GOVERNMENT POLYTECHNIC, PUNE

'120 – NEP' SCHEME

PROGRAMME	**DIPLOMA IN ME / MT**
PROGRAMME CODE	**04/05**
COURSE TITLE	**BASIC ELECTRICAL TECHNOLOGY**
COURSE CODE	**EE21203**
PREREQUISITE COURSE CODE & TITLE	**NA**

I. LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Course Type	Learning Scheme					Credits	Assessment Scheme											
			Actual Contact Hrs./Week			SLH	NLH		Paper Duration Hrs.	Theory				Based on LL & TSL				Based on SL		Total Marks
														Practical						
			CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
										Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
EE21203	BASIC ELECTRICAL TECHNOLOGY	AEC	2	-	2	-	4	3	-	-	-	-	-	25	10	25@	10	-	-	50

Total IKS Hrs for Term: 0 Hrs

Abbreviations: CL-Classroom Learning, **TL**-Tutorial Learning, **LL**-Laboratory Learning, **SLH**-Self Learning Hours, **NLH**-Notional Learning Hours, **FA** - Formative Assessment**, SA** -Summative assessment, **IKS** – Indian Knowledge System, **SLA**- Self Learning Assessment

Legends: @-Internal Assessment, **#** - External Assessment,***#** - Online Examination,**@$** - Internal Online Examination

Note:

FA-TH represents an average of two class tests of 30 marks each conducted during the semester.

1. If a candidate is not securing minimum passing marks in **FA-PR** (Formative Assessment - Practical) of any course, then the candidate shall be declared as **'Detained'** in that semester.
2. If a candidate does not secure minimum passing marks in SLA (Self Learning Assessment) of any course, then the candidate shall be declared as **'fail'** and will have to repeat and resubmit SLA work.
3. **Notional learning hours** for the semester are **(CL + LL + TL + SL) hrs. * 15 Weeks**
4. **1 credit** is equivalent to **30 Notional hours**.
5. * Self-learning hours shall not be reflected in the Timetable.

6.* Self-learning includes micro-projects/assignments/other activities.

II. RATIONALE:

Diploma holders are expected to handle various mechanical, electrical and electronics tools. This course will develop skills in handling tools, equipment safely related electrical engineering aspects useful for manufacturing, production and mechanical engineering based processes in industries.

III. COURSE-LEVEL LEARNING OUTCOMES (CO's)

Students will be able to achieve and demonstrate the following CO's on completion of course-based learning

CO1: Use Principles of electrical and magnetic circuits to solve mechanical engineering broadly defined problems.

CO2: Use of Transformer and Electric motors for given applications.

CO3: Use electrical safety devices in electrical circuits.

IV. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr. No	Theory Learning Outcomes (TLO'S) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
UNIT-I ELECTRIC AND MAGNETIC CIRCUIT (CL Hrs.- 10)				
1	TLO 1.1 Explain the given technical terms related to Electric and Magnetic circuits. TLO 1.2 Identify an analogy between Electric and Magnetic Circuits. TLO 1.3 Apply Fleming's right-hand rule and Lenz's law for the determination of the direction of induced emf in the given situation. TLO 1.4 Explain attributes of the given AC quantities. TLO 1.5 Find currents and voltages in the given star & delta AC circuits. TLO 1.6 Expalin the working of batteries. TLO 1.7 Wiring specifications & Standards.	1.1 Electric circuits E.M.F, Potential difference, power, Magnetic circuits M.M.F, magnetic force, permeability. 1.2 Electromagnetic induction, Faraday's laws of electromagnetic induction, Lenz's law, dynamically induced emf. 1.3 Statically induced emf. (a) Self-induced emf (b) Mutually induced emf; Equations of self and mutual inductance. 1.4 A .C. Signal terms: Cycle, Frequency, Periodic time, Amplitude, Angular velocity,RMS value, Average value, Form Factor, Peak Factor, impedance, phase angle, and power factor. 1.5 Voltage and Current relationship in Star and Delta connections. 1.6 Batteries- Types and Working 1.7 wiring specifications and IS electrical standards for safety and appliances.	Chalk-Board Presentations Videos on Flemings Right-hand rule and Lenz Law	CO1
UNIT-II TRANSFORMER AND THE SINGLE-PHASE INDUCTION MOTOR (CL Hrs.- 10)				
2	TLO 2.1 Explain with sketches the construction and working principle of the given type of single-phase transformer. TLO 2.2 Explain with sketches the working principle of the given autotransformer. TLO 2.3 Describe with sketches the construction of the given single-phase motor. TLO 2.4 Explain with the sketches the working principle of the given single-phase induction motors.	2.1 General construction and principle of different types of transformers, EMF equation and transformation ratio of transformers. 2.2 Auto transformers. Working Principles and Applications 2.3 Construction and Working principle of single phase AC. motor. Types of single phase motors, applications of single phase motors. 2.4 Applications of single phase Induction motors.	Chalk-Board Demonstration Hands-on	CO2
UNIT-III ELECTRICAL SAFETY AND PROTECTIVE DEVICES (CL HRS-10)				
3	TLO 3.1 Describe the characteristics and features of different protective devices TLO 3.2 Select the relevant protective device for the given application. TLO 3.3 Select the suitable switchgear for the given situation	3.1 Fuse: Operation, types and applications 3.2 MCB and ELCB/RCB: Operation and general specifications 3.3 Earthing: Types, Importance of Earthing, Factors Affecting Earthing Resistance. 3.4 Measures for reducing earth	Chalk-Board Demonstration Hands-on	CO3

Sr. No	Theory Learning Outcomes (TLO'S) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
	with justification. TLO 3.4 Select the I.E rule related to be applied for a given type of earthing.	resistance, I.E rules relevant to earthing.		

V. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL/TUTORIAL EXPERIENCES. (Any 12)

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
1	LLO 1 Voltage and Current measurement	Measure voltage and current in single-phase circuits with resistive load using appropriate meters	**2**	**CO1**
2	LLO 2 Power measurement of single-phase circuit	Measure power required by single phase circuit with resistive load.	**2**	**CO1**
3	LLO 3 Energy measurement	Measure Energy consumed by given equipment using energy meter.	**2**	**CO1**
4	LLO 4 Line and Phase voltage measurement of the star- delta connection circuit	Make a star and delta connection to measure line and phase voltage	**2**	**CO1**
5	LLO 5 Battery Testing	Test given battery using a digital multimeter.	**2**	**CO1**
6	LLO 6 Input and output quantities of Single phase transformer	6.1 Connect Single phase transformer for measuring input and output quantities 6.2 Determine its turns ratio	**2**	**CO2**
7	LLO 7 Continuity test of transformer- primary and secondary windings	Test primary and secondary winding to measure the continuity of the transformer.	**2**	**CO2**
8	LLO 8 Autotransformer	Measure the output voltage of the autotransformer.	**2**	**CO2**
9	LLO 9 Electrical wire specifications	Select the suitable gauge of wire for the given electrical application.	**2**	**CO1**
10	LLO 10 Electrical Switchboard assembly	Build the switchboard for the given requirement by connecting suitable coloured wire to respective terminals.	**2**	**CO1**
11	LLO 13 Connection of fuses in the electrical circuit.	Connect the fuse in the electrical circuit and check its operation at normal and abnormal conditions	**2**	**CO3**
12	LLO 14 Connection of MCB in the electrical circuit.	Connect MCB in the electrical circuit and check its operation at normal and abnormal conditions.	**2**	**CO3**
13	LLO 15 Connection of ELCB in electrical circuit.	Connect ELCB in the electrical circuit and check its operation at normal and abnormal conditions.	**2**	**CO3**

VI. SUGGESTED MICRO PROJECT/ASSIGNMENT/ACTIVITIES FOR SPECIFIC LEARNING/SKILLS DEVELOPMENT (SELF-LEARNING)

Micro project: NOT APPLICABLE

Assignment: - NOT APPLICABLE

VII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED

Sr. No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Single Phase Autotransformer: Single phase, Input 0-230,10 A, Output:0- 270 Volts	1,2,8
2	Measurement Digital Multimeter: Minimum 3 ½ digit 4 ½ digit display, multimeter measures Vac, Vdc (1000V max), Adc, Aac (10-amp max), Resistance (0-100 Mohm),	1,2,3,4,5, 6,7,8
3	Lamp Bank - 230 V 0-20 A	1,2,3,4, 6,7,8
4	Single phase Transformer-Single Phase Input 230/115V, 1KVA	6,7,8
5	Single Phase Induction Motor - 230 V 50 Hz AC supply	
6	Wattmeter of suitable rating, Stopwatch, Energymeter, Wire gauge	2,3,9
7	Fuse, MCB, ELCB	11,12

VIII. SUGGESTED FOR WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE

(Specification Table)

NOT APPLICABLE

IX. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)	Summative Assessment (Assessment of Learning)
For FA_PR, Formative (Continuous) assessment shall be based on process and product-related performance indicators. Course teachers may assign 60%, weightage for process and 40% weightage for product-related LL work.	For SA PR at the end of the semester PR examination will be conducted by the course teacher and based on PR exam performance marks out of 25 will be allocated

X. SUGGESTED COs- POs MATRIX FORM

For ME

Course Outcomes (COs)	Programme Outcomes(POs)							Programme Specific Outcomes *(PSOs)	
	PO-1 Basic and Discipline-Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2
CO1	3	1	-	-	-	-	1	-	-
CO2	3	1	-	-	-	-	2	-	-
CO3	2	-	-	-	-	-	3	-	-
	Legends:- High: 03, **Medium:** 02, **Low:** 01, **No Mapping:** - *PSOs are to be formulated at the institute level								

For MT

Course Outcomes (COs)	Programme Outcomes(POs)							Programme Specific Outcomes *(PSOs)			
	PO-1 Basic and Discipline-Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3	PSO4
CO1	3	1	-	-	-	-	1	-	-	1	-
CO2	3	1	-	-	-	-	2	-	1	1	-
CO3	2	-	-	-	-	-	3	2	2	2	-

Legends:- High: 03, **Medium:** 02, **Low:** 01, **No Mapping:** -
*PSOs are to be formulated at the institute level

XI. SUGGESTED LEARNING MATERIALS/BOOKS

Sr. No	Author	Title	Publisher with ISBN Number
1	Mittle and Mittal	Basic Electrical Engineering	McGraw Education, New Delhi, edition 2017, ISBN-13 978-0070593572
2	Jegathesan, V	Basic Electrical and Electronics Engineering	Wiley India, New Delhi, edition-2015 ISBN 978- 8126529513
3	Sedha, R.S.	A Textbook of Applied Electronics	S.Chand New Delhi, edition-2008 ISBN-13: 978- 8121927833

XII. LEARNING WEBSITES & PORTALS

Sr. No	Link/Portal	Description
1	https://www.electrical4u.com/fleming-left-hand-rule-and-flem ing-right-hand-rule/	Flemings's hand and left-hand rule
2	https://www.electrical4u.com/lenz-law-of-electromagnetic-induction/	Lenz's Law
3	https://www.animations.physics.unsw.edu.au/jw/	Electronic components, A.C. circuits, transformer, Electric motors.
4	https://en.wikipedia.org/wiki/Transformer	Transformer
5	http://www.alpharubicon.com/altenergy/understandingAC.htm	A.C. Current

Name & Signature:

Smt. S.P. Phadnaik
Lecturer in Electrical

Smt. M. H. Bilgi
Lecturer in Electrical

(Course Experts)

Name & Signature:

Mrs. Namita S. Kadam
(Programme Head)

Name & Signature:

Mr. Sudin B Kulkarni
(CDC In-charge)

GOVERNMENT POLYTECHNIC, PUNE

'120 – NEP' SCHEME

PROGRAMME	**DIPLOMA IN CE/EE/ET/ME/MT/CM/IT/DDGM**
PROGRAMME CODE	**01/02/03/04/05/06/07/08**
COURSE TITLE	**PROFESSIONAL COMMUNICATION**
COURSE CODE	**HU11202**
PREREQUISITE COURSE CODE & TITLE	**NA**

I. LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Course Type	Learning Scheme					Credits	Assessment Scheme											
			Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TSL				Based on SL		Total Marks
														Practical						
			CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
										Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
HU11202	PROFESSIONAL COMMUNICATION SKILLS	SEC	-	-	2	-	2	1		-	-	-	-	25	10	25@	10	-	-	50

Total IKS Hrs for Sem. : 0 Hrs

Abbreviations: CL- Classroom Learning, TL- Tu tutorial Learning, LL-Laboratory Learning, SL H-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS – Indian Knowledge System, SLA - Self Learning Assessment.

Legends: @ Internal Assessment, # External Assessment, *# OnLine Examination,@$ Internal Online Examination.

Note :

1. FA-TH represents the average of two class tests of 30 marks each conducted during the semester.
2. If the candidate does not secure minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If the candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self-learning hours shall not be reflected in the timetable.
7. * Self-learning includes micro-projects/assignments / other activities.

II. RATIONALE:

Communication is key to the smooth and efficient functioning of any industry or business. Professional communication is the need of every organization to maintain ethics, quality and standards. The efficacy of business communication skills is essential for engineering professionals to instruct, guide and motivate peers/ subordinates to achieve desired goals at the workplace. Thus, this course has been designed to enhance professional communication skills for effective presentation both in written and oral forms at the workplace.

III. COURSE-LEVEL LEARNING OUTCOMES (CO'S):

Students will be able to achieve and demonstrate the following COs on completion of course-based learning

CO1: Communicate effectively (oral and written) in various formal and informal situations minimizing the barriers.
CO2: Develop listening skills through active listening and note-taking.
CO3: Write the circulars, notices and minutes of the meeting.
CO4: Draft enquiry letter, complaint letter, and Job application with resume / CV, Compose effective Emails.
CO5: Write Industrial reports.

IV. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT:

Sr. No	Theory Learning Outcomes (TLO'S) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
	UNIT-I PROFESSIONAL COMMUNICATION: AN OVERVIEW			
1	TLO 1.1 Describe the importance of professional communication in given situations. TLO 1.2 Identify the types of communication barriers in given situations and suggest remedies. TLO 1.3 Use different types of verbal and non–verbal communication for the given situation.	1.1 Definition of professional communication- Importance, relevance, Elements and process of communication,7 C's of Professional Communication (Clarity, Conciseness, correctness, coherent, concrete, courteous & Complete). 1.2 Communication barriers, Types of barriers (Linguistic, Psychological, Technological). 1.3 Types of Communication– Verbal (Oral-Written), Formal, Informal (Grapevine) and Vertical Comm.	Language lab, Role plays, Chalkboard, Reference books, Case studies.	**CO1**
	UNIT - II LISTENING & NOTE-TAKING			
2	TLO 2.1 Identify the difference between listening and hearing. TLO 2.2 Differentiate the types of listening in various situations. TLO 2.3 Take notes during lectures and seminars. Make use of types of note-taking and note-making for different subjects/topics.	2.1 Difference between listening & Hearing. 2.2 Types of listening a)Active listening b)Passive listening c)Selective listening. 2.3 Techniques of Note-taking, Types of note taking (Outline notes, Mind Mapping, Flowcharts).	Language Lab, Classroom learning, NPTEL, Role Play.	**CO2**
	UNIT - III OFFICE DRAFTING			
3	TLO 3.1 Prepare notices/agenda for the given type of meeting/information. TLO 3.2 Prepare minutes of meeting/s. TLO 3.3 Draft a circular for a particular information/event.	3.1 Format of Notice, Drafting Agenda. 3.2 Preparing Minutes of the meeting. 3.3 Format of Circular.	Whiteboard, Language Lab, Reference books, Classroom learning.	**CO3**
	UNIT - IV WRITING SKILLS FOR PROFESSIONAL COMMUNICATION			
4	TLO 4.1 Compose cover letter and CV / Resume for jobs. TLO 4.2 Apply E-mail Etiquettes for professional purposes. TLO 4.3 Compose Emails for different official purposes.	4.1 Job Application with Resume / CV. 4.2 E-Mail Etiquettes. 4.3 Writing official E-Mails to communicate intended purposes.	Language lab, Classroom learning NPTEL, Reference books.	**CO4**

Sr. No	Theory Learning Outcomes (TLO'S) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
	UNIT - V REPORT WRITING			
5	TLO 5.1 Compose technical reports. TLO5.2 Draft accident and Investigation.	5.1 Introduction to report writing 5.2 Accident Report and Investigation Report.	Chalk and talk, Language Lab, Collaborative learning, Classroom learning.	**CO5**

V. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL /TUTORIAL EXPERIENCES.

