200-8.pdf
8. www.maxwell.ict.griffith.edu.au/yg/teaching/dns_module3_p3.pdf
9. www.eng.wayne.edu/~singhweb/seql.ppt
10. www.scs.ryerson.ca/~aabhari/cps213Chapter5.ppt
11. www.cs.sjsu.edu/faculty/lee/Ch2Problems2.ppt
12. www.rogtronics.net/files/datasheets/dac/sedraSmith.pdf
13. www.old.me.gatech.edu/mechatronics_course/ADC_F04.ppt
14. www.allaboutcircuits.com/vl_4/chpt_13/3.html
15. www.youtube.com/watch?v=5Wz5f3n5sjs
16. www.eee.metu.edu.tr/~cb/e447/Chapter%209%20-%20v2.0.pdf
17. www.cmc.gcg11.org/attachments/article/95/Memory2.ppt
18. www.cosc.brocku.ca/Offerings/3P92/seminars/Flash.ppt
19. www.webopedia.com/TERM/R/RAM.html
20. www.cs.sjsu,edu/~lee/cs147/Rahman.ppt

14. PO – COMPETENCY- CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	-	2	-	-	-	2
CO2	3	-	2	-	-	-	2
CO3	2	-	3	-	-	-	2
CO4	2	-	3	-	-	-	2
CO5	3	-	2	-	-	-	*2*
CO6	3	-	2	-	1	-	*2*

	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-
CO2	3	2	-	-
CO3	3	2	-	-
CO4	3	2	-	-
CO5	3	2	-	-
CO6	3	2	-	-

Sign: Name: Shri. A.D.Vikhankar Smt.M.V.Saraf (Course Experts)	Sign: Name:Shri.R.N.Shikari (Head of Department)
Sign: Name: (Program Head) (Electrical Engineering Dept.)	Sign: Name:ShriA.S.Zanpure (CDC)

EQUIVALENCE

GOVERNMENT POLYTECHNIC PUNE

Equivalence for 180 (S) Curriculum with 180 (OB) Curriculum

Sr. No.	Existing 180 (S) Curriculum												Proposed 180 (OB) Curriculum										RemarkS Equivalent/Not Equivalent	Signature
	Course code	Course Name	CREDITS				EXAM SCHEME						Course code	Course Name	CREDITS				EXAM SCHEME							
			TH	PR	TU	TOTAL	TH	PA	PR	OR	TW	TOTAL			TH	PR	TU	TOTAL	TH ESE	TH PA	PR-ESE	PR-PA	TOTAL		
1	HU181	English	2	2	0	4	80	20	-	-	25	125	HU1101	Communication Skill-I	2	0	1	3	40	10	25	25	100	Not Equivalen	
2	HU 182	Communication Skills	2	2	0	4	80	20	-	25		125	HU1102	Communication Skill-II	2	0	1	3	40	10	25	25	100	Not Equivalen	
3	SC 181	Applied Mathmatics -I	3	0	1	4	80	20	-	-		100	SC1101	Applied Mathamatics -I	3	0	2	5	80	20		25	125	Equivalent	
4	SC182	Applied Mathamatics-II	3	0	1	4	80	20	-	-		100	SC1102	Applied Mathamatics-II	3	0	2	5	80	20		25	125	Not Equivalent	
5	SC183	Engg Physics	3	2	0	5	80	20	50	_	_	150	SC1104	Engg Physics	3	2	0	5	80	20	25	25	150	Equivalent	EE,ET,CM,IT
6	SC184	Engg Chemistry	3	2	0	5	80	20	50	_	_	150	SC1105	Applied Chemistry	3	2	0	5	80	20	25	25	150	Equivalent	ET
12	SC282	Engg Mathematics	2	0	1	3	80	20	_	_	25	125	SC2104	ADVANCED MATHEMATICS I(ET)	2	0	1	3	40	10		25	75	Equivalent to both SC2104+SC2105	ET
												0	SC2105	ADVANCED MATHEMATICS	2	0	1	3	40	10		25	75		
	CM286	COMPUTER FUNDAMENTA	1	2	0	3	-	-	50	25		75	CM2102	FUNDAMENTALS OF ICT	1	2	0	3	-	-	25	25	75		
	ME284	ENGINEERING DRAWING	2	2	0	4	-	-	50	-	-	50	ME2104	ENGINEERING GRAPHICS	2	2	0	4	0	0	0	50	50	Equivalent	
1	ET281	BASIC ELECTRONICS	4	2	--	6	80	20	50	--	25	175	ET2101	BASIC ELECTRONICS	4	2	--	6	80	20	25	50	175	Equivalent	
2	ET286	PROGRAMMING IN C	3	2	1	6	80	20	50	--	25	175	ET2102	C' LANGUAGE PROGRAMMING	3	2	1	6	80	20	25	50	175	Equivalent	
3	ET282	ELECTRONICS WORKSHOP	--	4	1	5	0	0	25	--	25	50	ET2103	ELECTRONICS WORKSHOP	--	4	1	5	--	--	25	50	75	Equivalent	
4	ET283	INDUSTRIAL MEASURMENT	4	2	--	6	80	20	--	50	25	175	ET2104	INDUSTRIAL MEASURMENT	4	2	0	6	80	20	25	25	150	Equivalent	
	EE283	Fundamental of Electrical Engg	3	2	0	5	80	20	--	25	25	150	EE2103	Fundamental of Electrical Engg	3	2	0	5	80	20	25	25	150	Equivalent	
1	ET381	Mini Project	0	2	0	2	0	0	--	25	25	50	--	--	--	--	--	--	--	--	--	--	--	NO COURSE EQUIVALENT	
2	ET382	Network Analysis	3	2	1	6	80	20	25	--	--	125	ET3102	Electronic Circuits & Networks	3	2	1	6	80	20	25	25	150	Equivalent	
3	ET383	Applied Electronics	4	4	0	6	80	20	50	--	--	150	ET3103	Applied Electronics	4	4	0	8	80	20	50	25	175	Equivalent	
4	ET384	Electronic Instrumentation	3	2	0	5	80	20	25	--	--	125	ET3104	Electronic Instrumentation	2	2	0	4	40	10	25	25	100	Equivalent	
5	ET385	Analog Communication	4	2	0	6	80	20	50	--	--	150	ET3105	Principles of communication	4	2	0	6	80	20	25	25	150	Equivalent	

