GOVERNMENT POLYTECHNIC, PUNE

'120 – NEP' SCHEME

PROGRAMME	DIPLOMA IN EE / ET
PROGRAMME CODE	06 / 07
COURSE TITLE	BASIC ELECTRONICS
COURSE CODE	ET11201
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 (Practical)				Based on SL		Total Marks
			CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
										Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
ET11201	BASIC ELECTRONICS	DSC	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:

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

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: Use relevant passive components in Electronics circuits
CO2: Use relevant diode in different Electronics circuits
CO3: Use BJT in Electronics circuits
CO4: Use FET in Electronics circuits
CO5: Maintain DC-regulated power supply
CO6: Use the front panel to understand various controls of the instrument

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 PASSIVE COMPONENTS (CL Hrs-05, Marks-08)				
1.	**TLO 1.1:** Identify different types of Resistors. **TLO 1.2:** .Identify different types of Inductors. **TLO 1.3:** Identify different types of Capacitors.	1.1 Resistors: Definition, Classification of Resistors, Colour coding: with three, four, five Bands.Carbon composition resistor, Metal oxide film resistor, Variable Resistor (Potentiometer): constructional diagram, working and application 1.2Inductors: Definition, Classification, Colour coding, Construction and working of Air Core Inductor 1.3 Capacitors: Classification of Capacitors, Electrolytic capacitor (Aluminum),Ceramic Capacitor, Trimmer capacitor: constructional diagram, working and application.	Classroom Learning, Reference books, NPTEL	**CO1**
UNIT-II SEMICONDUCTOR DIODE AND ITS APPLICATION (CL Hrs-16, Marks-22)				
2	**TLO 2.1:** Differentiate between conductor,Insulator,Semiconductor , Energy band diagram **TLO2.2:**Describe the construction & working principle of semiconductor diode **TLO 2.3:**Describe working principle, characteristics, and application of the given types of Diode **TLO 2.4:**Describe the working of a given type of rectifier. **TLO 2.5:**Calculate ripple factor, PIV and efficiency of the given type of filter. **TLO 2.6:**Describe the need and working of the rectifier filter circuit.	2.1.Introduction to : conductor,semiconductors,Insulators, Energy band diagram 2.2. Construction, Symbol, Working principle, Applications of following diodes: PN junction, Zener, LED, Photodiode. 2.3 . Forward and Reverse Biasing and V-I Characteristics of the following diodes: PN junction, Zener, LED, Photodiode. 2.4.Types of Rectifiers: Half Wave, Full Wave Rectifier (bridge and center tapped): circuit operation, Input and Output waveforms for voltage and current 2.5.Parameters of rectifier: Average DC value of current and voltage, ripple factor, ripple frequency, PIV of the diode, TUF, efficiency of rectifier **(No derivation)** 2.6 Types of Filters: Shunt capacitor, Series inductor, LC and π filter.Comparison of filters.	Classroom Learning, Reference books, NPTEL	**CO2**

Sr. No	Theory Learning Outcomes (TLO'S) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
UNIT-III BIPOLAR JUNCTION TRANSISTOR (CL Hrs-08, Marks-12)				
3	**TLO 3.1:**Describe the working principle of the given type of transistor. **TLO 3.2:**Compare configuration of transistors. **TLO 3.3:**Justify the need for a biasing method. **TLO 3.4:** Describe the procedure to minimize the thermal runaway effect for the given type of transistor biasing circuit.	**3.1** Introduction to transistors **3.2** Different types of transistors: PNP, NPN and its Symbols **3.3** Transistor configurations: CB, CE, CC. Transistor characteristics (input, output,) in different transistor configurations.Applications of Transistor **3.4.** BJT biasing: DC load line, operating point, stabilization, thermal runaway, types of biasing, fixed biasing, base bias with emitter feedback, voltage divider. Use of heat sink	Classroom Learning, Reference books, NPTEL	**CO3**
UNIT- IV FIELD EFFECT TRANSISTOR (CL Hrs-07, Marks-10)				
4	**TLO 4.1:** Explain the working of FET for a given application **TLO 4.2:** Explain the given type of FET biasing method **TLO 4.3:**Compare the working of a given type of MOSFET **TLO 4.4:**Differentiate the working principle of FET and MOSFET.	**4.1**Construction of JFET (N-channel and P-channel), symbol, working principle and characteristics (Drain and Transfer characteristics) **4.2** FET Biasing: Source self-bias, drain to source bias **4.3** Applications of FET **4.4** MOSFET: Construction, working principle and characteristics of Enhancement and depletion MOSFET, MOSFET handling.	Classroom Learning, Reference books, NPTEL	**CO4**
UNIT –V REGULATORS AND POWER SUPPLY (CL Hrs-08, Marks-10)				
5	**TLO 5.1:** Describe the working of the given block of the DC-regulated power supply in the block diagram. **TLO 5.2:** Calculate the output voltage of the given zener voltage regulator circuit. **TLO 5.3:**Calculate load and line regulation of the given transistorized regulator.	**5.1**Basic block diagram of DC regulated power supply. **5.2** Zener diode voltage regulator. **5.3** Circuit diagram and working of transistorized Series and Shunt regulator. Numericals on Line and Load regulation.	Classroom Learning, Reference books, NPTEL	**CO5**