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
1	*LLO 1.1 Draw the communication cycle using real-life examples and explain the process of communication.	Communication Process and Cycle	2	CO1
2	LLO 2.1 Undertake the Roleplay / Group discussion to illustrate types/barriers to communication.	Role plays and Group Discussion	2	CO1
3	*LLO 3.1 Listen to audio in the language lab and make notes of it.	Active Listening	2	CO2
4	*LLO 4.1 Give a presentation / Seminar using the 7 C's of Communication.	Presentations / Seminars	2	CO1
5	*LLO 5.1 Explain the types of note-taking with examples and make notes on any one topic related to your curriculum.	Note taking & Note Making	2	CO2
6	*LLO 6.1 Prepare agenda for meeting and draft minutes of the meeting.	Agenda and Minutes of the Meeting	2	CO3
7	*LLO 7.1 Draft circulars for the given situation.	Office Drafting	2	CO3
8	*LLO 8.1 Respond to job advertisements referring to newspapers, and LinkedIn. Write a cover letter with a resume /CV.	Job Application with Resume / CV	2	CO4
9	*LLO 9.1: Write Four (formal) E-mails using ethics and etiquette.	E-Mail writing.	2	CO4
10	*LLO 10.1: Write a detailed report on the Accident/ Investigation.	Technical Report writing	2	CO5
11	*LLO 11.1: Prepare a case study related to linguistic barriers: language pronunciation, punctuation, and technical jargon and suggest remedies for the same.	Barriers to Communication	2	CO1

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
12	LLO 12.1: draft complaint/enquiry letter for various situations.	Complaint and Enquiry letter	2	CO4
13	LLO 13.1: List psychological barriers to communication. LLO 13.2 Prepare case studies on any two psychological barriers and suggest remedies to overcome the barriers.	Psychological barriers to Communication.	2	CO1
14	*LLO 14.1 - Draw a flow chart and mind mapping for any topic related to the curriculum.	Listening Skills.	2	CO2
15	*LLO 15.1 - Face mock interview arranged by your teacher.	Job Application, Resume / CV & Interview.	2	CO4

Note:

- "*" marked practicals are compulsory for coverage of all course outcomes.
- The remaining practicals are recommended to provide enhanced skills/abilities.
- Any **12** assignments out of **15** are compulsory

Note:

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her at the beginning of the semester. She/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. The micro-project could be industry 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 to the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than 15 (fifteen) student engagement hours during the course. In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become a problem solver so that s/he contributes to the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty.

VI. SUGGESTED MICRO PROJECT/ASSIGNMENT/ACTIVITIES FOR SPECIFIC LEARNING/SKILLS DEVELOPMENT (SELF-LEARNING)

Micro project

- Conduct an interview of any person and follow the procedure (interview questions, photo with the interviewee etc.)
- Listening and Speaking are lifelong learnings. Explain with appropriate examples and real-life case studies.
- Collect (four to five) emails with technical jargon, and barriers, make required corrections and keep a record of both the emails (original and Corrected one)
- Prepare a case study on Technological barriers to communication
- Complete any one certification course of (Two Weeks duration) from (MOOC/ NPTEL/ Coursera/ any other source)related to Communication Skills / Personality Development.
- Prepare a report on aspects of body language.

VII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED:

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Language Lab with software with internet facility.	**All**
2	LCD Projector	**All**
3	Smart Board with networking.	**All**
4	Printer.	**All**

VIII. SUGGESTED FOR WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE

(Specification Table):

N.A.

IX. ASSESSMENT ETHODOLOGIES/TOOLS:

Formative assessment (Assessment for Learning)	Summative Assessment (Assessment of Learning)
1. Term Work **(FA-PR)** 2. Micro-project.	1. Practical Exam of **25** marks using language lab**. (SA-PR)**

X. SUGGESTED COs- POs MATRIX FORM:

Course Outcomes (COs)	Programme Outcomes(POs)							ProgrammeSpecific Outcomes *(PSOs)		
	PO-1 Basic and Discipline-Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	-	-	-	-	-	-	1	-	-	-
CO2	-	-	-	-	-	-	1	-	-	-
CO3	-	-	-	-	-	-	1	-	-	-
CO4	-	-	-	-	-	-	1	-	-	-
CO5	-	-	-	-	-	-	1	-	-	-

Legends:- High:03, **Medium:**02, **Low:**01, **No Mapping:** -
*PSOs are to be formulated at the institute level.

XI. SUGGESTED LEARNING MATERIALS/BOOKS

Sr. No	Author	Title	Publisher with ISBN Number
1	M Ashraf Rizvi	Effective Communication Skills	Tata McGraw-Hill Publication-ISBN 0070599521, 9780070599529
2	Sanjay Kumar and Pushp Lata	Communication Skills	Oxford University Press ISBN 9780199457069
3	MSBTE Textbook	Communication Skills	MSBTE
4	Robert King	Effective communication Skills	Audio Book -ISBN 978181667009742
5	N P Sudharshana, C Savitha	English for Technical Communication	Cambridge-ISBN 978-13-16640-08-1
6	C. Murlikrishna, Sunita Mishra	Communication Skills for Engineers	Pearson - ISBN 978-81-317-3384-4
7	Meenakshi Raman, Sangeeta Sharma	Technical Communication, Principles and Practice	Oxford University Press -ISBN 978-1316640-08-1
8	K. K. Sinha	Business Communication	Galgotiya Publishing company, New Delhi ISBN 9789356227064
9	Rajendra Pal, J.S. Korlahalli	Essentials of Business Communication	Sultan Chand & Sons, New Delhi ISBN 9788180547294

XII. LEARNING WEBSITES & PORTALS

Sr. No	Link / Portal	Description
1	https://www.britishcouncil.in	Conversations
2	https://www.coursera.org	Certification courses
3	https://www.udemy.com	Communication skills training courses
4	http://www.makeuseof.com	Dale Carnegie's free resources

Name & Signature:

Mr.V.V.Kulkarni
Lecturer in English

Dr.S.P.Palve
Lecturer in English

(Course Experts)

Name & Signature:

Mrs. Namita S. Kadam
(Programme Head)

Name & Signature:

Mr. Sudin B Kulkarni
(CDC In-charge)

GOVERNMENT POLYTECHNIC, PUNE

'120 – NEP' SCHEME

PROGRAMME	**DIPLOMA IN CE/EE/ET/ME/MT/CM/IT/DDGM**
PROGRAMME CODE	**01/02/04/05/05/06/07/08**
COURSE TITLE	**YOUTH LEADERSHIP FOR CLIMATE ACTION**
COURSE CODE	**HU21202**
PREREQUISITE COURSE CODE AND TITLE	**NO**

I. LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Course Type	Learning Scheme					Credits	Assessment Scheme											
			Actual Contact Hrs./Week			SLH	NLH		Paper Duration Hrs.	Theory				Based on LL &TSL				Based on SL		Total Marks
														Practical						
			CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
										Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
HU21202	YOUTH LEADERSHIP FOR CLIMATE ACTION	VEC	-	-	-	2	2	1	-	-	-	-	-	-	-	-	-	50	20	50

Total IKS Hrs for Term: 0 Hrs

Abbreviations: CL-Classroom Learning, **TL**-Tutorial Learning, **LL**-Laboratory Learning, **SLH**-Self Learning Hours, **NLH**-Notional Learning Hours, **FA** - Formative Assessment**, SA** -Summative assessment, **IKS** – Indian Knowledge System, **SLA**- Self Learning Assessment

Legends: @-Internal Assessment, # - External Assessment,***#** - Online Examination,**@$** - Internal Online Examination

Note:

1. **FA-TH** represents an average of two class tests of 30 marks each conducted during the semester.
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3. If a candidate does not secure minimum passing marks in SLA (Self Learning Assessment) of any course, then the candidate shall be declared as **'fail'** and will have to repeat and resubmit SLA work.
4. **Notional learning hours** for the semester are **(CL + LL + TL + SL) hrs. * 15 Weeks**
5. **1 credit** is equivalent to **30 Notional hours**.
6. * Self-learning hours shall not be reflected in the Timetable.

6.*Self-learning includes micro-projects/assignments/other activities.

II. RATIONALE:

Climate change is a global phenomenon that transcends borders. Climate change poses significant threats to biodiversity, ecosystems, and natural resources. Its impacts, such as rising temperatures, extreme weather events, and sea-level rise, affect communities worldwide. Addressing climate change is a collective responsibility to safeguard the planet and its ecosystems for current and future generations. Climate change exacerbates social and economic inequalities, affecting vulnerable communities disproportionately. With increasing climate risks, and exposure to hazards, citizens need to improve clean and green skills.

Mitigating climate change and taking climate action is essential for preserving the Earth's biodiversity, maintaining ecosystem services, and ensuring the sustainability of vital resources upon which human societies depend. By taking climate action, societies can enhance resilience, reduce vulnerability, and promote social and economic stability. Sustainable practices help protect, preserve, and sustain the environment, as well as stimulate economic growth in sectors such as renewable energy and energy efficiency.

Climate action involves transitioning to more sustainable and resource-efficient practices. This includes adopting clean energy sources, improving energy efficiency, and promoting circular economies. Imparting skills to the human resources in the clean and green sectors is also a climate action. Such measures not only mitigate climate change but also contribute to the efficient use of resources and the reduction of environmental degradation.

The national, state, and multilateral efforts, such as the Mission Life, State Climate Action Planning, Paris Agreement, etc. provide a framework for countries to work together in reducing greenhouse gas emissions, adapting to climate impacts, and fostering technology transfer for sustainable development.

III. COURSE-LEVEL LEARNING OUTCOMES (CO's)

Students will be able to achieve & and demonstrate the following COs on completion of course-based learning

CO1: Demonstrate a comprehensive understanding of the science behind climate change, its causes, and its impacts on the environment, economy and society.
CO2: Understand the principles of water resource management (WRM), water conservation and its application in the context of climate change.
CO3: Understand the relationship between climate change and waste management, including the issues and impacts of waste management practices on greenhouse gas emissions.
CO4: Demonstrate a comprehensive understanding of energy systems, including sources, distribution, and consumption patterns
CO5: Advocate for and implement energy conservation practices at individual, community, and organizational levels to reduce overall energy demand.
CO6: Develop a comprehensive understanding of the intricate interconnections between biodiversity and climate, and recognize the reciprocal impacts each has on the other.

IV. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT:

Sr. No	Theory Learning Outcomes(TLO'S) aligned to COs.	Learning content mapped with TLOs.	Suggested Learning Pedagogies	Relevant COs
	UNIT-I LIVING WITH CLIMATE CHANGE			
	SUBUNIT 1: CLIMATE CHANGE PHENOMENON AND SCIENCE			
1.1	**TLO 1.1.1** Able to articulate the fundamental differences between weather and climate **TLO 1.1.2** Understanding of the basic principles of climate change, including the greenhouse effect, human-induced factors, and the consequences of a warming planet. **TLO 1.1.3** Able to define the concept of a carbon footprint, understanding it as the total amount of greenhouse gases.	1.1.1 Understanding Climate: Weather versus Climate 1.1.2 Climate and the Greenhouse Effect 1.1.3 Natural and Human-induced Climate Change 1.1.4 Carbon footprint	Video Lectures (Online Mode: Link https://www.mahayouthnet.in/)	1
	SUB UNIT 2: CLIMATE CHANGE IMPACTS			
1.2	**TLO 1.2.1** Grasp the foundational science behind climate change, including the greenhouse effect, human-induced emissions, and the role of feedback mechanisms in global warming. **TLO 1.2.2** Identify and analyze key indicators of climate change, such as rising global temperatures, changing precipitation patterns, sea level rise, and the frequency of extreme weather events. **TLO 1.2.3** Understand the diverse climate patterns across India's biogeographic regions, including the Himalayas, Indo-Gangetic Plains, Western Ghats, Eastern Ghats, Deccan Plateau, and coastal regions.	1.2.1Global impacts and uncertainties 1.2.2 Effects on India and its various biogeographic regions 1.2.3Impacts on livelihoods and economy: Agriculture and Horticulture 1.2.4Impacts on Vulnerable Communities: Fishing Communities	Video Lectures (Online Mode: Link https://www.mahayouthnet.in/)	1

SUB UNIT 3: CLIMATE ACTION				
1.3	**TLO1.3.1** Understand the concept of climate change mitigation and adaptation and its role in preparing for and responding to the impacts of climate change. **TLO1.3.2** Understand the concept of sustainable development and its three dimensions: economic, social, and environmental. **TLO1.3.3** Identify and articulate the connections between climate change impacts and existing social, economic, and environmental inequalities. **TLO1.3.4** Understand the importance of community-based climate action and initiatives led by local communities in India. **TLO 1.3.5** Understand the concepts of green skills and green work, emphasizing their role in promoting sustainability and environmentally conscious practices in various industries.	1.3.1 Mitigation and Adaptation 1.3.2 Intergovernmental processes 1.3.3 Sustainable Development Goals 1.3.4 Climate Justice 1.3.5 India's journey towards Climate Action 1.3.6 Majhi Vasundhara and Other Initiatives 1.3.7 Role of Individuals 1.3.8 Green Skills and Green Work	Video Lectures (Online Mode: Link https://www.mahayouthnet.in/)	2
UNIT-II WATER MANAGEMENT FOR CLIMATE CHANGE				
SUB UNIT 1: THE NEED OF WATER MANAGEMENT AND CONSERVATION				
2.1	**TLO 2.1.1** Understand the concept of water management and its significance in addressing water-related challenges. **TLO 2.1.2** Describe the water cycle and its role in the distribution and availability of water. **TLO 2.1.3** Identify regions facing water scarcity and understand the factors contributing to water shortages. **TLO 2.1.4** Analyze patterns of human water consumption and its impact on local and global water resources. **TLO 2.1.5**Examine water quality issues, including pollution sources, contaminants, and their effects on ecosystems and human health. **TLO 2.1.6** Recognize the role of community engagement in water conservation efforts and sustainable water management practices. **TLO 2.1.7** Understand the	2.1.1 Water - the basis of life. 2.1.2 The water cycle and freshwater availability. 2.1.3 Water use in India and the importance of groundwater. 2.1.4 Water Resources in Maharashtra. 2.1.5 Use of water in our lives. 2.1.6 Virtual Water. 2.1.7 Traditions of water use and management. 2.1.8 Water Quality - an important dimension. 2.1.9 Wastewater: a problem and a potential resource.	Video Lectures (Online Mode: Link https://www.mahayouthnet.in/)	2

	concept of wastewater and Identify and analyze the sources of pollutants in wastewater, including industrial discharges, agricultural runoff, and urban sewage.			
SUB UNIT 2: ISSUES AND CHALLENGES IN WATER MANAGEMENT				
2.2	**TLO 2.2.1** Understand the concept of water stress and its implications for a region's ability to meet water demand for various purposes. **TLO 2.2.2** Explore the role of agriculture in water stress, including irrigation practices, cropping patterns, and the impact of changing agricultural practices. **TLO 2.2.3** Understand the concept of water pollution and differentiate between various types of pollutants affecting water bodies. **TLO 2.2.4** Understand the environmental, ecological, and public health impacts of different pollutants in water, such as nutrients, heavy metals, pathogens, and synthetic chemicals. **TLO 2.2.5** Identify common waterborne diseases, such as cholera, typhoid, dysentery, and gastroenteritis, and understand their causative agents. **TLO 2.2.6** Define the challenges associated with inadequate sanitation, including issues related to open defecation, lack of access to sanitary facilities, and the impact on public health.	2.2.1 Water Stress in India. 2.2.2 Water resources limitation and increasing use. 2.2.3 Water stress in agriculture. 2.2.4 Water pollution and contamination. 2.2.5 Health impacts of poor water quality. 2.2.6 Water management and climate change. 2.2.7 The global challenge of water and sanitation. 2.2.8 Summary - causes of water stress.	Video Lectures (Online Mode: Link https://www.mahayouthnet.in/)	2
SUB UNIT 3:TOWARDS SUSTAINABLE WATER MANAGEMENT				
2.3	**TLO 2.3.1** Understand and define the concept of sustainable water management, considering its ecological, social, and economic dimensions. **TLO 2.3.2** Understand the significant initiatives launched by the Government of India/State government which focuses on water resources and management.	2.3.1 Towards sustainable water management 2.3.2 Swachh Bharat - The Mission for a Clean India 2.3.3 Jal Jeevan Mission - Water for All 2.3.4 Atal Bhujal Yojana - Replenish Groundwater 2.3.5 Mission Amrit Sarovar - Rejuvenate Water bodies 2.3.6 Jalyukt Shivar Abhiyan – Waterscapes.	Video Lectures (Online Mode: Link https://www.mahayouthnet.in/)	2