GOVERNMENT POLYTECHNIC PUNE
Equivalence for 180 (S) Curriculum with 180 (OB) Curriculum

Sr. No.	Existing 180 (S) Curriculum												Proposed 180 (OB) Curriculum										RemarkS Equivalent/Not Equivalent	Signature
	Course code	Course Name	CREDITS				EXAM SCHEME						Course code	Course Name	CREDITS				EXAM SCHEME					
			TH	PR	TU	TOTAL	TH	PA	PR	OR	TW	TOTAL			TH	PR	TU	TOTAL	TH ESE	TH PA	PR-ESE	PR-PA	TOTAL	
6	ET386	Linear Integrated Circuit	3	2	1	6	80	20	25	--	--	125	ET3106	Linear Integrated Circuits	3	2	1	6	80	20	25	25	150	Equivalent	
7	ET387	Power Electronics	4	2	0	6	80	20	--	25	--	125	ET3107	Power Electronics	3	2	0	5	80	20	25	25	150	Equivalent	
8	ET388	Digital Electronics	3	2	0	5	80	20	25	--	25	150	ET3108	Digital Electronics	3	2	1	6	80	20	25	25	150	Equivalent	
9	ET389	Microcontroller and Applications	4	4	0	8	80	20	50	--	--	150	ET3109	Microcontroller Fundamentals	4	4	0	8	80	20	50	25	175	Equivalent	
26	AU481	Environmental Science	0	2	0	2	0	0	0	0	50	50	AU 4101	Environmental Science@	0	2	0	2	0	0	0	50	50	Equivalent	
27	AU 482	COMMINITY DEVELOPMENT	2	0	0	2	80	20	0	0	0	100	AU 4104	Ethical Sources and Sustainibility	2	0	0	2	40	10	0	0	50	New course hence NA	
28	AU483	RENEWABLE & SUSTAINABLE ENERGY MANAGEMENT	2	0	0	2	80	20	0	0	0	100	AU 4102	Renewable Energy Technologies	2	0	0	2	40	10	0	0	50	Equivalent	
29	AU484	ENGINEERING ECONOMICS	2	0	0	2	80	20	--	--	--	100	AU 4103	Engineering Economics	2	0	0	2	40	10	0	0	50	Equivalent	
30	--	--	0	0	0	0	0	0	0	0	0		AU 4105	Digital Marketting	0	2	0	2	0	0	0	50	50	New course hence NA	
31	MA481	Construction Mnagement	3	0	0	3	80	20	0	0	0	100	--	--	0	0	0		0	0	0	0	0	Not Equivalent	
32	MA482	Industrial Organisation&Mnagement	3	0	0	3	80	20	0	0	0	100	MA 4102	Industrial Organization & Management	2	0	0	2	40	10	--	--	50	Equivalent	
33	MA483	Entrepreneurship Development	3	0	0	3	80	20	0	0	0	100	MA 4101	Entrepreneurship Development and Startup	2	0	0	2	40	10	--	--	50	Equivalent	
34	MA484	Materials Management	3	0	0	3	80	20	0	0	0	100	MA 4103	Materials Management	2	0	0	2	40	10	--	--	50	Equivalent	
35													MA 4104	Disaster Management	2	0	0	2	40	10	--	--	50	New course hence NA	
36	MA485	Superviosary Management	3	0	0	3	80	20	0	0	0	100	--	--	0	0	0		0	0	0	0	0	NA	