Sr. No	Theory Learning Outcomes (TLO'S) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
UNIT –VI INTRODUCTION TO ELECTRONIC INSTRUMENTS (CL Hrs-04, Marks-08)				
6	**TLO 6.1**:Describe the working of the Instrumentation system **TLO 6.2**: Describe the working of a Digital multimeter(DMM) **TLO 6.3**: Describe the working principle of the Function generator. **TLO 6.4**: Describe the working principle of CRO.	6.1 Generalized block diagram of instrumentation system. Types of instruments. 6.2 Block diagram, operation and application of Digital multimeter(DMM). 6.3 Block diagram, operation and application of Function generator. 6.4 Block diagram, operation and application of CRO.	Classroom Learning, Reference books, NPTEL	**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*	Determine the value of the given resistor, using a Digital Multimeter to confirm with colour code	Determine the value of the given resistor, using a Digital Multimeter to confirm with colour code.	02	CO1
2	Use the LCR-Q meter to measure the value of the given capacitor and Inductor	Use the LCR-Q meter to measure the value of the given capacitor and Inductor	02	CO1
3*	Test the performance of PN Junction Diode	Test the performance of the PN junction diode	02	CO2
4	Test the performance of the zener diode.	Test the performance of the Zener diode.	02	CO2
5	Test the performance of the photodiode by varying the light intensity as well as the distance of the light source.	Test the performance of the photodiode by varying the light intensity as well as the distance of the light source.	02	CO2
6*	Build/ Test the half-wave rectifier on breadboard	Build/ Test the half-wave rectifier on bread board with and without a filter.	02	CO2
7	Build/ Test the half-wave rectifier on breadboard with LC filter/ π filter.	Build/ Test the half-wave rectifier on breadboard with LC filter/ π filter.	02	CO2
8*	Build/ Test the full wave rectifier on breadboard using two diodes	Build/ Test the full wave rectifier on breadboard using two diodes	02	CO2
9	Use LC/ π filter with full wave rectifier to measure ripple factor.	Use LC/ π filter with full wave rectifier to measure ripple factor.	02	CO2
10*	Identify the terminals of the PNP and NPN transistor using different methods.	Identify the terminals of the PNP and NPN transistor using different methods.	02	CO3

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
11	Test the performance of BJT working in CB/CE mode	Test the performance of BJT working in CB/CE mode	02	CO3
12	Test the assembled BJT voltage divider bias circuit for a given input	Test the assembled BJT voltage divider bias circuit for a given input	02	CO3
13*	Test the performance of FET drain characteristics, transfer characteristics and calculate transconductance	Test the performance of FET drain characteristics, transfer characteristics and calculate transconductance	02	CO4
14	Test the performance of transistorized series voltage regulator for the given load regulation.	Test the performance of transistorized series voltage regulator for the given load regulation.	02	CO5
15	Test the performance of transistorized shunt voltage regulator for the given load regulation	Test the performance of transistorized shunt voltage regulator for the given load regulation	02	CO5
16*	Study block diagram and front panel controls of CRO.	Draw the front panel of the CRO and study specifications with the help of the manual.	02	CO6
17	Study the front panel and specifications of DMM.	Draw the front panel of DMM and study specifications with the help of a manual	02	CO6
18*	Study block diagram and front panel controls of the Function generator.	Draw the front panel of the function generator and study specifications with the help of a manual	02	CO6

Note: A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the Cos and competency. A judicial mix of a minimum of 12 or more practical needs to be performed. Out of which, the practicals marked as ' *' are compulsory.