SUB UNIT 4: INDIVIDUAL AND COMMUNITY ACTIONS FOR WATER AND WASTEWATER MANAGEMENT				
2.4	**TLO 2.4.1** Understand the concept of a water audit and its significance in assessing water use, efficiency, and conservation. **TLO 2.4.2** Analyze water use patterns in common household activities, including bathing, washing dishes, laundry, and gardening. **TLO 2.4.3** Understand the definition of greywater and Recognize common sources of greywater in households, including bathroom sinks, showers, bathtubs, and washing machines. **TLO 2.4.4** promote awareness within communities about the benefits of greywater management and its potential impact on water conservation. **TLO 2.4.5** Understand the concept of rainwater harvesting and its significance in sustainable water management. **TLO 2.4.6** Learn different methods used to calculate rainwater harvesting potential	2.4.1 Conduct water audits 2.4.2 Save water at home 2.4.3 Promote greywater management at home and in the community 2.4.4 Spread the word on sustainable water management 2.4.5 Calculate Rainwater Harvesting Potential.		2
UNIT III: WASTE MANAGEMENT AND CLIMATE ACTION				
SUBUNIT 1: WHAT IS WASTE?				
3.1	**TLO 3.1.1** Understand the term "domestic waste" and distinguish it from other types of waste generated in different contexts. **TLO 3.1.2** Classify domestic waste into different categories such as organic waste, recyclables, hazardous waste, and non-recyclables. **TLO 3.1.3** Learn various methods used to quantify household waste, including direct measurement, sampling, and estimation techniques. **TLO 3.1.4** Identify specific waste patterns associated with different generations and lifestyles **TLO 3.1.5** Understand the Sustainable Development Goals (SDGs)	3.1.1 Define and enlist types of waste 3.1.2 List the components of domestic waste 3.1.3 Differentiate between biodegradable and non-biodegradable waste 3.1.4 Assess the quantum of waste generated at home 3.1.5 Changes in Waste generation over human generations 3.1.6 Review lifestyle choices 3.1.7 SDGs and Link of Waste with SDGs	Video Lectures (Online Mode: Link https://www.mahayouthnet.in/)	3

	TLO 3.1.6 Analyze the critical role of waste management in achieving multiple SDGs			
SUBUNIT 2: ISSUES IN WASTE MANAGEMENT				
3.2	**TLO 3.2.1 E**mphasizing waste impact on the environment, human health, and overall sustainability. **TLO 3.2.2** Identify health risks associated with improper waste disposal, such as the spread of diseases and exposure to hazardous materials. **TLO 3.2.3** Analyze how waste, particularly organic waste in landfills, contributes to greenhouse gas emissions and climate change.	3.2.1 Why is waste an issue? 3.2.2 Health impacts from mismanagement of waste 3.2.3 Work conditions of waste workers 3.2.4 Waste of natural resources and increased greenhouse gas emissions	Video Lectures (Online Mode: Link https://www.mahayouthnet.in/)	3
SUBUNIT 3: APPROACHES TO WASTE MANAGEMENT				
3.3	**TLO 3.3.1** Clearly define the waste management hierarchy **TLO 3.3.2 W**aste management hierarchy role in guiding sustainable waste management practices such as source reduction, reuse, recycling, energy recovery, and disposal.	3.3.1 Hierarchy of waste management 3.3.2 Waste segregation at source 3.3.3 Reduce, Reuse, Recycle and Recover 3.3.4 Recycling of waste materials 3.3.5 Principle of circular economy 3.3.6 Avoiding waste by design 3.3.7 Composting	Video Lectures (Online Mode: Link https://www.mahayouthnet.in/)	3
SUBUNIT 4: LEGISLATIONS RELATED TO WASTE MANAGEMENT				
3.4	**TLO 3.4.1** Familiarize yourself with major national and international legislation related to waste management. **TLO 3.4.2** Define Extended Producer Responsibility (EPR) and explain its concept in the context of environmental management. **TLO 3.4.3** Define biomedical waste and distinguish it from other types of waste. Identify the various sources and types of biomedical waste generated in healthcare facilities.	4.1 Municipal Solid Waste Management Rules 2016 4.2 Plastic Waste Management Rules 4.3 Extended Producer Responsibility (EPR) 4.4 Biomedical Waste Management 4.5 Preventive Measures for Manual Scavenging	Video Lectures (Online Mode: Link https://www.mahayouthnet.in/)	3
SUBUNIT 5: ACTION FOR IMPROVING WASTE MANAGEMENT				
3.5	**TLO 3.5.1** Develop skills in data collection methods for waste assessment, such as waste audits, surveys, and interviews.	5.1 Waste assessment in your community or town 5.2 Setting up a compost unit	Video Lectures (Online Mode: Link https://www.mahayouthnet.in/)	3

	TLO 3.5.2 Analyze collected data to identify patterns, trends, and areas for improvement in waste management practices. **TLO 3.5.3** Define composting and explain the biological processes involved in the decomposition of organic matter. **TLO 3.5.4** Explore different composting methods, such as aerobic and anaerobic composting, and choose the most suitable technique for the compost unit. **TLO 3.5.5** Explore different biogas production technologies, such as continuous stirred tank reactors (CSTR) and anaerobic digesters.	5.3 Biogas: Is it a possibility?		
UNIT IV: ENERGY MANAGEMENT AND CLIMATE ACTION				
SUBUNIT 1: ENERGY IN OUR LIVES				
4.1	**TLO 4.1.1** Identify the key principles of efficient energy use and conservation. **TLO 4.1.2** Familiarize yourself with different energy sources, including renewable and non-renewable options. **TLO 4.1.3** Understand the connection between energy production, consumption, and climate change. **TLO 4.1.4** Understand India's commitments to sustainable energy at the national and international levels, including agreements	4.1.1 Energy and quality of life 4.1.2 Sources of energy 4.1.3 Energy and C Change 4.1.4 Judicious use of non-renewable energy resources 4.1.5 A Just Transition 4.1.7 India's commitment to sustainable energy 4.1.8 Policies and Programs for Energy Management 4.1.9 Clean Energy for Cooking	Video Lectures (Online Mode: Link https://www.mahayouthnet.in/)	4

SUBUNIT 2: YOUTH ACTION TO IMPROVE ENERGY MANAGEMENT				
4.2	**TLO 4.2.1** Recognize the role of youth in driving positive change in energy management. **TLO 4.2.2** Understand how youth-led initiatives can influence energy policies, behaviours, and practices. **TLO 4.2.3** Identify and promote energy-efficient practices in daily life, schools, and communities.	4.1.1 Avoid energy wastage 4.2.2 Energy-efficient appliances 4.2.3 Renewable Energy-Specific Policies and Schemes 4.2.4 Low Carbon Lifestyles book	Video Lectures (Online Mode: Link https://www.mahayouthnet.in/)	4
SUBUNIT 3: PROMOTE SUSTAINABLE ENERGY AT HOME, INSTITUTION AND IN THE COMMUNITY				
4.3	**TLO 4.3.1** Identify and calculate energy requirements at the household level and enlist ways of efficient energy usage **TLO 4.3.2** Identify opportunities for improving public energy use in their village or town **TLO 4.3.3** Design surveys that effectively capture data on energy-efficient appliance availability and usage patterns. **TLO 4.3.4** Identify and analyze emerging technologies within the energy sector that require specialized skills. **TLO 4.3.5** Demonstrate the ability to map existing skills within the energy sector workforce. **TLO 4.3.6** Analyze skill gaps and their implications for the industry.	4.3.1 Energy audit at home or institution 4.3.2 Energy saving opportunities 4.3.3 Energy access survey 4.3.4 Surveys of energy-efficient appliance availability and use 4.3.5 Survey of renewable energy use 4.3.6 Survey energy sector skilling opportunities 4.3.7 Share study findings with policymakers	Video Lectures (Online Mode: Link https://www.mahayouthnet.in/)	5
UNIT V: BIODIVERSITY CONSERVATION AND CLIMATE ACTION				
SUBUNIT 1: BIODIVERSITY IN OUR LIVES				
5.1	**TLO 5.1.**1 Understand the concept of biodiversity and its components **TLO 5.1.2** Clearly define the concept of biocultural diversity, explaining the interconnectedness of biological diversity (biodiversity) and cultural diversity. **TLO 5.1.3** Clearly define the concept of human dependence on biodiversity, outlining the various ways in which humans rely on	**5.1.1** What is biodiversity? **5.1.2** What is Biocultural diversity? **5.1.3** Nature of Human Dependence on Biodiversity **5.1.4** Biodiversity resources in your landscape	Video Lectures (Online Mode: Link https://www.mahayouthnet.in/)	6

	diverse ecosystems for survival and well-being. **TLO 5.1.4** Develop the ability to identify and categorize the various forms of biodiversity present in the specific landscape, including plants, animals, microorganisms, and their interactions.			
SUBUNIT 2: THREATS TO BIODIVERSITY				
5.2	**TLO 5.2.1** Categorize and differentiate between natural and anthropogenic threats to biodiversity, including habitat loss, pollution, climate change, invasive species, and overexploitation. **TLO 5.2.2** Clearly define the concepts of biocultural diversity and climate change, highlighting the interconnectedness between biological diversity, cultural diversity, and changing climatic conditions.	**5.2.1 Threats to biodiversity** **2.2.2 Biocultural diversity and climate change**	Video Lectures (Online Mode: Link https://www.mahayouthnet.in/)	6
SUBUNIT 3: CONSERVING BIODIVERSITY				
5.3	**TLO 5.3.1** Clearly define the concept of biodiversity conservation, emphasizing its importance in maintaining ecological balance and supporting human well-being. **TLO 5.3.2** Explore the historical background that led to the development of forest acts, considering factors such as colonial influences, resource extraction, and changing societal attitudes towards forests. **TLO 5.3.3** Clearly define the concept of biodiversity conservation actions, emphasizing the multifaceted approaches and strategies employed to protect and sustain biodiversity.	**5.3.1** Approaches to conservation of biodiversity. **5.3.** Key legislations for biodiversity conservation **5.3.3** Actions for biodiversity conservation at various levels, including awareness raising and advocacy in the community	Video Lectures (Online Mode: Link https://www.mahayouthnet.in/)	6

Note: All above Units are Mandatory units. (In Online mode, only Units nos 1 and 2 are Mandatory and units nos 3,4, and 5 are Elective/optional)

V. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL/TUTORIAL EXPERIENCES.

NOT APPLICABLE

VI. SUGGESTED MICROPROJECT/ASSIGNMENT/ACTIVITIES FOR SPECIFIC LEARNING/SKILLS DEVELOPMENT (SELF-LEARNING)

Table 01: Individual Activities

Sr. No	Unit Name	Activity	Activity Details
1	Living with Climate Change	Calculation of your carbon footprint online	To Calculate your carbon footprint online at https://www.unfccc.int/ https://www.carbonfootprint.com/ Use two carbon footprint calculators available online to Prepare your report for Carbon footprint. Compare the calculators used and suggest which is the better calculator with the reasons.
2	Water Management and Climate Action	Conducting water audits	To conduct a Personal-level water audit. 1. Track your overall water usage: a) Read your water meter, b) Estimate usage without a meter 2. Measure individual fixture flow rates: a) Faucet and showerhead flow b) Toilet flush: 3. Monitor your water habits: a) Keep a water use log b) Observe your routines 4. Analyze your findings: a) Compare your usage to benchmarks, b) Identify potential leaks c) Prioritize areas for improvement 5. Implement water-saving strategies: a) Install water-efficient fixtures b) Shorten showers and bath times c) Run appliances only when full d) Fix leaky faucets promptly e)Utilize alternative water sources
3	Waste Management and Climate Action	Surveying Home waste	To find out How much waste is generated in your home every day conduct a home survey for a weekAnalyze as per the following: a) What makes up the maximum part of the waste? b) How much of what was thrown out could have been reused or recycled? c) Could the amount of garbage be reduced? List the ways to reduce waste at home. Calculate: a) Waste generated over a week (in grams) divided by 7= waste (gms)/ day, b) Waste (gms)/ day divided by the number of persons in your house= Waste (gms)/ day/capita Using your survey results, you can calculate the approximate waste generated by the entire population of a block of flats, township, village, town, city, etc.
4	Energy Management and Climate Action	Preparation of Survey report on energy-efficient appliances.	To prepare a Survey report on energy-efficient appliances, their availability and use. 1. Availability of Energy-Efficient Appliances: 2. Use of Energy-Efficient Appliances 3. Government Policies and Incentives 4. Technological Advancements 5. Environmental Impact and Consumer Trends
5	Biodiversity Conservation and Climate Action	Preparation of a Survey report on Biodiversity resources in your landscape	To prepare a Survey report on Biodiversity resources in your landscape based on any one point among the list given below. 1. List of trees, plants, and shrubs in the village/ town outskirts, their classification, occurrence, and usage study. 2. Draw a biocultural map of the landscape of the village/ town, the diversity of trees (mother trees) and those who maintain it 3. A village called Tree: Understand a tree as an ecosystem and the biodiversity associated with the tree. 4. Ranmeva special study 5. Dietary diversity across three generations, a ‘change over time’ study.

Table 2: Group Activity

Sr. No.	Unit Name	Community Project Name	Activity Details
1.	Living with Climate Change	Conduction of Feasibility Study of Renewable Energy	Conduct a feasibility study on implementing renewable energy sources (such as solar, wind, or hydroelectric power) for a specific area or institution. Analyze costs, benefits, environmental impacts, and logistics involved in transitioning to renewable energy**.**
2.	Water Management and Climate Action	Preparation of water audit for the college campus.	To prepare a water audit for the college campus based on the following points 1. Gather Information: 2. Identify Water Use Areas: 3. Assess Indoor Water Usage: 4. Evaluate Outdoor Water Usage: 5. Measurements and Inspections: 6. Data Analysis: 7. Recommendations for Conservation: 8. Cost-Benefit Analysis: 9. Create an Action Plan: 10. Implementation and Monitoring: 11. Educational Outreach: 12. Documentation and Reporting:
3.	Waste Management and Climate Action	Conduction of survey on Waste assessment in your locality.	1. Conduct a survey of waste management systems in your town/ locality. Observe all the stages of waste management, and note who is involved at each stage viz. Waste collection Transport Processing in different ways Disposal etc. 2. Analysis of waste management in your /locality. 3. Assessment of Waste Segregation in your /locality.
4	Energy Management and Climate Action	Conduction of energy audit at home or Institute	To conduct an energy audit at home or Institute based on the following points. Analyze your findings based on the energy audit and suggest necessary actions to minimize energy consumption. 1. Gather information and Create a checklist about the following. **1. Lighting:** • Turn off lights in unoccupied rooms. • Replace incandescent bulbs with LEDs • Utilize natural light whenever possible **2. Heating and Cooling:** • Set your thermostat to energy-efficient temperatures (25°C in summer, 20°C in winter) • Seal air leaks around windows and doors. • Clean or replace air filters regularly. **3. Appliances:** • Unplug electronics and chargers when not in use. • Wash clothes and dishes in cold water whenever possible. • Use energy-efficient appliances when purchasing new ones **4. Insulation:** • Check your attic and basement for proper insulation. • Seal any gaps or cracks around pipes and vents. **5.** Suggest corrective actions.

Sr. No.	Unit Name	Community Project Name	Activity Details
5.	Biodiversity Conservation and Climate Action	Preparation of report on Bio-Cultural Diversity Conservation	Prepare a report on Bio-Cultural Diversity Conservation. The report should include : **a) Introduction** i) What is biodiversity? ii)What is its importance in our life? iii) Connections of human beings with their nonliving surrounding and with living forms. **b) Biodiversity resources in your landscape -:** List of trees, plants, and shrubs in the village/ town outskirts, their classification, occurrence, and usage study. **c) Understand a tree as an ecosystem and the biodiversity associated with the tree.**

Note: (1) Individual activities:

The student should complete **any Three activities** among the list given in Table No. 01. above. **(Total Marks: 30 i.e. 10 Marks for each activity)**

(2) Group activity:

Students should complete **any One Community Project** among the list given in Table No. 02 above. **(Total Marks: 20)**

VII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	NIL (SLA Course)	NIL

VIII. SUGGESTED FOR WEIGHTAGE TO LEARNING EFFORTS & AND ASSESSMENT PURPOSE

(Specification Table)

NOT APPLICABLE

IX. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)	Summative Assessment (Assessment of Learning)
Individual activities and group activities. (50 marks)	Online Examination and issue of online certificate. (Total 4 Certificates)

Note: Student will be awarded 1 credit only upon submission of certificates

i) One Certificate on combined completion of Units 1 and 2 and

ii) One Certificate each on completion of Units nos. 3,4, and 5.