GOVERNMENT POLYTECHNIC PUNE
Equivalence for 180 (S) Curriculum with 180 (OB) Curriculum

Sr. No.	Existing 180 (S) Curriculum												Proposed 180 (OB) Curriculum										RemarkS Equivalent/Not Equivalent	Signature
	Course code	Course Name	CREDITS				EXAM SCHEME						Course code	Course Name	CREDITS				EXAM SCHEME					
			TH	PR	TU	TOTAL	TH	PA	PR	OR	TW	TOTAL			TH	PR	TU	TOTAL	TH ESE	TH PA	PR-ESE	PR-PA	TOTAL	
37													MA 4105	Introduction to E-commerce	2	0	0	2	40	10	--	--	50	NA	
38	MA486	Total Quality Management	3	0	0	3	80	20	0	0	0	100	--	--	0	0	0		0	0	0	0	0	NA	
39	MA487	Management Information System	3	0	0	3	80	20	0	0	0	100	MA 4106	Information Management	2	0	0	2	40	10	--	--	50	Not Equivalent	
													ET4101	Industry Inplant Training	0	0	6	6	--	--	50	50	100	New course hence NA	
10	ET481	Project & Seminar	0	8	0	8	--	--	50	50	50	150	ET4102	Project	0	4	0	4	0	0	50	50	100	Equivalent	
11													ET4103	Seminar	0	2	0	2	0	0	25	25	50	Equivalent	
12	ET482	Audio Video Engineering	3	2	0	5	80	20	--	25	--	125	ET4105	Consumer Electronics	3	2	0	5	80	20	25	25	150	Not Equivalen	
13	ET483	Microwave Communication	3	2	0	5	80	20	--	25	--	125	ET5107	Microwave & Radar Communication	3	2	0	5	80	20	25	25	150	Equivalent	
14	ET484	Optical Communication	3	2	0	5	80	20		25	25	150	ET5103	Fiber Optic Communication	3	2	0	5	80	20	25	25	150	Equivalent	
15	ET485	Digital Communication	4	2	0	6	80	20	50	--	--	150	ET4107	Digital Communication	3	2	0	5	80	20	25	25	150	Equivalent	
16	ET486	Instrumentation and Control	4	2	0	6	80	20	--	25	25	150	ET4109	Instumentation & Control	3	2	1	6	80	20	25	25	150	Not Equivalen	
17	ET487	Computer Network	4	2	0	6	80	20	--	--	25	125	ET5104	ComputerNetworking and Data Communication	3	2	0	5	80	20	25	25	150	Equivalent	
18	ET488	Peripheral Interface Controller	4	2	0	6	80	20	50	--	--	150	--	--	--	--	--	--	--	--	--	--	--	--	NO COURSE EQUIVALENT	
19	--	--	--	--	--	--	--	--	--	--	--	--	CM4104	Professional Practice I	0	2	0	2	0	0	0	50	50	NA	
20	--	--	--	--	--	--	--	--	--	--	--	--	CM4105	Professional Practice II	0	2	0	2	0	0	0	50	50	NA	
21	--	--	--	--	--	--	--	--	--	--	--	--	ET4104	Maintenance of Eletronics & EDA Tools	0	4	0	4	0	0	50	50	100	NA	
22	--	--	--	--	--	--	--	--	--	--	--	--	ET4106	Basics of Internet of Things	3	2	0	5	80	20	25	25	150	NA	
23	ET581	Wireless Communication	4	2	0	6	80	20	0	25	25	150	ET4108	Mobile & Wireless Communication	4	2	0	6	80	20	25	25	150	Not Equivalen	

GOVERNMENT POLYTECHNIC PUNE

Equivalence for 180 (S) Curriculum with 180 (OB) Curriculum

Sr. No.	Existing 180 (S) Curriculum												Proposed 180 (OB) Curriculum										RemarkS Equivalent/Not Equivalent	Signature
	Course code	Course Name	CREDITS				EXAM SCHEME						Course code	Course Name	CREDITS				EXAM SCHEME					
			TH	PR	TU	TOTAL	TH	PA	PR	OR	TW	TOTAL			TH	PR	TU	TOTAL	TH ESE	TH PA	PR-ESE	PR-PA	TOTAL	
24	ET582	Satellite Communication	4	2	0	6	80	20	0	25	25	150	ET5106	Satellite Communication	3	2	0	5	80	20	25	25	150	Not Equivalen	
25	ET583	Robotics	4	2	0	6	80	20	0	25	25	150	ET5102	Robotics	3	2	0	5	80	20	25	25	150	Not Equivalen	
26	ET584	Industrial Automation	4	2	0	6	80	20	0	25	25	150	ET5105	Industrial Automation	3	2	0	5	80	20	25	25	150	Not Equivalen	
27	ET585	VLSI	4	2	0	6	80	20	0	25	25	150	--	--	--	--	--	--	--	--	--	--	--	--	--	
28	ET586	Embedded System Technology	4	2	0	6	80	20	0	25	25	150	ET5101	Embedded Systems	3	2	0	5	80	20	25	25	150	Equivalent	
29	--	--	--	--	--	--	--	--	--	--	--	--	ET5108	Biomedical Instrumentation	3	2	0	5	80	20	25	25	150	NA	
30	--	--	--	--	--	--	--	--	--	--	--	--	ET5106	Python	3	2	0	5	80	20	25	25	150	NA	