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

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

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

- Prepare a chart of different types of Resistors showing their specifications and applications
- Prepare a chart of different types of Capacitors showing their specifications and Applications

- Prepare a chart of different types of Diodes showing their specifications and Applications
- Prepare a chart of different types of Rectifiers showing their specifications and applications
- Diode: Build a circuit on general-purpose PCB to clip a positive half cycle at 1.5V of a waveform with input signal 5Vpp and prepare the report.
- Diode: Build a circuit on a general-purpose PCB to clamp a waveform at 3V using a diode and passive component.
- Rectifier: Build a half-wave rectifier for 6V,500mA output current on general-purpose PCB.
- Rectifier: Build a full wave rectifier with a capacitor filter for 6V,500mA output current on a general-purpose PCB.
- BJT: Build a circuit to switch on and off the LED by using BJT as a switching component.
- JVoltage Regulator: Build a circuit of DC-regulated power supply on a general-purpose PCB for 12V and 500mA output.

Assignment

- Differentiate active and Passive component
- Test different Active components on CRO.
- Give a seminar on any relevant topic.
- Collect information on passive components and prepare charts of the same.
- Make a chart of different semiconductor components.
- Analyze Data sheets of BJT, FET and MOSFET

VII. LABORATORY EQUIPMENT/ INSTRUMENTS/ TOOLS/ SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Variable DC power supply 0-30V,2 Amp, SC protection, display for voltage and current	3,4,5,,6,7,8,9,10,11,12,13,14,15
2	Cathode Ray Oscilloscope Dual trace 20 MHz,1MΩ, Input Impedance	3,4,5,,6,7,8,9,10,11,12,13,14,15,16,17, 18
3	Function Generator 0-2MHz with Sine, square, and triangular output	3,4,5,,6,7,8,9,10,11,12,13,14,15,16,17, 18
4	Digital Multimeter:3/1/2 digit display,9999 counts digital	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	Passive Components	CO1	5	2	4	2	8
2	II	Semiconductor Diode and its Applications	CO2	16	8	10	4	22
3	III	Bipolar Junction Transistor	CO3	8	4	4	4	12
4	IV	Field Effect Transistor	CO4	7	2	6	2	10
5	V	Regulators and Power supply	CO5	8	4	4	2	10
6	VI	Introduction to Electronic Instruments.	CO6	4	4	4	--	08
Grand Total				**48**	**24**	**32**	**14**	**70**

IX. ASSESSMENT METHODOLOGIES / TOOLS

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

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	2	-	2	2	3	-	2
CO2	3	3	3	2	-	2	2	3	3	3
CO3	2	2	2	3	-	2	2	2	2	2
CO4	2	2	2	2	-	2	2	2	2	2
CO5	3	2	3	3	-	2	2	3	2	3

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
1	Albert Malvino	Basic Electronics.	8th Edition, Tata McGraw Hill ,2015ISBN10:1259200116 ISBN13:9781259200113
2	B.L.Theraja, S Chand	Basic Electronics.	Publishing, 2007, ISBN 10: 8121925568ISBN 13: 9788121925563
3	R.S.Sedha	Applied Electronics	S.Chand&company Ltd., New Delhi, ISBN:8121927833
4	P.Ramesh Babu	Electronics Devices and Circuits	Scitech PublicationPvt.Ltd 2009 , ISBN:8183711723
5	Boyestad & Nashelsky	Electronic Devices and Circuit Theory	Pearson Education India; 11 edition (2015) ISBN: 978-9332542600
6	H S Kalsi	Elecronic Instrumentation	3rd Edition,Tata McGraw Hill ISBN 978-0-07-070206-6

XII. LEARNING WEBSITES & PORTALS

Sr.No	Link/Portal	Description
1.	www.nptel.com	Online Learning Initiatives by IITs
2.	http://www.electronics-tutorials	Basic Electronics Tutorials and Revision
3.	https://en.wikipedia.org/wiki/P%E2%80%93n_junction	Semiconductor diode description
4.	https://learn.sparkfun.com/tutorials/transistors	The basics of the most common transistor around
5.	http://www.pitt.edu/~qiw4/Academic/ME2082/Transistor%20Basics.pdf	Transistor Configurations
6.	http://faculty.cord.edu/luther/physics225/Handouts/transistors_handout.pdf	Fundamentals of Transistors
7.	www.khanacademy.com	Basic Electronics Concepts
8.	www.datasheetscafe.com	Datasheets of electronic components for a specific application.

Name & Signature:

Smt. J.J. Pathan
Lecturer in E&TC

Smt. M.S. Datar
Lecturer in E&TC

(Course Experts)

Name & Signature:	Name & Signature:
Shri. S.S.Prabhune (Programme Head)	**Shri. S.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	COMMUNICATION SKILLS (ENGLISH)
COURSE CODE	HU11201
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	
HU 11201	COMMUNICATION SKILLS (ENGLISH)	AEC	03	-	02	01	06	03	03	30	70	100	40	25	10	--	--	25	10	150

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:

The most commonly used medium to express oneself is language. English is a global language used in all spheres of human life i.e. personal, professional and social. English Language proficiency focuses on strong reading, writing, speaking and listening skills. It will include grammar, vocabulary, comprehension and describing skills to enhance overall language proficiency. English for professional purposes aim to equip the students with the necessary language skills required for Public Speaking, presentation and negotiation. English for academic purposes will include academic writing skills and critical thinking considering the need of students to communicate in the engineering domain.