A total of 4 Certificates are needed to be submitted which will be issued online along with the submission of Individual activities and Group activities.

X. SUGGESTED COs- POs MATRIX FORM

NOT APPLICABLE

XI. SUGGESTED LEARNING MATERIALS/BOOKS

Sr.No	Description	Mode	Remarks
1	Learning material.	Learning material is available in PDF form	Learning material is available for all units in PDF form at the institute website.

XII. LEARNING WEBSITES & PORTALS

Sr.No	Web Link /Portal	Description
1	(Online Mode: Link https://www.mahayouthnet.in/)	Learning material is available online in the course menu after registration for this online course for all units.

XIII. ROLE OF STUDENT AND FACULTY:

(a) ROLE OF STUDENT.

1. **i) Course Registration:** Students should register for this course by adopting the normal procedure for registration as applicable for other courses, as per the schedule declared in the academic calendar through his/her MIS login.

   ii) Online Registration: Online registration for this **Self-paced course** "**YOUTH LEADERSHIP FOR CLIMATE ACTION" in online mode by using the URL as under.**

   " URL for online registration: https://www.mahayouthnet.in/

   Students may join the course by scanning the QR Code as mentioned below.

(Important Note: Students must complete both actions "a" and "b" as mentioned above. Merely completing the registration process in the Institute MIS will not get the student registered for this course.)

2. Students should complete the **Module No. 01 and 02** of this course in online mode and complete the online assignments as available in the online module. Upon completion of these activities, the student will receive a certificate of completion for Units No. 1 and 2. (Will be generated Online from The portal)

3. Students should take up online **Module Nos. 03, 04 and 05** (**which are available as "Elective Modules" in the same online module, No separate registration is needed for these modules**) and complete all unit-wise assignments as available in the online module. Upon completion of these activities, students will receive a separate certificate of completion for each unit i.e. **Units 03,04 and 05**) i.e. **three certificates**. (Will be generated Online from The portal)

4. Student must submit all 4 certificates (first certificate upon completing units nos. 1 and 2 and individual certificates upon completing units nos 3,4 and 5. A Total 4 certificates are needed to be submitted to the concerned faculty assigned for this course by the Concerned Head of the Department)

5. **Most Important Note regarding the award of 1 credit for this course: student must complete any 3 individual activities among the list of activities mentioned in table no 1 above AND must complete any 1 group activity AND submit all 4 certificates (generated in online mode upon completion of all 5 units in online study mode). Upon satisfying these conditions, the student will be awarded 1 credit for this course (SLA).**

6. **Detention/ Fail:** If a candidate does not secure minimum passing marks in SLA (Self Learning Assessment) of any course, then the candidate shall be declared as a **'fail'** and will have to repeat and resubmit SLA work.

(b) ROLE OF FACULTY:

1. i) Regarding confirmation of Course Registration: Faculty should confirm that the course registration has been confirmed by the concerned registration in charge and HOD from their MIS login.

ii) Online Registration for the course: Faculty should confirm that the student has registered for the course in online mode by scanning the QR code OR through the link provided by the portal for registering for the **Self-paced course** "**YOUTH LEADERSHIP FOR CLIMATE ACTION"** in online mode. Faculty should collect screenshots from the students and maintain a record of such screenshots for the concerned semester/term.

2. Regarding submissions to be accepted: The faculty should ensure that the student has completed all 5 modules as mentioned above. The faculty should get the 4 certificates (per student) submitted as submission against completion of the online self-paced course "**YOUTH LEADERSHIP FOR CLIMATE ACTION"** during the term/semester for which, the student have registered. Also, the Faculty should accept the submissions from each student regarding the completion of the group activities as well as individual activities as mentioned above. This activity of submission must be completed before the last date of submission for other courses. ie before the provisional detention schedule as per the academic calendar for that term.

3. **Regarding SLA assessment and allocation of Marks:** Faculty should assess the submission with following guidelines.

   i) Upon submission of online generated all 4 certificates (upon completion of online modules from the portal), the student should be considered eligible for the award of 1 credit along with satisfying the following conditions. (Faculty must not assess the individual activities and group activities if the student fails to submit all 4 certificates as proof of completion of the online course)

   ii) Upon accepting the submission concerning individual activities and group activities, the assessment of these activities should be done by the faculty as per the assessment norms mentioned above in **"VI"** titled "**SUGGESTED MICROPROJECT/ASSIGNMENT/ACTIVITIES FOR SPECIFIC LEARNING/SKILLS DEVELOPMENT (SELF-LEARNING)"**

   iii) Faculty should preserve the record of student-wise allotted marks in the rubrics provided for SLA assessment.

   iv) FACULTY should fill UP the marks of the student in the MIS mark sheet, only if the student has completed the online course (submitted all 4 certificates) and assessment of the group activities along with individual activities has been completed within the term schedule.

   v) In case the student fails to complete " iv" above, the faculty should fill up the marks obtained by the student for the part-submission and fill up those marks in the MIS mark sheet.

Name & Signature:		
Shri. Nitin D. Toradmal Lecturer in Electronics Govt. Polytechnic, Pune	**Shri. Balaji Vharkat** UNICEF, Maharashtra	**Shri. Girish W. Sonone** Lecturer in Electronics Govt. Polytechnic, Mumbai
Name & Signature:	Name & Signature:	
Smt. N. S. Kadam (Programme Head)	**Shri.S.B.Kulkarni** (CDC In-charge)	

GOVERNMENT POLYTECHNIC, PUNE

'120 – NEP' SCHEME

PROGRAMME	**DIPLOMA IN METALLURGICAL ENGINEERING**
PROGRAMME CODE	**05**
COURSE TITLE	**ELEMENTS OF MECHANICAL ENGINEERING**
COURSE CODE	**ME21203**
PREREQUISITE COURSE CODE & TITLE	**NA**

I. LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Course Type	Learning Scheme					Credits	Assessment Scheme											
			Actual Contact Hrs./Week			SLH	NLH		Paper Duration Hrs.	Theory				Based on LL & TSL				Based on SL		Total Marks
														Practical						
			CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
										Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
ME21203	ELEMENTS OF MECHANICAL ENGINEERING	SEC	3	-	2	1	6	3	3	30	70	100	40	25	10	25@	10	25	10	175

Total IKS Hrs for Term: 0 Hrs

Abbreviations: CL-Classroom Learning, **TL**-Tutorial Learning, **LL**-Laboratory Learning, **SLH**-Self Learning Hours, **NLH**-Notional Learning Hours, **FA** - Formative Assessment**, SA** -Summative assessment, **IKS** – Indian Knowledge System, **SLA**- Self Learning Assessment

Legends: @-Internal Assessment, **#** - External Assessment, ***#** - Online Examination, **@$** - Internal Online Examination

Note:

FA-TH represents an average of two class tests of 30 marks each conducted during the semester.

1. If a candidate is not securing minimum passing marks in **FA-PR** (Formative Assessment - Practical) of any course, then the candidate shall be declared as **'Detained'** in that semester.
2. If a candidate does not secure minimum passing marks in SLA (Self Learning Assessment) of any course, then the candidate shall be declared as **'fail'** and will have to repeat and resubmit SLA work.
3. **Notional learning hours** for the semester are **(CL + LL + TL + SL) hrs. * 15 Weeks**
4. **1 credit** is equivalent to **30 Notional hours**.
5. * Self-learning hours shall not be reflected in the Timetable.
6. * Self-learning includes micro-projects/assignments/other activities.

II. RATIONALE:

Metallurgy Engineers often come across various engg. components for selection of materials and manufacturing processes. They are required to know basic principles of working of different machines and equipments. They are also required to look after the maintenance of the machines. It is therefore necessary for them to know how to interpret the assembly drawings, component drawings in order to carry out any engineering work.

III. COURSE-LEVEL LEARNING OUTCOMES (CO'S)

Students will be able to achieve & demonstrate the following CO's on completion of course-based learning

CO1: Draw proportionate free hand drawing of IC engine parts etc.

CO2: Develop the ability to read the drawing and identify conventional representations.

CO3: State working principal of IC engines.

CO4: State working principal of compressors, pumps etc.

CO5: Identify different power transmission devices.

IV. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr. No	Theory Learning Outcomes (TLO'S) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
UNIT-I ADVANCED SECTIONAL VIEWS (CL Hrs- 9, Marks- 12)				
1	TLO 1.1 Draw different types of sections. TLO 1.2 Draw sectional views of IC engine parts. TLO 1.3 Draw sectional views of pulley, gear, flanged couplings and bearings.	1.1 Types of sections: Conventional, revolved, removed, partial, offset. 1.2 Free hand sketches of Crankshaft, Engine body, camshaft, flywheel. 1.3 Free hand sketches of Pump body, pulley, gears, flanged coupling, bearing.	Chalk-Board Model Demonstration Video Demonstrations	CO1
UNIT-II BLUE PRINT READING (CL Hrs- 8, Marks- 12)				
2	TLO 2.1 Draw machine symbols and surface finish symbols. TLO 2.2 Identify specifications on drawing TLO 2.3 Identify limit fit and tolerance, Hole and shaft basis system.	2.1 Machine symbols, surface finish. 2.2 Specification on drawing such as material hardness, heat treatment, micro structure. 2.3 Concept of limit fit and tolerance. Hole basic system, shaft basis system.	Chalk-Board Model Demonstration Video Demonstrations	CO2
UNIT-III I. C. ENGINES (CL Hrs- 10, Marks- 16)				
3	TLO 3.1 Classify IC engines. TLO 3.2 Identify different IC engine parts. TLO 3.3 Describe working of two stroke petrol and four stroke petrol/diesel engines. TLO 3.4 Comparision between 2 stroke and 4 stroke cycle I.C. engine. TLO 3.5 Comparision between petrol and diesel I.C. engine.	3.1 Classification of I.C.engine, construction of I.C.engine. 3.2 I.C. engine terminology 3.3 Construction and working of 2 stroke cycle petrol engine. 3.4 Construction and working of 4 stroke cycle petrol engine. 3.5 Construction and working of 4 stroke cycle diesel engine. 3.6 Applications of I.C. engine.	Chalk-Board Model Demonstration Video Demonstrations	CO3
UNIT-IV PUMPS AND COMPRESSORS (CL Hrs- 10, Marks- 16)				
4	TLO 4.1 Select suitable pumps. TLO 4.2 Describe working of reciprocating pump. TLO 4.3 Describe working of centrifugal pump. TLO 4.4 Select suitable Compressors. TLO 4.5 Describe working of reciprocating Compressor.	4.1 Classification of pumps. 4.2 Construction of reciprocating pump. 4.3 Working of single acting reciprocating pump. 4.4 Construction and working of centrifugal pump. 4.5 Classification of Compressors. 4.6 Working of reciprocating Compressors. 4.7 Uses of Compressors air.	Chalk-Board Model Demonstration Video Demonstrations	CO4
UNIT–V POWER TRANSMISSION DEVICES (CL Hrs- 8, Marks- 14)				
5	TLO 5.1 Identify different types of drives. TLO 5.2 Identify different types of gears. TLO 5.3 Compare between different drives. TLO 5.4 List advantages & disadvantages of different drives.	5.1 Types of Belt drive (according to shape and arrangement), Open and cross belt, Flat belt and V belt. 5.2 Chain Drives- introduction. 5.3 Classification of Gears- Spur, Helical, Bevel, Worm. 5.4 Comparison between drives. 5.5 advantages & disadvantages of different drives.	Chalk-Board Model Demonstration Video Demonstrations	CO5

V. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL/TUTORIAL EXPERIENCES.

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
1	LLO 1.1 Draw two views from given isometric view	Draw two views from given isometric view of couplings and pulley and bearings.	4	1
2	LLO 2.1 Draw two views from given isometric view	Draw two views from given isometric view of gears and bearings.	4	1
3	LLO 3.1 Draw simple assembly	Draw simple assembly containing six parts.	4	2
4	LLO 4.1 Draw free hand sketches	Draw free hand sketches of IC engine parts	2	1
5	LLO 5.1 Identify IC engine parts	Observe IC engine parts and write function of each.	2	1,3
6	LLO 6.1 Demonstrate working of Petrol engine	Demonstrate working of Petrol engine.	2	3
7	LLO 7.1 Demonstrate working of Diesel engine.	Demonstrate working of Diesel engine.	2	3
8	LLO 8.1 Demonstrate working of centrifugal pump	Demonstrate working of centrifugal pump.	2	3
9	LLO 9.1 Demonstrate working of reciprocating pump	Demonstrate working of reciprocating pump.	2	3
10	LLO 10.1 Demonstrate working of reciprocating compressor.	Demonstrate working of reciprocating compressor.	2	3
11	LLO 11.1 Demonstrate working of belt drive	Demonstrate working of belt drive.	2	5
12	LLO 12.1 Demonstrate working of gear drive	Demonstrate working of gear drive.	2	5

VI. SUGGESTED MICRO PROJECT/ASSIGNMENT/ACTIVITIES FOR SPECIFIC LEARNING/SKILLS DEVELOPMENT (SELF-LEARNING)

Micro project:

Only one micro project is planned to be undertaken by student that needs to be assigned to him/her. It should preferably be undertaken individually to build up skill and confidence in every student to become problem solver so that he/she contributes to the projects of industry. In special situations w here groups have to be formed for micro projects, the number of students in one group should not exceed three. A suggestive list of micro projects is given here. a. Prepare model of any suitable topic from syllabus. b. Prepare charts of suitable topics from syllabus. c. Any other suitable micro project as decided by teacher and industry expert. d. Literature survey and report writing on recent developments in any area from syllabus.

A suggestive list of micro projects is given here.

a. Prepare model of any suitable topic from syllabus.
b. Prepare charts of suitable topics from syllabus.
c. Any other suitable micro project as decided by teacher and industry expert.
d. Literature survey and report writing on recent developments in any area from syllabus.