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GOVERNMENT POLYTECHNIC PUNE
Equivalence for 180 (S) Curriculum with 180 (OB) Curriculum
Other Department

Sr. No.	Existing 180 (S) Curriculum										Proposed 190 (OB) Curriculum									Remarks Equivalent/ Not Equivalent	Signature
	Course code	Course Name	CREDITS			EXAM SCHEME					Course code	Course Name	CREDITS			EXAM SCHEME					
			TH	PR	TU	TH	PA	PR	OR	TW			TH	PR	TU	TH	PA	PR-ESE	PR-PA		
1	ET285	ELEMENTS OF ELECTRONICS (ME /MT)	3	2		80	20			25	ET2105	ELEMENTS OF ELECTRONICS ENGINEERING (ME)	3	2	0	80	20	0	25	Equivalent	
2	ET287	BASIC ELECTRONICS (MT)	3	2		80	20			25	ET2106	PRINCIPLES OF ELECTRONICS (MT)	3	2	0	80	20	0	25	Equivalent	
3	ET284	FUNDAMENTALS OF ELECTRONICS (CM/IT)	3	2		80	20		25	25	ET2107	FUNDAMENTALS OF ELECTRONICS (CM/IT)	3	2	0	80	20	25	25	Equivalent	
4	ET281	BASIC ELECTRONICS (ET/ET)	4	2		80	20		50	25	ET2108	ELECTRONICS COMPONENTS AND CIRCUITS (EE)	2	2	0	40	10	25	25	Equivalent	
5	ET390	DIGITAL ELECTRONIC AND MICROPROCESSOR	3	2		80	20	50			ET3101	DIGITAL TECHNIHQUES AND APPLICATION	3	2	0	80	20	25	25	Equivalent	

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GOVERNMENT POLYTECHNIC PUNE
Equivalence for 180 (OB) Curriculum with MSBTE Curriculum

Sr. No.	Existing MSBTE-I Scheme Curriculum											Proposed 180 (OB) Curriculum											% Deviation	RemarkS Equivalent/Not Equivalent
	Course code	Course Name	CREDITS				EXAM SCHEME					Course code	Course Name	CREDITS				EXAM SCHEME						
			TH	PR	TU	TOTAL	THESE	THPA	PR-ESE	PR-PA	TOTAL			TH	PR	TU	TOTAL	THESE	THPA	PR-ESE	PR-PA	TOTAL		
1	22101	English	3	2	0	5	70	30	25	25	150	HU1101	Communication Skill-I	2	0	1	3	40	10	25	25	100	20%	Equivalent
2	22009	Business communication using Computers	--	2	--	2	--	--	35	15	50	HU1102	Communication Skill-II	2	0	1	3	40	10	25	25	100	20%	Equivalent
3	22103	Basics Mathematics	4	0	2	6	70	30	--	--	100	SC1101	Applied Mathamatics -I	3	0	2	5	80	20	--	25	125	15%	Equivalent
4	22210	Applied Mathematics	4	0	2	6	70	30	--	--	100	SC1102	Applied Mathamatics-II	3	0	2	5	80	20	--	25	125	20%	Equivalent
5	22102	Physics	2	2	0	4	70	15	25	25	150	SC1104	Engg Physics	3	2	0	5	80	20	25	25	150	20%	Equivalent
		Chemistry	2	2	0	4		15	25	25		SC1105	Applied Chemistry	3	2	0	5	80	20	25	25	150	20%	Equivalent
6	22210	Applied Mathematics	4	0	2	6	70	30	--	--	100	SC2104	ADVANCED MATHEMATICS-3(ET)	2	0	1	3	40	10	--	25	75	20%	Equivalent
												SC2105	ADVANCED MATHEMATICS 4(ET)	2	0	1	3	40	10	--	25	75	20%	Equivalent
7	22001	FUNDAMENTALS OF ICT	2	2	--	4	--	--	25	25	50	CM2102	FUNDAMENTALS OF ICT	1	2	0	3	-	-	25	25	75	0 %	Equivalent
8	22003	Engineering Graphics	2	4	--	6	--	--	50	50	100	ME2104	ENGINEERING GRAPHICS	2	2	0	4	0	0	0	50	50	0 %	Equivalent
9	22216	BASIC ELECTRONICS	4	4	--	8	70	30	50#	50	200	ET2101	BASIC ELECTRONICS ENGINEERING	4	2	--	6	80	20	25	50	175	20%	Equivalent
10	22218	C PROGRAMMING LANGUAGE	4	4	--	8	70	30	25	25		ET2102	C' LANGUAGE PROGRAMMING	3	2	1	6	80	20	25	50	175	0 %	Equivalent
11	22006	Workshop Practice	--	4	--	4	--	--	50	50	100	ET2103	ELECTRONICS WORKSHOP	--	4	1	5	--	--	25	50	75	80%	More towards advancement
12	--	--	--	--	--	--	--	--	--	--		ET2104	INDUSTRIAL MEASURMENT	4	2	0	6	80	20	25	25	150	NA	New course for Part time diploma
13	22215	Elements of Electrical Engineering	4	2	--	6	70	30	25	25	150	EE2103	Fundamental of Electrical Engg	3	2	0	5	80	20	25	25	150	10 %	Equivalent
14	22217	Electronic Engineering Material	3	--	--	3	70	30	--	--	100	--	--	--	--	--	--	--	--	--	--	--	NA	NA
15	22330	Electronic Circuits & Networks	3	2	2	7	70	30	25 @	25	150	ET3102	Electronic Circuits & Networks	3	2	1	6	80	20	25	25	150	20%	Equivalent
16	22329	Applied Electronics	4	4	--	8	70	30	50#	50	200	ET3103	Applied Electronics	4	4	0	8	80	20	50	25	175	15%	Equivalent