III. COURSE-LEVEL LEARNING OUTCOMES (COS)

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

CO1: Construct grammatically correct sentences in English.

CO2: Compose paragraphs and dialogues on given situations.

CO3: Comprehend passages correctly.

CO4: Use contextual words in English appropriately.

CO5: Deliver effective presentations in English using appropriate body language.

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 VOCABULARY (CL Hrs. -10, Marks-12)			
1.	TLO 1.1 Use transcription to pronounce words correctly. TLO 1.2 Use prefixes and suffixes for flexibility and precision in language. TLO 1.3 Employ synonyms and antonyms to express similarity and contrast between words. TLO 1.4 Use Homophones to expand their vocabulary. TLO 1.5 Make use of the collocations correctly.	1.1 Phonetics: Vowels (12), Consonants (24), Diphthongs (8) 1.2 Prefix & Suffix: Definition & Examples, List of common prefixes and suffixes 1.3 Synonyms & Antonyms: Vocabulary expansion, context & Usage 1.4 Homophones: Identifying Homophones, Meaning & Context, Vocabulary Expansion 1.5 Collocations: Definition & identification, types of collocations.	Language Lab Drill, Classroom learning, Reference Books & NPTEL.	CO1
	UNIT II PARAGRAPH AND DIALOGUE WRITING (CL Hrs. -06, Marks-12)			
2.	TLO 2.1 Formulate paragraphs with Synchronized sentence structure on the given situation/topic. TLO 2.2 Develop dialogues to practice language skills in a structured and meaningful way.	**2.1 Types of paragraphs:** Technical, Descriptive and Narrative **2.2 Dialogue Writing:** i. Greetings ii. Development iii. Closing Sentence.	Classroom learning Skit, Language Lab, YouTube & videos	CO2
	UNIT III COMPREHENSION - SEEN AND UNSEEN PASSAGES (CL-Hrs. - 16, Marks-24)			
3.	TLO 3.1 Respond to the given questions of the specified passage. TLO 3.2 Formulate sentences using new words TLO 3.3 Use correct syntax to construct meaningful sentences for the given situation. TLO 3.4 Interpretation of passages in written and Spoken Form.	3.1 Passages from MSBTE workbook 1. Say No to Plastic bags 2. Interview of Dr. APJ Abdul Kalam 3. Maximum Achievements 4. Be Remarkable 5. Arunima Sinha: A Biography 6. Roses of Gratitude 3.2 Importance of Comprehension 3.3 Unseen Passages3.4 Interpretation of passages in written and Spoken Form.	Classroom learning, interactive sessions & discussion	CO3

	UNIT- IV COMMUNICATIVE LANGUAGE (CL-Hrs. -07, Marks-14)			
4.	TLO 4.1 Describe technical objects with specifications. TLO 4.2 Explain the given picture in grammatically correct language. TLO 4.3 Diary Entry on situations. TLO 4.4 Translate from English to Marathi/Hindi- and vice versa.	4.1 Technical objects: i. Heading ii. Description of Technical objects. 4.2 Picture Description: i. Situational picture. ii. Describe in your own words 4.3 Diary Entry : i. Date ii. Content iii. Name of the writer 4.4 Translation of paragraph from English to Marathi/Hindi-Vice versa (Question not to be asked on Translation in Theory Examination)	Language Lab, Pictures on situations and classroom learning.	CO4
	UNIT- V PRESENTATION SKILLS (CL Hrs. - 06, Marks- 08)			
5.	TLO 5.1 Cultivate/Develop the habit of being presentable TLO 5.2 Formulate speeches for occasions TLO 5.3 Prepare PowerPoint presentation TLO 5.4 Use appropriate body language for effective communication	5.1 Dressing & Grooming : i. Dressing for the occasion, ii. Proper grooming 5.2 Speech Writing: i. Situation ii. Salutations iii. Introduction of the topic iv. Description/Body v. Conclusion 5.3 PowerPoint Presentation: i. Layout ii. Font size iii. Colour combination 5.4 Kinesics : i. Facial expressions ii Eye contact iii Postures iv Gestures	Classroom Learning & Language Lab.	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 Use transcription in the correct form. LLO 1.2 Learn to differentiate vowels, diphthongs and consonants.	Write 20 words using phonetic transcription.	2	CO1
2	LLO 2.1 Learn the correct pronunciation by using headphones in the language lab.	Practice pronunciation as per IPA using language lab.	2	CO1