Assignments:

a. Prepare journal based on practical performed in laboratory. Journal consists of drawing, observations, required equipment's, date of performance with teacher signature.
b. Group discussion
c. Assignments
d. Seminar

VII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED

Sr. No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Drawing board/minidrafter and drawing instruments, Std.specifications	1,2,3,4
2	Petrol engine with any standard specifications	5,6
3	Diesel engine with any standard specifications.	5,7
4	Centrifugal pump with any standard specifications.	8
5	Reciprocating pump with any standard specifications	9
6	Belt drive, chain drive with any standard specifications.	11
7	Different models of gears	12

VIII. SUGGESTED FOR WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr. No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Advanced Sectional Views	CO1	9	4	4	4	12
2	II	Blue Print Reading	CO2	8	4	4	4	12
3	III	IC Engines Working	CO3	10	4	8	4	16
4	IV	Pumps and Compressors	CO4	10	4	8	4	16
5	V	Power Transmission Devices	CO5	8	4	6	4	14
Grand Total				**45**	**20**	**34**	**20**	**70**

IX. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)	Summative Assessment (Assessment of Learning)
1. Tests 2. Seminar/Presentation 3. Term Work	1. Practical 2. Theory

X. SUGGESTED COs- POs MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes * (PSOs)			
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3	PSO-4
CO1	2	-	2	-	-	1	2	-	-	-	-
CO2	2	1	2	-	-	1	2	-	-	-	-
CO3	2	-	-	-	1	1	2	-	-	-	-
CO4	2	-	1	-	1	1	2	-	-	-	-
CO5	2	-	1	-	1	1	2	-	-	-	-

Legends:- High: 03, **Medium:** 02, **Low:** 01, **No Mapping:** -
*PSOs are to be formulated at the institute level

XI. SUGGESTED LEARNING MATERIALS/BOOKS

Sr. No	Author	Title	Publisher with ISBN Number
1	N.D.Bhatt	Machine Drawing	Chartor Publishing House ISBN: 9789385039232
2	N.Sidheswar, P.Kannaiah, Sastry V.V.S	Machine Drawing	McGraw Hill Education ISBN: 9780074603376
3	V.Ganesan	IC Engines	Tata Mc Graw Hill ISBN: 9781259006197
4	R. S. Khurmi	Hydraulic Machinery	S.Chand Co Ltd.,New Delhi ISBN: 9788121901628
5	Jagadish Lal	Hydraulic Machinery	Metropolitan Publishers ISBN: 9788120004405
6	S.P.Sukhatme	Heat Transfer	Tata McGraw Hill ISBN: 9788173715440

XII. LEARNING WEBSITES & PORTALS

Sr. No	Link/Portal	Description
1	https://www.youtube.com/watch?v=TEOcTMj8o7w	Introduction to Sections
2	https://www.youtube.com/watch?v=VO-xekz8vps&pp=ygUgbGltaXQgZml0IGFsbG93YW5jZSAmIHRvbGVyYW5jZSA%3D	Limit, Fit, Allowance & Tolerance – Difference explained with example
3	https://www.youtube.com/watch?v=NP_yYqPx0VE	how to read engineering drawing - GD&T - Geometric dimensions and tolerances
4	https://www.youtube.com/watch?v=0SPn5AxVx3k	4 Stroke Engine Animation
5	https://www.youtube.com/watch?v=Gfz_lOGV9zk&pp=ygUUcHVtcCBhbmltYXRpb24gdmlkZW8%3D ,	Reciprocating Pumps | Working of Single acting and Double acting reciprocating pumps
6	https://www.youtube.com/watch?v=lmjIQqo8mX4	Centrifugal Pumps

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(Course Experts)

Name & Signature:	Name & Signature:
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GOVERNMENT POLYTECHNIC, PUNE

'120 – NEP' SCHEME

PROGRAMME	**DIPLOMA IN METALLURGICAL ENGINEERING**
PROGRAMME CODE	**05**
COURSE TITLE	**PRINCIPLES OF PHYSICAL METALLURGY**
COURSE CODE	**MT21201**
PREREQUISITE COURSE CODE & TITLE	**NA**

I. LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Course Type	Learning Scheme					Credits	Assessment Scheme											
			Actual Contact Hrs./Week			SLH	NLH		Paper Duration Hrs.	Theory				Based on LL & TSL				Based on SL		Total Marks
														Practical						
			CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
										Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
MT21201	PRINCIPLES OF PHYSICAL METALLURGY	SEC	3	-	4	1	8	4	3	30	70	100	40	25	10	25@	10	25	10	175

Total IKS Hrs for Term: 0 Hrs

Abbreviations: CL-Classroom Learning, **TL**-Tutorial Learning, **LL**-Laboratory Learning, **SLH**-Self Learning Hours, **NLH**-Notional Learning Hours, **FA** - Formative Assessment**, SA** -Summative assessment, **IKS** – Indian Knowledge System, **SLA**- Self Learning Assessment

Legends: @-Internal Assessment, **#** - External Assessment, ***#** - Online Examination, **@$** - Internal Online Examination

Note:

FA-TH represents an average of two class tests of 30 marks each conducted during the semester.

1. If a candidate is not securing minimum passing marks in **FA-PR** (Formative Assessment - Practical) of any course, then the candidate shall be declared as **'Detained'** in that semester.
2. If a candidate does not secure minimum passing marks in SLA (Self Learning Assessment) of any course, then the candidate shall be declared as **'fail'** and will have to repeat and resubmit SLA work.
3. **Notional learning hours** for the semester are **(CL + LL + TL + SL) hrs. * 15 Weeks**
4. **1 credit** is equivalent to **30 Notional hours**.
5. * Self-learning hours shall not be reflected in the Timetable.
6. * Self-learning includes micro-projects/assignments/other activities.

II. RATIONALE:

This course deals with solidification of metals and alloys. Various types of equilibrium diagrams and their relationship between microstructure and properties of metals and alloys are studied in course. It forms a vital link in the processes of making, shaping and heat treating of metals. It thus interfaces with the other areas of metallurgy such as process metallurgy, mechanical metallurgy and engineering metallurgy. Therefore, an engineering diploma student must be conversant with equilibrium diagrams, and metallography from the point of view of producing structures of metals that give the best properties. The study of these concepts and principles of physical metallurgy will develop skills in students to identify and interpret microstructures, and properties of steel, where the emphasis is laid on the application of these metals and alloys.

III. COURSE LEVEL LEARNING OUTCOMES (CO'S)

Students will be able to achieve & demonstrate the following CO's on completion of course-based learning

CO1: Plot various cooling curves for pure metals and alloys.

CO2: Plot various binary equilibrium diagrams and calculate amount of phases using Lever Rule.

CO3: Interpret Iron -Iron carbide diagram Phase equilibrium diagram.

CO4: Prepare metallographic specimen and operate Metallurgical microscope for microstructure analysis.

CO5: Perform macroscopic test on steel.

IV. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr. No	Theory Learning Outcomes (TLO'S) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
UNIT-I SOLIDIFICATION OF METALS (CL Hrs- 06, Marks- 12)				
1	TLO 1.1 Describe solidification. TLO 1.2 Describe the nucleation and growth process during solidification. TLO 1.3 Compare solidification of pure metal with alloy. TLO 1.4 Define grain and grain boundary. TLO 1.5 Draw cooling curves for pure metal and alloy. Define Solid Solution. Describe different solid solutions. Differentiate between substitution and interstitial solid solutions. TLO 1.6 State and apply Hume-Rothery's principles for formation of solid solutions. TLO 1.7 Describe different compounds.	1.1 Concept of solidification-Transformation of liquid pure metal and alloys into solid. 1.2 Nucleation and growth, dendrite formation. 1.3 Grain and grain boundaries. 1.4 Cooling curves for pure metals and binary alloys. 1.5 Solid solutions - Substitutional solid solution, Interstitial solid solution & Intermediate solid solution. 1.6 Hume- Rothery's rules for formation of solid solution. 1.7 Intermediate compounds, electron compounds, their examples.	Lecture Assignment	**CO1**
UNIT-II EQUILIBRIUM DIAGRAMS (CL Hrs- 09, Marks- 14)				
2	TLO 2.1 Define phase. TLO 2.2 Derive Gibbs phase rule for metallurgical systems. TLO 2.3 Construct binary equilibrium diagram. TLO 2.4 Derive Lever Rule. TLO 2.5 Determine proportions of phases by applying lever rule.	2.1 Definition of phase. 2.2 Gibbs's phase rule and its application. 2.3 Construction of equilibrium diagrams. 2.4 Isomorphous System, Eutectic system, Partial Eutectic systems, Layer type systems. 2.5 Lever Rule: Its derivation and application to equilibrium diagrams,	Lecture Assignment Chart	**CO2**
UNIT-III IRON–IRON CARBIDE EQUILIBRIUM DIAGRAM (CL Hrs- 12, Marks- 16)				
3	TLO 3.1 Define allotropy. TLO 3.2 Draw Fe-Fe_3C diagram. TLO 3.4 Write transformation reactions in Iron-Iron carbide diagram. TLO 3.5. Classify steel based on Iron -Iron carbide diagram TLO 3.6 Draw microstructures of different steels. TLO 3.6 Describe microstructure and properties of plain carbon steels on cooling with reference to iron - iron carbide diagram.	3.1 Allotropic transformation of iron. 3.2 Draw Fe-Fe_3C diagram. 3.3 Reactions in Fe-Fe_3C diagram. 3.4 Critical temperatures in Fe-Fe_3C diagram. 3.5 Classifications of plain carbon steel with reference to Fe-Fe_3C diagram. (Hypo and hyper eutectoid steels)	Lecture Assignment Chart	**CO3**

Sr. No	Theory Learning Outcomes (TLO'S) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
UNIT-IV MICROSCOPIC EXAMINATION (CL Hrs- 12, Marks-16)				
4	TLO 4.1 Describe steps for microscopic examination. TLO 4.2 Describe steps for metallographic preparation of specimens. TLO 4.3 Define Etching. TLO 4.4 Describe etching techniques. TLO 4.5 Name etching reagents. TLO 4.6 Select proper etchant. TLO 4.7 Draw microstructures of steels. TLO 4.8 Use metallurgical microscope. TLO 4.9 Draw ray diagram of metallurgical microscope. TLO 4.10 State advantages of oil immersion objective. TLO 4.11 Define Electron Microscopy. TLO 4.12 State types of electron microscopes. TLO 4.13 State use of Image Analyzer software.	4.1 Define Microscopic Examination, 4.2 Specimen Preparation: Sampling, mechanical and electrolytic polishing. Metallographic polishing abrasives polishing cloth, and cleaning methods. 4.3 Define Etching, etching techniques and etching reagents, 4.4 Analysis and interpretation of phases in plain carbon steel. 4.5 Metallurgical microscope- Optical /Inverted microscope: Principle, construction and working of Optical microscope optical system, objectives, eyepiece. 4.6 Draw ray diagram of metallurgical microscope. 4.7 Define Electron Microscopy. 4.8 Types of Electron Microscopes- Introduction to Scanning Electron Microscope (SEM) and Transmission Electron Microscope (TEM). 4.9 Introduction to Image Analyzer software.	Lecture Assignment Demonstration	**CO4**
UNIT- V MACROSCOPIC EXAMINATION (CL Hrs- 6, Marks- 12)				
	TLO 5.1 State purpose and principle of macroscopic examination. TLO 5.2 Describe steps for macroscopic examination. TLO 5.3 Explain various methods of recording macrostructures. TLO 5.4 Describe the Sulphur printing, phosphorus printing, and oxide printing tests. TLO 5.5 Enlist various types of Etching reagents for macro etching. TLO 5.6 To study Grain flows of forged components, hydrogen flakes.	5.1. Macroscopic Examination: Purpose and Principle. 5.2 Procedure for macroscopic examinations. 5.3 Methods of recording macrostructures by photographic and contact printing. 5.4 Sulphur printing, phosphorus printing, and oxide printing. 5.5 Etching reagents for macro etching, 5.6 Grain flows of forged components, examination of fractures and other applications of macro etching.	Lecture Assignment Demonstration	**CO5**

V. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL/TUTORIAL EXPERIENCES.

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
1	LLO 1.1 Draw cooling curves for pure metals and alloys.	Draw cooling curves for pure metals and alloys.	4	CO1
2	LLO 2.1 Draw various binary equilibrium diagrams.	Draw various binary equilibrium diagrams.	4	CO2
3	LLO 3.1 Draw Iron -Iron carbide diagram Phase equilibrium diagram and interpret transformation reactions and critical temperature.	A) Draw Fe-Fe3C equilibrium diagram.	4	CO3
		B) To study transformation reactions in Iron-Carbon diagram. Critical temperatures in Iron- iron carbide diagram.	8	CO3
4	LLO 4.1 Develop skill for metallographic specimen preparation and operate Metallurgical microscope for microstructure analysis.	Prepare micro-specimen for metallographic observation.	8	CO4
5	LLO 5.1 Prepare etching reagent and do etching of specimen	Prepare etching reagent and do etching of specimen.	8	CO4
6	LLO 6.1 Operate and identify metallurgical microscope.	Identify and label various parts of metallurgical microscope.	8	CO4
7	LLO 7.1 Draw microstructures of plain carbon steels by microscopic observation.	Observe prepared specimen under microscope and interpret the micro structural phases. Draw microstructures of plain carbon steels by microscopic observation.	8	CO4
8	LLO 8.1 To study Phosphorus, Sulphur and oxide distribution by Phosphorous, Sulphur and oxide printing	To study Phosphorus, Sulphur and oxide distribution by Phosphorous, Sulphur and oxide printing.	8	CO5
Note: Take the practical l in a batch size of 20 to 30 students.				

VI. SUGGESTED MICRO PROJECT/ASSIGNMENT/ACTIVITIES FOR SPECIFIC LEARNING/SKILLS DEVELOPMENT (SELF-LEARNING)

Micro projects-

- Search and write different grades of materials used as abrasives in polishing of specimens.
- Search and write the information on backup materials used in specimen mounting.
- Make a report on industrial applications of quantitative metallographic techniques.
- To make a poster of an Iron -Iron carbide diagram.
- To make poster of ray diagram of optical microscope.

Assignment

- Study and draw cooling curves for any two pure metals. (ferrous and 1 nonferrous)
- Write any five examples of various solid solutions.
- Draw any two types of phase diagrams of metallic alloy systems (Example Cu-Ni).
- Define and derive the Lever rule with an example.
- Calculate the amount of phases present at particular temperature and composition (Select any one type of alloy).
- Study and draw Iron –Iron carbide diagram.
- Prepare posters /tables to illustrate the use of etching reagents for different metals and alloys.
- Construct equilibrium diagrams for different types of solid solutions. Eg. Cu-Ni system.
- Construct equilibrium diagram for metals partially soluble in solid state from given data.
- Study Principle, construction and working of Optical microscope
- Study Principle, construction, working and applications of Electron microscopes and compare it with optical microscopy.

VII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED

Sr. No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Standard Fe-Fe_3C equilibrium diagram, Equilibrium diagram	3
2	Metallurgical Microscope with Image Analyzer software	6
3	Standard specimens (for steels)	6,7
4	Mounting press	6
5	Emery papers of different grades	6
6	Etching reagents	5,8
7	Grinder	6
8	Chart Polishing /Lapping machine	6
9	Cutting machine	6

VIII. SUGGESTED FOR WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr. No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Solidification of metals	CO1	06	04	06	02	12
2	II	Equilibrium diagrams	CO2	09	04	08	04	14
3	III	Iron –iron carbide equilibrium diagram	CO3	12	04	04	04	16
4	IV	Microscopic examination	CO4	12	04	08	04	16
5	V	Macroscopic examination	CO5	06	04	06	02	12
Grand Total				**45**	**20**	**32**	**16**	**70**

IX. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)	Summative Assessment (Assessment of Learning)
1. Tests 2. Rubrics for COs 3. Assignment 4. Self-Learning 5. Term Work 6. Seminar/Presentation	1. End Term Exam 2. Micro-project

X. SUGGESTED COs- POs MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes *(PSOs)			
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3	PSO-4
CO1	3	2	2	1	1	1	3	3	2	2	2
CO2	3	3	3	2	1	2	2	3	2	2	2
CO3	3	3	2	2	2	2	3	3	2	3	3
CO4	3	2	2	3	1	1	2	3	3	3	3
CO5	3	2	2	3	1	1	2	3	3	3	3

Legends:- High: 03, **Medium:** 02, **Low:** 01, **No Mapping:** -
*PSOs are to be formulated at the institute level

XI. SUGGESTED LEARNING MATERIALS/BOOKS

Sr. No	Author	Title	Publisher
1	Sidney H. Avner	Introduction to Physical Metallurgy	Second Edition, Tata McGraw-Hill 1997 ISBN 0-07-463006-7
2	Robert W. CAHN, Peter HAASEN	Physical Metallurgy	Volume Fourth Edition, 1996, North Holland ISBN 0 444 89875
3	Dr.V.D. Kodgire, S.V. Kodgire	Material Science and Metallurgy	Everest Publishing House, 43rd Edition ISBN 81-86314-00-8
4	V. Raghavan	Physical Metallurgy	PHI Learning Private limited

XII. LEARNING WEBSITES & PORTALS

Sr. No	Link/Portal	Description
1	https://youtu.be/2a1Ft6j1n1Q	Solidification of metals
2	https://youtu.be/b2PRoZ0dxac	Mechanism of solidification
3	https://youtu.be/VtBrmWcNu8k	Equilibrium Phase diagram
4	https://www.youtube.com/watch?v=eWs6Sv4S7yU	Lever rule derivation
5	https://www.youtube.com/watch?v=5vaYfd0fekI	Iron carbide diagram
6	https://www.youtube.com/watch?v=fc8zrgYJCJw	Metallographic specimen preparation steps
7	https://www.youtube.com/watch?v=UuHofNW40Yw	Etching technique and etchant preparation

Name & Signature:
Mrs. Sarika Satish Aglave
Lecturer in Metallurgical Engineering
(Course Expert)

Name & Signature:	Name & Signature:
Mrs. Namita S. Kadam (Programme Head)	**Mr. Sudin B Kulkarni** (CDC In-charge)

GOVERNMENT POLYTECHNIC, PUNE

'120 – NEP' SCHEME

PROGRAMME	**DIPLOMA IN METALLURGICAL ENGINEERING**
PROGRAMME CODE	**05**
COURSE TITLE	**BASIC METALLURGY**
COURSE CODE	**MT31201**
PREREQUISITE COURSE CODE & TITLE	**NA**

I. LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Course Type	Learning Scheme					Credits	Assessment Scheme											
			Actual Contact Hrs./Week			SLH	NLH		Paper Duration Hrs.	Theory				Based on LL & TSL				Based on SL		Total Marks
														Practical						
			CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
										Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
MT31201	BASIC METALLURGY	DSC	3	-	4	1	8	4	3	30	70	100	40	25	10	25@	10	25	10	175

Total IKS Hrs for Term: 1 Hr

Abbreviations: CL-Classroom Learning, **TL**-Tutorial Learning, **LL**-Laboratory Learning, **SLH**-Self Learning Hours, **NLH**-Notional Learning Hours, **FA** - Formative Assessment**, SA** -Summative assessment, **IKS** – Indian Knowledge System, **SLA**- Self Learning Assessment

Legends: @- Internal Assessment, # - External Assessment, ***#** - Online Examination, **@$** - Internal Online Examination

Note:

FA-TH represents an average of two class tests of 30 marks each conducted during the semester.