17	22333	Electronic Measurments & Instrumentation	4	4	--	8	70	30	50@	50	200	ET3104	Electronic Instrumentation	2	2	0	4	40	10	25	25	100	20 %	Equivalent,50% is covered in EI ,20% covered in I &C and 10 % covered in electronic workshop
18	22334	Principles of Electronic communication	4	2	--	6	70	30	25#	25	150	ET3105	Principles of communication	4	2	0	6	80	20	25	25	150	10%	Equivalent
19	22423	Linear Integrated Circuits	4	2	--	6	70	30	25#	25	150	ET3106	Linear Integrated Circuits	3	2	1	6	80	20	25	25	150	15%	Equivalent
20	22427	Basic Power Electronics	3	2		5	70	30	25 @	25	150	ET3107	Power Electronics	3	2	0	5	80	20	25	25	150	20%	Equivalent
21	22320	Digital Techniques	4	2	--	6	70	30	25#	25	150	ET3108	Digital Electronics	3	2	1	6	80	20	25	25	150	20%	Equivalent
22	22426	Microcontroller and Applications	4	2	--	6	70	30	25#	25	150	ET3109	Microcontroller Fundamentals	4	4	0	8	80	20	50	25	175	10%	Equivalent
23	22447	Environmental Studies	3	--	--	3	70	30	--	--	100	AU 4101	Environmental Science@	0	2	0	2	0	0	0	50	50	20%	Equivalent
24	--	--	--	--	--	--	--	--	--	--	--	AU 4104	Ethical Sources and Sustainibility	2	0	0	2	40	10	0	0	50	NA	New subject is introduced towards advancement(As per industry need)
25	22528	Wind power Technology	3	2	--	5	70	30*	25	25	150	AU 4102	Renewable Energy Technologies	2	0	0	2	40	10	0	0	50	20%	Equivalent
26	--	--	--	--	--	--	--	--	--	--	--	AU 4103	Engineering Economics	2	0	0	2	40	10	0	0	50	NA	New subject is introduced towards advancement
27	--	--	--	--	--	--	--	--	--	--	--	AU 4105	Digital Marketting	0	2	0	2	0	0	0	50	50	NA	New subject is introduced towards advancement
28	22509	Management	3	--	--	3	70* #	30*	--	--	100	MA 4102	Industrial Organization & Management	2	0	0	2	40	10	--	--	50	65%	More towards advancement
29	22032	Entrepreneurship Development	2	2	--	4	--	--	50@	50~ `	100	MA 4101	Entrepreneurship & Startup	2	0	0	2	40	10	--	--	50	10%	Equivalent
30	--	--	--	--	--	--	--	--	--	--	--	MA 4103	Materials Management	2	0	0	2	40	10	--	--	50	NA	New subject is introduced towards advancement
31	--	--	--	--	--	--	--	--	--	--	--	MA 4104	Disaster Management	2	0	0	2	40	10	--	--	50	NA	New subject is introduced towards advancement

32	--	--	--	--	--	--	--	--	--	--	--	MA 4105	Introduction to E-commerce	2	0	0	2	40	10	--	--	50	NA	New subject is introduced towards advancement
33	--	--	--	--	--	--	--	--	--	--	--	MA 4106	Information Management	2	0	0	2	40	10	--	--	50	NA	New subject is introduced towards advancement
34	22057	Industrial Traning	--	6	--	6	--	--	75#	75	150	ET4109	Industry Inplant Training	--	6	--	6	--	--	50	50	100	10%	Equivalent
35	22060	Capstron project execution &r epot writing		4		4	--	--	50@	50~	100	ET4102	Project	0	4	0	4	0	0	50	50	100	10%	
36	22058	Capstron project planning	--	2	--	2	--	--	25 @	25	50	ET4103	Seminar	0	2	0	2	0	0	25	25	50		Equivalent
37	22636	Emerging trends in Electronics	3	--	--	3	70* #	30*	--	--	100	ET4103	Seminar	0	2	0	2	0	0	25	25	50	20%	Equivalent
38	22425	Consumer Electronics	3	2	--	5	70	30	25 @	25	150	ET4105	Consumer Electronics	3	2	0	5	80	20	25	25	150	5%	Equivalent
39	22535	Microwave & Radar	3	2	--	5	70	30	25@	25	150	ET5107	Microwave & Radar Communication	3	2	0	5	80	20	25	25	150	10%	Equivalent
40	22428	Digital Communication System	4	4	--	8	70	30	50#	50	200	ET4107	Digital Communication	3	2	0	5	80	20	25	25	150	15%	Equivalent
41	22531	Control System & PLC	4	2	--	6	70	30	25 @	25	150	ET4109	Instumentation & Control	3	2	1	6	80	20	25	25	150	20%	Equivalent. The contents of 22531 Control system &PLC are covered in two courses ET4109 Instrumentation &control course and ET5105 Industrial Automation course.
42	22634	Computer Networking and Data	3	2	--	5	70	30*	25#	25	100	ET5104	Computer Networking and Data Communication	3	2	0	5	80	20	25	25	150	20%	Equivalent
43	--	--	--	--	--	--	--	--	--	--	--	CM4104	Professional Practice I	0	2	0	2	0	0	0	50	50	NA	New subject is introduced towards advancement.(for microproject work)
44	--	--	--	--	--	--	--	--	--	--	--	CM4105	Professional Practice II	0	2	0	2	0	0	0	50	50	NA	New subject is introduced towards advancement(for microproject work)

45	22036	Maintenance of Eletronics Equipment & EDA Tools	--	4	--	4	--	--	50 @	50	100	ET4104	Maintenance of Eletronics & EDA Tools	0	4	0	4	0	0	50	50	100	20%	Equivalent
46	--	--	--	--	--	--	--	--	--	--	--	ET4106	Basics of Internet of Things	3	2	0	5	80	20	25	25	150	NA	New subject is introduced towards advancement(Need of industry)
47	22533	Mobile & Wireless Communication	4	4	--	8	70	30	50#	50	200	ET4108	Mobile & Wireless Communication	4	2	0	6	80	20	25	25	150	15%	Equivalent
48	22647	Optical network & Satellite Communication	3	2	--	5	70	30*	25@	25	150	ET5103	Fiber Optic	3	2	0	5	80	20	25	25	150	20%	Equivalent
												ET5106	Satellite Communication	3	2	0	5	80	20	25	25	150		
49	22643	Mechatronics	3	2	--	5	70	30*	25@	25	49	--	--	--	--	--	--	--	--	--	--	--	NA	NA
50	22534	Industrial Automation	3	2	--	5	70	30	25@	25	150	ET5105	Industrial Automation	3	2	0	5	80	20	25	25	150	15%	Equivalent
51	22062	VLSI and VHDL	2	2	--	4	--	--	25#	25	150	--	--	--	--	--	--	--	--	--	--	--	NA	NA
52	22532	Embedded Systems	3	2	--	5	70	30	25#	25	150	ET5101	Embedded Systems	3	2	0	5	80	20	25	25	150	20%	Advance topic i.e.ARM is indroduced towards advancement
53	--	--	--	--	--	--	--	--	--	--	--	ET5102	Robotics	3	2	0	5	80	20	25	25	150	NA	New subject is introduced towards advancement
54	--	--	--	--	--	--	--	--	--	--	--	ET5108	Biomedical Instrumentation	3	2	0	5	80	20	25	25	150	NA	New subject is introduced towards advancement
55	--	--	--	--	--	--	--	--	--	--	--	ET5106	Phython	3	2	0	5	80	20	25	25	150	NA	New subject is introduced towards advancement

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HEAD OF DEPARTMENT

ANNEXURE

Government Polytechnic, Pune

(An autonomous Institute of Government of Maharashtra)

University Road, Pune 16

(www.gppune.ac.in)

Department of Electronics and Telecommunication Engineering

INDUSTRY QUESTIONNAIRE

Dear Sir/Madam,

Government Polytechnic Pune, is an autonomous institute of Government of Maharashtra. Imparting engineering diploma programmees such as, Civil, Electrical, Mechanical, Electronics and Telecommunication, Computer Engineering, Information Technology, Metallurgy and Dress Design and Garment Manufacturing. Being autonomous academically, each department has to design and implement of the curriculum of respective program after every 5 years. Now it is time to revise existing curriculum, which will be implementing from academic year 2019-20. In this regard, a survey is being conducted to identify needs of the industry in changing technical scenario.