1. If a candidate is not securing minimum passing marks in **FA-PR** (Formative Assessment - Practical) of any course, then the candidate shall be declared as **'Detained'** in that semester.
2. If a candidate does not secure minimum passing marks in SLA (Self Learning Assessment) of any course, then the candidate shall be declared as **'fail'** and will have to repeat and resubmit SLA work.
3. **Notional learning hours** for the semester are **(CL + LL + TL + SL) hrs. * 15 Weeks**
4. **1 credit** is equivalent to **30 Notional hours**.
5. * Self-learning hours shall not be reflected in the Timetable.
6. * Self-learning includes micro-projects/assignments/other activities.

II. RATIONALE:

Basic metallurgy mainly deals with basic topics required for understanding metallurgical subjects. The subject is a collection of widely different basic topics such as fuels, refractory, vacuum technology, and conceptual understanding of the structure of solid materials and their properties.

III. COURSE-LEVEL LEARNING OUTCOMES (CO'S)

Students will be able to achieve and demonstrate the following CO's on completion of course-based learning

CO1: Familiar with material structure and properties**.**

CO2: Compare cold-working and hot-working

CO3: Select and apply various fuels for applications.

CO4: Select appropriate refractory as per applications.

CO5: State working principles of various temperature measuring device.

CO6: State role of vacuum in metallurgical applications.

IV. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr. No	Theory Learning Outcomes (TLO'S) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
	UNIT-I INTRODUCTION (CL Hrs-01 Marks-02)			
1	TLO 1.1 State the different aspects of basic metallurgy. TLO 1.2 State the area applications of Basic metallurgy. TLO 1.3 Use concepts given in Ancient Indian Metallurgy for metal working or processing to solve given problems.	1.1 Importance of metallurgy, various branches of metallurgy and scope under Indian conditions. 1.2 Ancient Indian Metallurgy for metal working or processing.e.g Blacksmithy	Improved Lecture Assignment Demonstration	**CO1**
	UNIT-II NATURE OF SOLIDS (CL Hrs-06, Marks-10)			
2	TLO 2.1 Conversant with structure and unit cell, types of crystal system and designation of planes and direction with applications. TLO 2.2 Apply the concept of a defect in crystal with causes and effects.to solve the given simple engineering-related problem(s). TLO 2.3 Use of the concept of allotropic & and polymorphism in metal to investigate simple engineering works. TLO 2.4 Explain polymeric materials' properties; uses and Structure. TLO 2.5 Explain the characteristics and structure of nonmetallic materials.	2.1States of matter, types of structures (amorphous and crystalline), atomic structure of metals. 2.2 Types of crystal structure, Unit cell and Parameter, No. of atoms per unit cell of FCC, BCC, HCP and SC. 2.3 Determination of atomic packing factor and density of metal 2.4 Allotropic forms of metals & and alloys with importance. 2.5 Miller indices for planes and directions 2.6 Imperfections in the crystals - point; line and surface, with examples. 2.7 Polymorphism. 2.8 Structures of silicates, carbon, and glasses 2.9 Polymeric structure. Ceramics and their comparison with metals (Strength-to-weight ratio).	Improved Lecture Assignment Demonstration	**CO1**
	UNIT-III PLASTIC DEFORMATION (CL Hrs-06, Marks-08)			
3	TLO 3.1 Compare cold and hot working of process, parameter, properties and application. TLO 3.2 Explain the annealing mechanism with applications.	3.1 Grain structure, cold working, Hot working, process, advantages, disadvantages, applications and comparison. 3.2 Mechanism of annealing, recovery recrystallisation and grain growth.	Improved Lecture Assignment Demonstration	**CO2**

Sr. No	Theory Learning Outcomes (TLO'S) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
UNIT- IV SOLIDS FUELS (CL Hrs-10, Marks-14)				
4	TLO 4.1 Explain the term fuel and its classification. TLO 4.2 Classify solid fuels. TLO 4.3 Explain the properties and advantages of each solid fuel. TLO 4.4 Compare wood, peat; lignite bituminous coal and anthracite in terms of appearance, properties and uses. TLO 4.5 Classify bituminous coal. TLO 4.6 Explain the carbonization process and list various products of carbonization. TLO 4.7 Enlist properties and application of Metallurgical Coke or Hard Coke. TLO 4.8 Describe various requirements/selection criteria of fuel for a cupola Furnace or any coal-fired furnace.	4.1 Classifications of fuels, solid fuels classification; properties; advantages, limitations and application, 4.2 Occurrence/origin of coal with reference to Indian conditions, 4.3 Classifications & characteristics of fuels-wood, peat, lignite, bituminous anthracite proximate analysis & ultimate analysis, calorific value, units of heat energy, ignition temperature. 4.4 Carbonization of coal-process, products and their uses. 4.5 Properties and uses of Metallurgical coke, bi-products of coke. Use of pulverized and briquetted coal or coke. 4.6 Selection criteria of good fuel for a particular application.	Improved Lecture Assignment Demonstration	**CO3**
UNIT –V LIQUID & GASEOUS FUELS (CL Hrs-10, Marks-14)				
5	TLO 5.1 Explain the properties, advantages, limitations and general uses of liquid fuels. TLO 5.2 Classify petroleum. TLO 5.3 Define refinery and list various products of petroleum refining. TLO 5.4 Describe properties, calorific value, composition and uses of any one liquid fuel. TLO 5.5 Describe the manufacturing of water gas or producer gas. TLO 5.6 Properties and uses of LPG/BF gas. TLO 5.7 Describe any one liquid or gaseous fuel consisting of burners.	5.1 Important properties and uses of various liquid fuels. 5.2 Resources of petroleum, classification of crude oil- properties, refining of petroleum, products and uses 5.3 Properties, calorific value advantages, disadvantages and uses of Petrol, diesel, kerosene and furnace oil & other products. 5.4 Classification of gaseous fuels, Manufacture of water gas and producer gas fuels. 5.5 Gaseous fuels composition. Properties and uses of Natural gas. Blast furnace gas, coke oven gas and liquefied petroleum gases. Water gas, producer gas. 5.6 Introduction to green fuel eg. H2 fuel. 5.7 Types of flames, Burners required for combustion of liquid and gaseous fuels and their working principles. 5.7 Regenerators & recuperators.	Improved Lecture Assignment Demonstration	**CO3**

Sr. No	Theory Learning Outcomes (TLO'S) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
UNIT –VI REFRACTORY MATERIALS (CL Hrs-06, Marks-10)				
6	TLO 6.1 Define and classify refractory TLO 6.2 Explain important properties of refractories TLO 6.3 Explain the PCE test of refractory. TLO 6.4 Explain the properties and uses of any one acidic refractory TLO 6.5 Explain the properties and uses of any one basic refractory TLO 6.6 Explain any special /neutral refractory advantages and applications.	6.1 Classification of refractory. General properties such as refractoriness, porosity, chemical inertness, and strength at elevated temperatures. 6.2 Testing of refractory such as PCE test. 6.3 Properties and application of acidic refractories such as fireclay, silica, and alumina. 6.4 Properties and application of basic refractories such as magnesite, and chromite. 6.5 Properties and application of neutral refractories such as carbon and special refractories like insulation materials, zirconia, and cer-wool. 6.6 Selection of refractory for specific furnaces.	Improved Lecture Assignment Demonstration	**CO4**
UNIT –VII FURNACE & TEMPARATURE MEASURING DEVICES (CL Hrs-05, Marks-08)				
7	TLO 7.1 Enlist various industrial furnaces in the metallurgical area application TLO 7.2 State refractory and the fuel used in the cupola furnace. TLO 7.3 Classification of Furnaces explain the working and uses of the shaft furnace. TLO 7.4 Enlist various temperature measuring devices and state their working principle. TLO 7.5 Explain the infrared analyzer for temperature measurement.	7.1 Basic types of furnaces, Use in industries 7.2 Types of furnaces – Shaft, reverberatory, coke-fired furnace. 7.3 Refractories used in furnaces, different fuels used in furnaces. 7.4 Classification of temperature measuring device. 7.5 Construction, working, advantages, disadvantages and applications of Thermocouples and Pyrometers in Metallurgical Industries. 7.6 Introduction to Infrared analyzer for temperature measurement.	Improved Lecture Assignment Demonstration	**CO5**
UNIT –VIII VACCUM & APPLICATION IN METALLURGY (CL Hrs-01, Marks-04)				
8	TLO 8.1 Explain the term vacuum with measuring unit. TLO 8.2 Enlist various vacuum-producing pumps. TLO 8.3 Explain the working of vacuum pumps. TLO 8.4 Enlist and explain areas of vacuum in metallurgical applications.	8.1 Define vacuum. Unit of vacuum. 8.2 Method of vacuum production, equipment, and its working principles. 8.3 Application of Vacuum Metallurgy.	Improved Lecture Assignment Demonstration	**CO6**

V. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL/TUTORIAL EXPERIENCES.

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
1	LLO 1.1 (a) Calculate atomic packing density & and theoretical density of metal by knowing crystal structure. (b) Draw planes & and directions in the unit cell of the crystal (c) identify & and compare various crystal defects.	A: Study of Crystal structures F.C.C., B.C.C., H.C.P., structures to be studied with the help of models, sketching structures, B: Miller indices planes and direction with the help of models and sketches. C: Study of Point, line and surface Crystal defect with models and sketch.	16	CO1
2	LLO 2.1 Proximate analysis of coal and coke.	Determination of moisture content, volatile matter, ash content & and carbon % in coal and coke.	12	CO3
3	LLO 3.1 Calculate the Calorific value of solid (coal/ coke) fuel.	Determination of calorific value of coal and coke by using a bomb calorimeter.	8	CO3
4	LLO 4.1 Study of flash point apparatus.	Determination of flash point of liquid fuel such as furnace oil.	4	CO3
5	LLO 5.1 Familiar with the working of oil burners.	Study of different types of oil burners of furnaces.	4	CO3
6	LLO 6.1 Familiar with the working of gas burners.	Study of burners used for gas fuels.	4	CO3
7	LLO 7.1 Measure mechanical properties of refractories.	Determination of cold crushing strength and porosity of different refractories.	8	CO4
8	LLO 8.1 Visual inspection of refractories	Identification of various types of refractories and physical defects such as chips, cracks etc.	4	CO4

VI. SUGGESTED MICRO PROJECT/ASSIGNMENT/ACTIVITIES FOR SPECIFIC LEARNING/SKILLS DEVELOPMENT (SELF-LEARNING)

Micro projects-

- Model of Crystal unit cell: Prepare model or sketch 3D or isometric diagram of cubic –SC, FCC, BCC & HCP.
- Miller indices to plot planes & and direction in unit cell: Collect data and plot given planes and direction in given sketch.
- Model or sketch of crystal defects: Prepare models or sketches using a tennis ball or 3-D diagram. Collect information about the cause of defects.
- **Data Analysis of solid, liquid and gaseous fuels**: Collect data on quality control analysis, energy efficiency assessment, environmental monitoring, and process optimization. Analyze the data, calculate composition, Physical Properties & and thermal properties (CV), and create a presentation, including short videos, to present your findings.
- **Burners of liquid fuel and gaseous fuels of melting or HT furnaces**: Prepare design or drawing using information and collect data r information regarding the working and performance of burners in fuels.
- **Properties & application of different furnace refractories**: Create an information sheet using the proper properties of the refractories with respect to given furnace n.
- **Construction of fuel-fired furnace or Model**: Design a model or furnace using construction details and working principles.
- **Induction furnace**: create animations or collect videos showing working principles & and effective melting.
- **Temperature measuring devices**: Develop a list, working, construction, and specification details of various thermocouples, sugar cones or any high-temperature measuring instruments or pyrometry.
- **Applications of vacuum in Metallurgy**: Collect and present applications of vacuum in various fields such as in vacuum melting, vacuum heat treatment & and vacuum casting a 5-minute video presentation.

Assignments –

- Collect examples based on real-world applications of basic metallurgical principles and make a PDF file.
- Calculate the theoretical density using unit cell & and atomic area of particular metals
- Collect examples of crystal defects and prepare a PDF file.
- Collect information about various natural and synthetic solid fuels in terms of chemical composition, physical properties, CV and uses eg peat, lignite, bituminous coal & and anthracite and Make a PDF file.
- Collect information about various natural & and synthetic liquid fuels in terms of chemical composition, physical properties, CV, and uses and Make a PDF file.
- Collect information about various natural and synthetic gas fuels in terms of chemical composition, physical properties, CV, and uses and Make a PDF file.
- Collect information and make information sheets for various refractories.
- Collect information about the construction & and working of furnaces and make information sheets for various furnaces.
- Collect at least 05 examples of the use of temperature-measuring devices or pyrometers in the metallurgical field.

VII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED

Sr. No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Models of crystal structure and defects	1
2	Bomb calorimeter, micro oven, muffle furnace, Models of industrial gas or oil burners	2,3,4,5,6
3	Weigh balance, UTM	7

VIII. SUGGESTED FOR WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr. No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Introduction	CO1	1	1	1	-	02
2	II	Nature of Solids	CO1	6	2	4	4	10
3	III	Plastic Deformation	CO2	6	2	2	4	08
4	IV	Solid Fuels	CO3	10	4	4	6	14
5	V	Liquid & Gaseous Fuels & Furnaces	CO3	10	4	4	6	14
6	VI	Refractory Materials	CO4	6	3	3	4	10
7	VII	Furnace & Temperature Measuring devices	CO5	5	2	2	4	08
8	VIII	Vacuum & Application In Metallurgy	CO6	1	1	1	2	04
Grand Total				**45**	**19**	**21**	**30**	**70**

IX. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)	Summative Assessment (Assessment of Learning)
1. Tests 2. Assignment 3. Self-Learning 4. Term Work	1. End Term Exams

X. SUGGESTED COs- POs MATRIX FORM

Course Outcomes (COs)	Programme Outcomes(POs)							Programme Specific Outcomes *(PSOs)			
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3	PSO-4
CO1	3	2	2	2	2	1	2	3	1	2	1
CO2	3	1	1	2	1	-	2	3	1	2	1
CO3	3	2	2	2	1	-	2	3	2	2	1
CO4	2	2	1	3	2	2	2	3	2	2	1
CO5	1	2	2	2	2	2	2	3	2	2	1
CO6	1	1	2	-	2	1	-	2	-	-	1

Legends:- High: 03, **Medium:** 02, **Low:** 01, **No Mapping:** -
*PSOs are to be formulated at the institute level

XI. SUGGESTED LEARNING MATERIALS/BOOKS

Sr. No	Author	Title	Publisher
1	Francis	Fuel Technology Vol I & II	Pergaman Press, London
2	D. Swarup	Elements of Metallurgy	Rastogi Publication, Meerut ISBN-10: 8171338135 ISBN-13: 9788171338139
3	Gilchrist J.D.	Fuels & Refractories	Perganson Press, London ISBN-10:0080204295 ISBN13:9780080204291
4	O.P. Gupta	Elements of Fuels, Refractories	Oxford Press ISBN-10:8174090886 ISBN13:9788174090881
5	Dr.V.D. Kodgire, S.V. Kodgire	Material Science and Metallurgy	Everest Publishing House, 43rd Edition ISBN: 81-86314-00-8

XII. LEARNING WEBSITES & PORTALS

Sr. No	Link/Portal	Description
1.	https://www.youtube.com/watch?v=ZhneRTIQcJo&list=PLTRfC2ohxTauiO03RgT_ps_bicjD19Pbb	Unit cell and structure
2.	https://www.youtube.com/watch?v=X1ZSqLXROpg&list=PLpSo8psGcEo1CQu8kp7vuMSh1_TzXiBoL	Fuels- types and uses

Name & Signature: Pkamble **Mr. Pravin B. Kamble** Lecturer in Metallurgical Engineering (Course Expert)	
Name & Signature: Nkadam **Mrs. Namita S. Kadam** (Programme Head)	Name & Signature: **Mr. Sudin B Kulkarni** (CDC In-charge)

GOVERNMENT POLYTECHNIC, PUNE

'120 – NEP' SCHEME

PROGRAMME	**DIPLOMA IN CE/ME/MT**
PROGRAMME CODE	**01/04/05**
COURSE TITLE	**APPLIED PHYSICS**
COURSE CODE	**SC11204**
PREREQUISITE COURSE CODE & TITLE	**NA**

I. LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Course Type	Learning Scheme					Credits	Assessment Scheme											
			Actual Contact Hrs./Week			SLH	NLH		Paper Duration Hrs.	Theory				Based on LL & TSL				Based on SL		Total Marks
														Practical						
			CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
										Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
SC11204	APPLIED PHYSICS	DSC	3	0	2	1	6	3	2	30	70*#	100	40	25	10	25@	10	25	10	175

Total IKS Hrs for Term: 02 Hrs

Abbreviations: CL-Classroom Learning, **TL**-Tutorial Learning, **LL**-Laboratory Learning, **SLH**-Self Learning Hours, **NLH**-Notional Learning Hours, **FA** - Formative Assessment**, SA** -Summative assessment, **IKS** – Indian Knowledge System, **SLA**- Self Learning Assessment

Legends: @- Internal Assessment, # - External Assessment, ***#** - Online Examination, **@$** - Internal Online Examination

Note:

FA-TH represents an average of two class tests of 30 marks each conducted during the semester.