Your experience in the industry and your valuable time of 10-15 minutes to respond to this short survey will greatly help to develop an outcome-based Electrical Engineering diploma curriculum to enhance their employability and match the industry need for the next couple of years.

General Information

S.No.	Particulars	Information
1	Name of Industry	
2	Type of Industry – small, medium or large	
3	Product(s) /Service(s) of the Industry	
4	Postal Address	
5	Telephone Numbers	
6	Website	
7	Contact Person: (Name, Designation, E-mail, Mobile/Contact No.) (Attached your visiting card)	

8	In your industry, Diploma engineers in Electronics and Telecommunication engineering are involved to what extent in the following activities?	Please tick (√) in any one column			
		To a great extent	**To a considerable extent**	**To some extent**	**Very rarely**
	a) Maintenance and Servicing				
	b) Production				
	c) Installation				
	d) Marketing				
	e) Materials Management				
	f) Research/Design/Development				
	g) Testing				
	h) Quality Control/Energy Audit				
	i) Any Other 1.....				
	2.....				

Competencies expected from Diploma in Electronics and Telecommunication Engineering

S. No.	Skills (i.e. What diploma holders will do in the industry at entry level) Legends: Most essential (**ME**), Essential (**E**), Desirable (**D**), Not Required (**NR**)	Tick (√) in one column			
		ME	**E**	**D**	**NR**
	Behavioural Skills				
1	Use relevant soft skills such as team work, leadership, time management, decision making, planning, conflict resolutions, counselling and others, effectively in different situations.				
2	Develop life-long learning skills through learning-to-learn strategies.				
3	Follow safe practices in production, operation and maintenance.				

S. No.	Skills (i.e. What diploma holders will do in the industry at entry level) Legends: Most essential (**ME**), Essential (**E**), Desirable (**D**), Not Required (**NR**)	Tick (√) in one column			
		ME	**E**	**D**	**NR**
4	Communicate to higher authorities and subordinate				
5	Respond positively in all circumstances				
6	Demonstrate ideas ,innovative thoughts and experiences				
7	Negotiate a fruitful outcome in an interaction				
8	Acknowledge mistake ,misunderstanding, errors etc				
9	Motivate others for achieving desired goal				
	Generic Skills (GS)				
1	Communicate in English in oral and written form.				
2	Use relevant management principles in industry.				
3	Plan to establish 'start-up small E&TC engineering related unit'				
4	Apply quality principles for assuring quality of products and services.				
5	Use computers for word processing, data analysis and presentations.				
	Technical Skills (TS)				
1	Apply basic principles of physics and chemistry for solving Electronics and **T**elecommunication engineering related problems.				
2	Apply the basic mathematical principle to solve basic Electronics and Telecommunication engineering calculations.				
3	Apply mathematical tools to analyse Electronics and Telecommunication engineering system.				
4	Apply principles of basics of electronics for developing various systems.				
5	Prepare circuits and PCBs manually using various techniques.				
6	Prepare Electronics and Telecommunication circuit drawings using CAD software.				
7	Use basic principles of Electrical engineering in relevant situations.				
8	Prepare simple jobs in the shop floor of the Electronics and Telecommunication engineering workshop.				
9	Select Electronics and Telecommunication engineering material as per requirement in the system.				
10	Measure various parameters in electronics systems with suitable meters and instruments.				
11	Calibrate, use and maintain different types of instrumentation system in industry and other system.				
12	Operate, test and maintain Electronics equipment's, machineries and systems.				
13	Develop and implement the code with the help of software programming to embed into the system				
14	Select appropriate microcontroller for specific application development.				
15	Use relevant power electronics devices and microcontroller for controlling various devices in system.				
16	Knowledge of various simulation softwares.				
17	Implement energy conservation techniques in electronics system.				
18	Use of various communication devices and techniques.				
19	Establishing computer network and use of various computer communication networks protocols				
20	Knowledge of various audio video techniques, equipment and tools.				
21	Knowledge of various digital communication techniques and processes				
22	Update and application of advanced communication system such as mobile , optical and microwave communication				
23	Use of various antennas and communication links.				
24	Use automation techniques for process control.				
25	Knowledge of various mechatronics systems and sensors				
26	Update and apply the advanced technique of allied disciplines through self-learning				
27	Implement pollution reduction techniques for sustainable environment in industries.				
28	Knowledge of IC design and fabrication				
29	Knowledge and Use of various Biomedical instruments				
30	***Please mention any other***				
31					
32					
33					
34					
	(Use separate sheet for more)				