1. If a candidate is not securing minimum passing marks in **FA-PR** (Formative Assessment - Practical) of any course, then the candidate shall be declared as **'Detained'** in that semester.
2. If a candidate does not secure minimum passing marks in SLA (Self Learning Assessment) of any course, then the candidate shall be declared as **'fail'** and will have to repeat and resubmit SLA work.
3. **Notional learning hours** for the semester are **(CL + LL + TL + SL) hrs. * 15 Weeks**
4. **1 credit** is equivalent to **30 Notional hours**.
5. * Self-learning hours shall not be reflected in the Timetable.
6. *Self-learning includes micro-projects/assignments/other activities.

II. RATIONALE:

This course is designed with some fundamental information to help diploma engineers apply the basic concepts and principles of physics to solve broad-based engineering problems. The study of basic principles and the concepts of motion, elasticity, viscosity, surface tension, sound, heat, optics, photo electricity and X-rays will help in understanding the technology courses where emphasis is laid on the applications.

III. COURSE-LEVEL LEARNING OUTCOMES (CO'S)

Students will be able to achieve and demonstrate the following CO's on completion of course-based learning

CO1: Estimate errors in measurement and Apply laws of motion in various applications.
CO2: Select relevant material in industries by analyzing its physical properties.
CO3: Apply the concept of simple harmonic motion, resonance and ultrasonic waves for various engineering applications.
CO4: Use basic principles of heat in related engineering problems.
CO5: Use basic principles of optics in related engineering problems.
CO6: Apply the concept of modern Physics (X-rays, LASER, Photocell) for various engineering

applications.

IV. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT:

Sr. No	Theory Learning Outcomes (TLO'S) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
UNIT-I GENERAL PHYSICS (CL Hrs-7, Marks-12)				
1	**TLO 1.1** List fundamental and derived quantities with their unit. Explain the procedure of measuring the dimensions of a given object by using Vernier Calipers and Screw Gauge. **TLO 1.2** Calculate the angular velocity of the given body. Derive equations of Angular motion. **TLO 1.3** To Study range, angle of projection and maximum height of projectile.	**1.1 Units and Measurements:** Introduction, Definition of unit, Fundamental and derived units, Different System of units, Dimensions of physical quantities, measurement errors. **1.2 Angular Motion**: Definition, radius vector, angular displacement, angular velocity, angular acceleration and units, relation between linear and angular velocity, relation between linear acceleration and angular acceleration. Analytical Treatment. **1.3 Projectile motion:** Projectile motion, trajectory, range of projectile, angle of projection, time of flight.	Chalk and board Improved lecture, Tutorial Assignment Demonstration	CO1
UNIT-II PROPERTIES OF MATTER (CL Hrs -10, Marks-14)				
2	**TLO 2.1** Apply the concept of elasticity and plasticity to select the material for engineering applications. **TLO 2.2** Apply the concept of Surface Tension to find the coefficient of Viscosity. **TLO 2.3** Establish a relation between given types of moduli of elasticity.	**2.1 Surface Tension:** Definition and unit, molecular theory of surface tension, Cohesive and adhesive forces, angle of contact and its significance, the shape of the liquid surface in a capillary tube, capillary action and examples, surface tension by capillary rise method (no derivation), effect of impurity and temperature on surface tension. analytical treatment. **2.2 Viscosity:** Definition, velocity gradient and its unit, Newton's law of viscosity, terminal velocity, Stokes law, Stokes formula, coefficient of viscosity by Stokes method (no derivation), types of flow of liquid - streamline flow, turbulent flow, Reynold's number (significance), applications and analytical treatment. **2.3 Elasticity:** Deforming Force and Restoring Force, Elasticity, Plasticity,	Chalk and board Improved lecture, Tutorial Assignment Demonstration Educational Games	CO2

Sr. No	Theory Learning Outcomes (TLO'S) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
		Rigidity. Stress and Strain and their types, elastic limit and Hooke's law, types of moduli of elasticity, analytical treatment.		
UNIT-III WAVES & OSCILLATIONS (CL Hrs-07, Marks-10)				
3	**TLO 3.1** To study the properties of sound waves. **TLO 3.2** Find the parameters required to analyze the given wave motion and simple harmonic motion. **TLO 3.3** Explain the concept of resonance and its applications. **TLO 3.4** Describe the properties of given ultrasonic waves.	**3.1 Sound:** Sound waves, amplitude, frequency, time-period, wavelength and velocity of the wave, the relation between velocity, frequency and time-period of a wave. Analytical Treatment. **3.2 SHM:** Simple Harmonic Motion, Uniform Circular Motion as Simple Harmonic Motion, Equation of Simple Harmonic Motion, Phase of Simple Harmonic Motion. **3.3 Resonance:** Resonance concept in prehistoric times, the concept of different frequencies (Mantras) used to ignite different chakras in the body (IKS). Applications of resonance. **3.4 Ultrasonic waves:** Properties of ultrasonic waves. Applications of ultrasonic waves.	Chalk and board Improved lecture, Tutorial Assignment Demonstration.	CO3
UNIT- IV HEAT (CL Hrs-6, Marks-10)				
4	**TLO 4.1** To study different Gas laws. **TLO 4.2** Distinguish Between Good Conductors and Bad Conductors of Heat. **TLO 4.3** Introduction of Thermodynamics	**4.1 Gas Laws:** Explanation of Gas laws, Boyle's law, Charles law, Gay Lussac's law, General Gas Equation, analytical treatment, units of temperature ^{0}C, ^{0}K, ^{0}F with their conversion, absolute scale of temperature. **4.2 Heat:** modes of heat transfer, conduction, convection and radiation. **4.3** Introduction of Thermodynamics	Chalk and board Improved lecture, Tutorial Assignment Demonstration.	CO4
UNIT –V OPTICS (CL Hrs-6, Marks-10)				
5	**TLO 5.1** State laws of reflection and refraction. Describe the phenomenon of total internal reflection. **TLO 5.2** Distinguish between optical fibre communication systems and ordinary systems.	**5.1 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 reflection of light.	Chalk and board Improved lecture, Tutorial Assignment Demonstration.	CO5

Sr. No	Theory Learning Outcomes (TLO'S) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
		5.2 Fiber optics: Propagation of light through optical fiber, the structure of the 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, analytical treatment.		
	UNIT - VI MODERN PHYSICS (CL Hrs-9, Marks-14)			
	TLO 6.1 Explain the properties of photons based on Planck's hypothesis. **TLO 6.2** Explain the construction and working of a given photoelectric device. **TLO 6.3** Explain the method to produce X-rays with its properties and engineering applications. **TLO 6.4** Differentiate between LASER and ordinary light. **TLO 6.5** Describe the properties of nanomaterials.	**6.1 Photoelectricity:** Planck's hypothesis, properties of photons.Photoelectric effect: threshold frequency, threshold wavelength, stopping potential, Work function, characteristics of the photoelectric effect, Einstein's photoelectric equation Photoelectric cell and LDR: Principle Working and applications. **6.2 X-rays:** Production of X-rays by modern Coolidge tube, properties and engineering applications. **6.3 LASER:** Laser: properties, absorption, spontaneous and stimulated emission, Population inversion, active medium, optical pumping, three energy level system, He-Ne Laser. Engineering applications of Laser. **6.4** Introduction to Nanotechnology.	Chalk and board Improved lecture, Tutorial Assignment Demonstration.	CO6

V. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL/TUTORIAL EXPERIENCES.

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
1	LLO1.1 Use of given instrument and i) Mention name and range of the given instrument. ii) Calculate the least count of the given instrument. iii) List the uses of the given instrument.	Identify the given instrument and i) Mention the name and range of the given instrument. ii) Calculate the least count of the given instrument. iii) List the uses of the given instrument.	**2**	**CO1**
2	LLO 2.1 Use a Vernier caliper to	Measurements of dimensions of the given	**2**	**CO 1**

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
	Measure the dimensions of given objects. Measure the dimensions of objects of known dimensions. LLO 2.2 Estimate the errors in measurement	object by Vernier caliper.		
3	LLO 3.1 Use a Micrometer Screw gauge to Measure the dimensions of given objects. Measure the dimensions of objects of known dimensions. LLO 3.2 Estimate the measurement errors.	Measurements of dimensions of given objects by micrometer screw gauge.	**2**	**CO1**
4	LLO 4.1 Study of Projectile motion.	Predict the range of the projectile from the initial launch speed and angle.	**2**	**CO1**
5	LLO 5.1 Use Capillary Rise Method to study Surface Tension.	Determine surface tension by capillary rise method.	**2**	**CO2**
6	LLO 6.1 Use Stokes's method to determine the coefficient of viscosity.	Measure the coefficient of viscosity of a given liquid using Stokes's method (Stokes law).	**2**	**CO2**
7	LLO 7.1 Use Hooke's Law to calculate Spring constant.	Calculate the spring constant using Hooke's law.	**2**	**CO2**
8	LLO 8.1 Use a resonance tube to determine the velocity of sound. (Concept of resonance).	Determine the velocity of sound by using a Resonance Tube. (Concept of resonance).	**2**	**CO3**
9	LLO 9.1 Use a simple pendulum to determine the acceleration due to gravity.	Determination of Acceleration due to Gravity by Simple Pendulum.	**2**	**CO3**
10	LLO 10.1 Use Boyle's Law to study the relation between pressure and volume for a given gas.	Verify Boyle's law and establish a relation between pressure and volume for a given gas.	**2**	**CO4**
11	LLO 11.1 Use the Refraction Phenomenon to determine the refractive index of the glass slab.	Determination of the refractive index of the glass slab.	**2**	**CO5**
12	LLO 12.1 Use of He-Ne laser beam, to study properties of LASER.	Study the properties and working of the laser using a He-Ne laser beam.	**2**	**CO6**
13	LLO 13.1 Use photoelectric cells to study the effect of : Intensity of light on photoelectric current.	Study the effect of the Intensity of light on photoelectric current.	**2**	**CO6**

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
14	LLO 14.1 Use photoelectric cells to study the effect of : Applied potential on photoelectric current.	Study effect of Applied potential on photoelectric current. using Photoelectric cell	**2**	**CO6**
15	LLO 15.1 Study of Divergence of LASER.	Determine the divergence of laser beam	**2**	**CO6**

Note: A suggestive list of practical LLOs is given in the table, more such practical LLOs can be added to attain the COs and competency. A judicial mix of a minimum of 12 or more for physics practical LLOs needs to be performed so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry. ii. Hence, the 'Process' and 'Product' related skills associated with each LLOs of the laboratory work are to be assessed according to a suggested sample of Performance Indicators (Weightage in %) as follows:

1) Preparation of experimental set up 20%
2) Setting and operation 20%
3) Safety measures 10%
4) Observations and Recording 10%
5) Interpretation of result and Conclusion 20%
6) Answer to sample questions 10%
7) Submission of the report in time 10%.

VI. SUGGESTED MICROPROJECT/ASSIGNMENT/ACTIVITIES FOR SPECIFIC LEARNING/SKILLS DEVELOPMENT(SELF-LEARNING)

Only one Micro Project is planned to be undertaken by a student assigned to him/her at the beginning of the semester. She/He ought to submit it by the end of the semester to develop industry-oriented COs. Each micro-project should encompass two or more COs. The Micro-Project could be industry application-based, internet-based, workshop-based, laboratory-based or field-based. The assessment of the micro-project is to be done under Self Learning Assessment (SLA). The Micro Project is preferably assigned to a group of (4-6) students or an individual taking into consideration the capabilities and circumstances at the time.

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

Micro project:

- Vernier calipers: Prepare prototype vernier caliper of desired least count using card sheet
- Properties of matter: Prepare a chart of different viscous liquids.
- Sound: Prepare a chart of the velocity of sound in different materials.
- Heat: Collect good and bad conducting materials of heat
- Mobile applications: Use mobile applications for conversions of different physical quantities.
- Optical Fiber and TIR: Prepare model to demonstrate total internal reflection
- Physical quantities: Prepare a Chart on comparison of systems of units for different physical quantities.

- LASER: Prepare a chart to study Total Internal Reflection.
- X-rays/Photoelectric cell: Prepare a chart showing the properties and applications of X-rays and Photoelectric cells.

Assignment:

- Convert the units of a given physical quantity from one system of units to another.
- Prepare a chart to summarize units and measurements.
- Distinguish between transverse waves and longitudinal waves based on frequencies explain infrasonic waves, audible sound waves and ultrasonic waves.
- Collect different elastic materials and mention their Young's modulus.
- Demonstrate the variation of the angle of refraction with respect to the refractive index.
- Use a digital vernier caliper and micrometer screw gauge for measurements (lab-based).
- Applications of optical fibers in, engineering.
- Applications of X-Ray in engineering.
- Applications of LASER in engineering.
- Applications of Photoelectricity in engineering.

VII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED

Sr. No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Vernier Calliper : Range: 0-15 cm, Resolution 0.01 cm.	2
2	Micrometer screw gauge: Range 0-25 mm, Resolution 0.01 mm.	3
3	Simple pendulum, Stop Watch.	4
4	Glass Slab 75x50x12mm.	10
5	Travelling microscope: Range: 0.05-22 cm, Resolution 0.001 cm, Capillary tube	5
6	Battery eliminator (0-12 V, 2 A)	11,12,13
7	Voltmeter(0-10 V), ammeter (0-5 A)	1
8	Boyle's law apparatus.	10
9	Stoke's apparatus, Wooden scale, Small metal sphere.	6
10	Hooke's law apparatus	7
11	Resonance tube, Tuning fork set, Rubber pad.	8
12	Photoelectric cell.	12,13
13	He-Ne laser kit	11

VIII. SUGGESTED FOR WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE

(Specification Table)

Sr. No	Unit	Unit Title	Aligned COs	Learning Hours	R - Level	U - Level	A - Level	Total Marks
1	I	General Physics	CO1	**7**	3	4	5	12
2	II	Properties of Matter	CO2	**10**	4	4	6	14
3	III	Waves And Oscillations	CO3	**7**	3	3	4	10
4	IV	Heat	CO4	**6**	3	4	3	10
5	V	Optics	CO5	**6**	3	4	3	10
6	VI	Modern Physics	CO6	**9**	4	5	5	14
Grand Total				**45**	**20**	**24**	**26**	**70**

IX. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)	Summative Assessment (Assessment of Learning)
Two Unit Tests of 30 marks and the average of two unit tests. For Laboratory Learning 25 MARKS	End Semester assessment of 25 marks for laboratory learning. End Semester assessment of 70 marks (Online)

X. SUGGESTED COs- POs MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline - Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3	2	-	1	1	1	2			
CO2	3	2	1	2	1	1	2			
CO3	3	1	1	1	1	1	2			
CO4	3	1	1	1	1	1	2			
CO5	3	1	1	1	1	1	2			
CO6	3	1	1	2	2	1	2			

Legends:-High:03, **Medium:**02, **Low:**01, **NoMapping:**-
*PSOs are to be formulated at the institute level

XI. SUGGESTED LEARNING MATERIALS/BOOKS

Sr.No.	Author	Title	Publisher with ISBN Number
1	Narlikar J. V. ;Joshi , A. W.; Mathur, Anuradha ; et al	Physics Textbook Part I - Class XI	National Council of Education Research and Training, New Delhi, 2010, ISBN: 8174505083
2	Narlikar, J.V.;Joshi , A. W.; Mathur, Anuradha ; et al	Physics Textbook Part II - Class XI	National Council of Education Research and Training, New Delhi, 2015, ISBN: 8174505660
3	Narlikar J.V.;Joshi , A. W.; Ghatak A.K. et al	Physics Textbook Part I - Class XII	National Council of Education Research and Training, New Delhi, 2013, ISBN: 8174506314
4	Narlikar, J.V.;Joshi , A. W.; Ghatak A.K. et al	Physics Textbook Part II - Class XII	National Council of Education Research and Training, New Delhi, 2013, ISBN: 8174506713

XII. LEARNING WEBSITES & PORTALS

Sr.No	Link/Portal	Description
1	www.sciencejoywagon.com/physicszone	Electricity, Magnetism and Semiconductors, basic fiber optics
2	https://phet.colorado.edu	Electricity, Magnetism and Semiconductors, Thermometry and basic fiber optics
3	www.physicsclassroom.com	Concepts of basic physics
4	http://nptel.ac.in/course.php?disciplineId=104	Concepts of basic physics
5	http://hperphysics.phy-astr.gsu.edu/hbase/hph.html	Concepts of basic physics
6	https://www.youtube.com/results?search_query=amruta+university+physics+expts	Concepts of basic physics
7	https://www.youtube.com/results?search_query=physics+class+11+chapter+1	Concepts of basic physics
8	https://www.youtube.com/watch?v=zRGh9_a1J7s	Concepts of basic physics
9	https://iksindia.org	IKS physics
10	https://www.ancient-origins.net/history-famous-people/indian-sageacharya-kanad-001399	IKS Philosophy of atom by Acharya Kanad.

Name & Signature:

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Lecturer in Physics

Mr. N.S. Salave
Lecturer in Physics
(Course Experts)

Mr. A.D. Ghorpade
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Name & Signature:

Mrs. Namita S. Kadam
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Mr. Sudin B Kulkarni
(CDC In-charge)

GOVERNMENT POLYTECHNIC, PUNE

'120 – NEP' SCHEME

PROGRAMME	**DIPLOMA IN CE/EE/ET/ME/MT/CM/IT**
PROGRAMME CODE	**01/02/03/04/05/06/07**
COURSE TITLE	**APPLIED MATHEMATICS**
COURSE CODE	**SC11207**
PREREQUISITE COURSE CODE & TITLE	**BASIC MATHEMATICS (SC11205/SC11206)**

I. LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Course Type	Learning Scheme					Credits	Assessment Scheme											
			Actual Contact Hrs./Week			SLH	NLH		Paper Duration Hrs.	Theory				Based on LL & TSL				Based on SL		Total Marks
														Practical						
			CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
										Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
SC11207	APPLIED MATHEMATICS	AEC	3	1	-	-	4	2	3	30	70	100	40	-	-	-	-	-	-	100

Total IKS Hrs for Term: 6 Hrs

Abbreviations: CL-Classroom Learning, **TL**-Tutorial Learning, **LL**-Laboratory Learning, **SLH**-Self Learning Hours, **NLH**-Notional Learning Hours, **FA** - Formative Assessment**, SA** -Summative assessment, **IKS** – Indian Knowledge System, **SLA**- Self Learning Assessment

Legends: @-Internal Assessment, # - External Assessment,***#** - Online Examination,**@$** - Internal Online Examination

Note:

FA-TH represents an average of two class tests of 30 marks each conducted during the semester.

1. If a candidate is not securing minimum passing marks in **FA-PR** (Formative Assessment - Practical) of any course, then the candidate shall be declared as **'Detained'** in that semester.
2. If a candidate does not secure minimum passing marks in SLA (Self Learning Assessment) of any course, then the candidate shall be declared as **'fail'** and will have to repeat and resubmit SLA work.
3. **Notional learning hours** for the semester are **(CL + LL + TL + SL) hrs. * 15 Weeks**
4. **1 credit** is equivalent to **30 Notional hours**.
5. * Self-learning hours shall not be reflected in the Timetable.
6. *Self-learning includes micro-projects/assignments/other activities.

II. RATIONALE:

An Applied Mathematics course, covering integration, definite integration, differential equations, numerical methods, and probability distribution, equips engineering students with essential problem-solving tools. It enables them to model and analyze complex systems, make informed decisions and address real-world engineering challenges effectively.

III. COURSE-LEVEL LEARNING OUTCOMES(CO'S)

Students will be able to achieve and demonstrate the following CO's on completion of course-based learning

CO1: Apply Solve the broad-based engineering problems of integration using suitable methods.
CO2: Use definite integration to solve given engineering-related problems.
CO3: Apply the concept of differential equations to find the solutions of given engineering problems.
CO4: Employ numerical methods to solve programme-specific problems.
CO5: Use probability distributions to solve elementary engineering problems.

IV. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr. No	Theory Learning Outcomes (TLO'S) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
UNIT-I Indefinite Integration (CL Hrs-15, Marks-20)				
1	TLO1.1 Solve the given simple problem(s) based on rules of integration. TLO1.2 Evaluate the given simple integral(s) using the substitution method. TLO1.3 Integrate given simple functions using the integration by parts TLO1.4 Solve the given simple integral by partial fractions	**Unit - I Indefinite Integration** 1.1 Simple Integration: Rules of integration and integration of standard functions 1.2 Integration by substitution. 1.3 Integration by parts. 1.4 Integration by partial fractions (only linear non-repeated factors at the denominator of the proper fraction).	Improved Lecture Demonstration Chalk-Board Presentations Video Demonstrations	**CO1**
Unit - II Definite Integration (CL Hrs-08, Marks-12)				
2	TLO2.1 Solve given examples based on Definite Integration. TLO2.2 Use properties of definite integration to solve given problems	**Unit - II Definite Integration** 2.1 Definite Integration: Definition, and rules of definite integration with simple examples. 2.2 Properties of definite integral (without proof) and simple examples	Video Simulation Chalk-Board Improved Lecture Presentations	**CO2**
Unit - III Differential Equation (CL Hrs-08, Marks-12)				
3	TLO3.1 Find the order and degree of given differential equations. TLO3.2 Form simple differential equations for given elementary engineering problems. TLO3.3 Solve given differential equations using the methods of Variable separable and Exact Differential Equations (Introduce the concept of a partial differential equation). TLO3.4 Solve the given Linear Differential Equation.	**Unit - III Differential Equation** 3.1 Concept of Differential Equation. 3.2 Order, degree and formation of Differential equations 3.3 Methods of solving differential equations: Variable separable form, Exact Differential Equation, Linear Differential Equation.	Video Demonstrations Presentations Chalk-Board Improved Lecture Flipped Classroom	**CO3**

Sr. No	Theory Learning Outcomes (TLO'S) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
Unit - IV Numerical Methods (CL Hrs-06, Marks-14)				
4	TLO4.1 Find roots of algebraic equations by using appropriate methods. TLO4.2 Solve the system of equations in three unknowns by iterative methods TLO4.3 Solve problems using the Bakhshali iterative method for finding approximate squareroots. (IKS)	**Unit - IV Numerical Methods** 4.1 Solution of algebraic equations: Bisection method, Regula falsi method and Newton–Raphson method. 4.2 Solution of simultaneous equations containing three Unknowns by iterative methods: Gauss-Seidel and Jacobi's method. 4.3 Bakhshali iterative method for finding the approximate square root. (IKS)		**CO4**
Unit - V Probability Distribution (CL Hrs-08, Marks-12)				
5	TLO5.1 Solve given problems based on repeated trials using Binomial distribution TLO5.2 Solve given problems when the number oftrials is large and the probability is very small. TLO5.3 Utilize the concept of normal distribution to solve related engineering problems	**Unit - V Probability Distribution** 5.1 Binomial distribution. 5.2 Poisson's distribution. 5.3 Normal distribution.		**CO5**

V. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL/TUTORIAL EXPERIENCES.

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
1	LLO 1.1 Solve simple problems of Integration by substitution	*Integration by substitution	1	CO1
2	LLO 2.1 Solve integration using parts	*Integration by parts	1	CO1
3	LLO 3.1 Solve integration by partial fractions(only linear non-repeated factors at the denominator of the proper fraction).	Integration by partial fractions.	1	CO1
4	LLO 4.1 Solve examples on Definite Integral based on given methods.	Definite Integral based on given methods.	1	CO2
5	LLO 5.1 Solve problems on properties of definite integral.	*Properties of definite integral	1	CO2
6	LLO 6.1 Solve given problems for finding the area under the curve and volume of revolution.	* #Area under the curve and volume of revolution.(Only for Civil, Mechanical Metallurgical Engineering)	1	CO2

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
7	LLO 7.1 Solve examples on meanvalue and root mean square value.	* #Mean value and root mean square value. (Only for Information Technology, Computer, Electrical and Electronics Engineering)	1	CO2
8	LLO 8.1 Solve examples on order, degree and formation of differential equations.	Order, degree and formation of the differentialequation.	1	CO3
9	LLO 9.1 Solve the first-order first-degree differential equation using the variable separable method.	Variable separable method.	1	CO3
10	LLO 10.1 Solve the first-order first-degree differential equation using exact differential equation and linear differential equation.	*Exact differential equation and linear differential equation.	1	CO3
11	LLO 11.1 Solve engineering application problems using differentialequations.	*Applications of differential equations.(Take programme specific problems)	1	CO3
12	LLO 12.1 Solve problems on the Bisection method and Regula falsi method.	*Bisection method and Regula falsi method.	1	CO4
13	LLO 13.1 Solve problems on the Newton-Raphson method.	Newton-Raphson method.	1	CO4
14	LLO 14.1 Solve problems on Jacobi's method and Gauss-Seidel Method.	Jacobi's method and Gauss-Seidel Method.	1	CO4
15	LLO 15.1 Use Bakhshali iterative methods for finding the approximate value of the square root. (IKS)	*Bakhshali iterative methods for findingthe approximate value of square root. (IKS)	1	CO4
16	LLO 16.1 Solve engineering problems using Binomial distribution.	*Binomial Distribution	1	CO5
17	LLO 17.1 Solve engineering problems using Poisson distribution.	*Poisson Distribution	1	CO5
18	LLO 18.1 Solve engineering problems using Normal distribution.	Normal Distribution	1	CO5
19	LLO 19.1 Solve problems on Laplace transform and properties of Laplace transform.	* # Laplace transform and properties of Laplacetransform.(Only for Electrical and Electronics Engineering)	1	CO2
20	LLO 20.1 Solve problems on Inverse Laplace transform and properties of Inverse Laplace transform.	* # Inverse Laplace transform and properties ofInverse Laplace transform.(Only for Electrical and Electronics Engineering)	1	CO2

Note: Out of the above suggestive LLOs –

1. '*' Marked Practicals (LLOs) Are mandatory.
2. A minimum of 80% of the above list of lab experiments are to be performed.
3. A judicial mix of LLOs is to be performed to achieve the desired outcomes

VI. SUGGESTED MICROPROJECT/ASSIGNMENT/ACTIVITIES FOR SPECIFIC LEARNING/SKILLS DEVELOPMENT (SELF-LEARNING)

Micro-project

NA

Assignment

NA

VII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED

Sr. No	EquipmentNamewithBroadSpecifications	Relevant LLO Number
1	Open-source software like SageMaths, MATHS3D, GeoGebra, Graph, DPLOT and Graphing Calculator (GraphEq2.13), and ORANGE can be used for Algebra, Calculus, Trigonometry and Statistics respectively.	All

VIII. SUGGESTED FOR WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr. No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Indefinite Integration	CO1	15	2	6	12	20
2	II	Definite Integration	CO2	8	2	4	6	12
3	III	Differential Equation	CO3	8	2	4	6	12
4	IV	Numerical Methods	CO4	6	2	4	8	14
5	V	Probability Distribution	CO5	8	2	4	6	12
Grand Total				**45**	**10**	**22**	**38**	**70**

IX. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)	Summative Assessment (Assessment of Learning)
1. Tests	1. End Term Exam

X. SUGGESTED COS- POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline-Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3	1	-	-	1	-	1			
CO2	3	1	-	-	1	-	1			
CO3	3	2	1	1	1	1	1			
CO4	2	3	2	2	1	1	1			
CO5	2	2	1	1	2	1	2			

Legends:-High:03, **Medium:**02, **Low:**01, **No Mapping:-** *PSOs are to be formulated at the institute level.

XI.SUGGESTED LEARNING MATERIALS/BOOKS

Sr. No	Author	Title	Publisher
1	Grewal B. S.	Higher Engineering Mathematics	Khanna publication New Delhi, 2013 ISBN: 8174091955
2	Dutta. D	A textbook of Engineering Mathematics	New Age publication New Delhi, 2006 ISBN: 978- 81-224-1689-3
3	Kreysizg, Ervin	Advance Engineering Mathematics	Wiley publication New Delhi 2016 ISBN: 978-81- 265-5423-2
4	Das H.K.	Advance Engineering Mathematics	S Chand publication New Delhi 2008 ISBN: 9788121903455
5	S. S. Sastry	Introductory Methods of Numerical Analysis	PHI Learning Private Limited, New Delhi. ISBN-978-81-203-4592-8
6	C. S. Seshadri	Studies in the History of Indian Mathematics	Hindustan Book Agency (India) P 19 Green Park Extension New Delhi. ISBN 978-93-80250-06-9
7	Marvin L. Bittinger DavidJ.Ellenbogen Scott A. Surgent	Calculus and Its Applications	Addison-Wesley 10th Edition ISBN-13: 978-0-321-69433-1
8	Gareth James, Daniela Witten,Trevor Hastie RobertandTibshirani	An Introduction to StatisticalLearning with Applications in R	Springer New York Heidelberg Dordrecht LondonISBN 978-1-4614-7137-0 ISBN 978-1-4614-7138-7 (eBook)

XIII. LEARNING WEBSITES & PORTALS

Sr. No	Link/Portal	Description
1	http://nptel.ac.in/courses/106102064/1	Online Learning Initiatives by IITs and IISc
2	https://www.khanacademy.org/math?gclid=CNqHuabCys4CFdOJaddHo Pig	Concept of Mathematics through video lectures andnotes
3	https://www.wolframalpha.com/	Solving mathematical problems, performing calculations, and visualizing mathematical concepts.
4	http://www.sosmath.com/	Free resources and tutorials
5	http://mathworld.wolfram.com/	Extensive math encyclopedia with detailed explanationsof mathematical concepts
6	https://www.mathsisfun.com/	Explanations and interactive lessons covering variousmath topics, from basic arithmetic to advanced
7	http://tutorial.math.lamar.edu/	The comprehensive set of notes and tutorials covers awide range of mathematics topics.
8	https://www.purplemath.com/	Purplemath is a great resource for students seeking helpwith algebra and other foundational mathematics to improve learning.
9	https://www.brilliant.org/	Interactive Learning in Mathematics

Sr. No	Link/Portal	Description
10	https://www.edx.org/	Offers a variety of courses
11	https://www.coursera.org/	Coursera offers online courses in applied mathematicsfrom universities and institutions around the globe.
12	https://ocw.mit.edu/index.htm	The Massachusetts Institute of Technology (MIT) offersfree access to course materials for a wide range of mathematical courses.

Name & Signature:

Shri. Vitthal B. Shinde
Lecturer in Mathematics

Shri. Sachin B. Yede
Lecturer in Mathematics

(Course Experts)

Name & Signature:	Name & Signature:
Smt. N. S. Kadam (Programme Head)	**Shri. S. B. Kulkarni** (CDC In-charge)