Date: ***Seal*** ***Signature***

Government Polytechnic, Pune

Validation of 180 OB curriculum by Industry / Engineering Institute/ Research Institute

Course Detail

Name of Program: Electronics & telecommunication Engineering

Name of the Course: ----------

Course code :----------

Course offered to: - First year/Second year/Third year

Validator information

Name of the validator :- _____

Designation of the validator:- ----------

Name of the organisation:_____

Please mention the Field /s of Expertise:-

_____

Email :-_____ Mobile No: _____

Validator report

S.No.	Parameters	Excellent (5)	Very Good (4)	Good (3)	Satisfactory (2)	Needs Improvement(1)
1	The design of course outcomes					
2	Inclusion of Technological Skills					
3	Inclusion of Behavioural Skills					
4	Inclusion of Employability skills					
5	The extent of mapping the list of practicals(practical outcomes) with the course outcomes.					
6	Inclusion of content on socially relevant topics					

Any other suggestion for improvement: _____

_____

Date Seal of Organization Signature of Validator

Government Polytechnic, Pune

To,

_____

_____

Subject: - Validation of 180 OB curriculum from stake holders

Dear Sir/Madam

This autonomuous institute is catering to the technical education system since 1957. Recently institute has developed 180 outcome based (180 OB) curriculum for all the eight programmes as below .

S. No	Programme
1	Diploma in Civil Engineering
2	Diploma in Electrical Engineering
3	Diploma in Electronics and Telecommunication Engineering
4	Diploma in Mechanical Engineering
5	Diploma in Metallurgy
6	Diploma in Computer Engineering
7	Diploma in Information technology
8	Diploma in DDGM

As a part of curriculum development process, validation of class declaration course from industry is an important step for further improvement. Hence you are kindly requested to fill the validation report attached here with. We would appreciate if this validation report reaches on or before ___ ____. Please send this report on the following email id.--------

Thanks & Regards

HOD,

Program name

Enclosed- 1) Copy if the curriculum

2) validation report

Government Polytechnic, Pune

(An Autonomous Institute of Government of Maharashtra)

Department of Electronics & Telecommunication Engineering

List Of Industries Visited / Contacted For Curriculum Validation

1. Baumer India Private India, Pune
2. Hms Industral Netwworks, Pune
3. Railtel Corporation India, Pune
4. Ericsson India Private Limited, Pune
5. Medical Development and Engineering, Pune
6. Deeptech Enterprises, Pune
7. Saitronics, Karad
8. Transtech Systems, Pune
9. A.K.Technologies, Pune
10. PatronicseBoards Private Ltd, pune

Government Polytechnic, Pune

(An Autonomous Institute of Government of Maharashtra)

Department of Electronics & Telecommunication Engineering

List Of Industries Visited / Contacted For Industry Need Survey

1. Prasar Bharti, Pune (Government of India division)
2. Medical Development and Engineering
3. Bharat broadband Network Ltd. (BBNL, division of BSNL)
4. Electronic Test Development Corporation (ETDC) (Government of India division)
5. SMC Corporation (India)Private Limited, Noida
6. V. J. Instruments , Washim
7. Mechatronics Technical System , Pune
8. Indraneel Technologies, Pune
9. Consise Engineering Solutions Pvt. Ltd.Pune
10. Infinity Engineering Solutions , Ahmednagar
11. Precision Automation Pvt. Ltd. Pune
12. Efficient Toroidal Coil Corporation, Pune
13. Samarth Engineering , Ichalkaranji
14. Skyleap Technologies LLP, Pune
15. Swaraj Robotics & Automation , Pune
16. Tata Motors Ltd., Pune
17. Ericsson India Pvt. Ltd. Mumbai
18. Lectrotek Systems Pvt. Ltd. Pune
19. MSEDCL , Pune (distribution)
20. Educational Multimedia Research Centre (EMMRC), University of Pune
21. Vishal Vyapar Vikash, Guwahati
22. ATE Welding Engineering Robotics and Automation Pvt. Ltd. , Pune
23. Dynalog (India) Limited, Pune
24. Kuksons Electronics Pvt. Ltd. Pune
25. Digitech Controls and Systems, Pune
26. AQ Mechanical & Electrical Manufacturing India Pvt. Ltd. Pune
27. Plural Technology Pvt. Ltd. Pune
28. Scope T&M Pvt. Ltd.Pune
29. MSETCL , Pune (Transmission)

30. Siddhi Electrosystems, Pune
31.Mahesh Elctrical Instruments , Mumbai
32.Expert Instruments Private Limited, Pune
33. Defence Reasarch and Development Establishment (R&DE (E)), Dighi
34. Defence and Aerospace (DRDO) , dighi