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
3	LLO 3.1 Enhance the understanding of word formation. LLO 3.2 Enrich word power. LLO 3.3 Construct words with the specific meanings.	Formulate 20 words using Prefix and Suffix.	2	CO1
4	LLO 4.1 Use words and phrases effectively. LLO 4.2 Enrich vocabulary. LLO 4.3 Develop overall language skills.	Construct sentences using 20 collocations.	2	CO1
5	LLO 5.1 Articulate ideas clearly and effectively. LLO 5.2 Improve grammar and punctuation.	Write two paragraphs of 75 words each.	2	CO3
6	LLO 6.1 Add depth to narratives. LLO 6.2 Form grammatically correct sentences.	Compose situational dialogues. (Any Two)	2	CO3
7	LLO 7.1 Promote the development of effective communication skills. LLO 7.2. Improve non-verbal communication Skills. LLO 7.3 Enhance interpersonal skills. LLO 7.4 Build confidence.	Enact Role Plays as per situation and context.	2	CO5
8	LLO 8.1 Acquire the ability to convey complex ideas clearly and concisely. LLO 8.2 Expand technical vocabulary. LLO 8.3 Enhance the written communication Skills.	Describe any three technical objects using correct grammar.	2	CO1 CO3
9	LLO 9.1 Develop storytelling skills. LLO 9.2 Connect with the audience.	Narrate anecdotes of various situations in English.	2	CO5
10	LLO 10.1 Notice and articulate specific elements, colours, shapes, & other visual aids. LLO 10.2 Express observations & interpretations clearly and concisely. LLO 10.3 Enhance vocabulary.	Describe a given picture. (Any Two)	2	CO1 CO4
11	LLO 11.1 Express information coherently and engagingly. LLO 11.2 Build confidence.	Introduce oneself and others.	2	CO5

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
12	LLO 12.1 Present complex information in a clear & concise manner. LLO 12.2 Develop public speaking skills and presentation skills.	Prepare a PowerPoint presentation on a given topic.	2	CO5
13	LLO 13.1 Improve language skills &expand vocabulary.	Translate paragraph --English to Marathi/Hindi (vice -Versa) (Any4)	2	CO1 CO3
14	LLO 14.1 Reflect on thoughts, feelings, and experiences.	Write your experience in 50 words on (Four) given situations (Diary Entry)	2	CO3 CO5
15	LLO 15.1 Develop language acquisition.	Respond to the questions based on the given passages.	2	CO2
16	LLO 16.1 Build confidence in public speaking. LLO 16.2 Enhance the skills in planning and prioritization.	Deliver oral presentations using correct grammar and appropriate body language.	2	CO5
Note: *Note*: Any **12** out of **16** practical's are compulsory.				

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

Micro project

- Report different types of episodes/anecdotes.
- Seminar preparation and presentations.
- Make a Podcast episode based on Indian Freedom Fighters.
- Summarize the editorial columns of English newspapers.
- Summarize the content of an eminent person's biography/autobiography. Write a review on the following: Short stories, Novels and Films.
- Prepare a booklet on the contribution of eminent Indian scientists.
- Prepare a podcast referring to Bhagwat Geeta.
- Prepare blogs, podcasts, vlogs.
- Prepare a questionnaire & conduct interviews of Industry Personnel, social workers, and entrepreneurs Prepare and participate in debates and extempore speeches.

VII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Language Lab with relevant software and Computer system with all necessary components like; motherboard, random access memory (RAM), Read-only memory (ROM), Graphics cards, sound cards, internal hard disk drives, DVD drive, network interface card	All
2	LCD Projector with document reader	All
3	Smart Board with networking	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	Vocabulary	CO1	10	2	4	6	12
2	II	Paragraph and Dialogue Writing	CO2	6	2	4	6	12
3	III	Comprehension (Seen and Unseen Passages)	CO3	16	5	6	13	24
4	IV	Communicative Language	CO4	7	2	4	8	14
5	V	Presentation Skills	CO5	6	2	2	4	8
			Grand Total	**45**	**13**	**20**	**37**	**70**

IX. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)	Summative Assessment (Assessment of Learning)
1. Tests 2. Rubrics for COs 3. Assignment 4. Midterm Exam 5. Self-Learning 6. Term Work 7. Seminar/Presentation	1. End Term Exam 2. Micro-project 3. Tutorial Performance

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	1	1	-	-	-	2	1			
CO2	1	1	-	-	-	2	1			
CO3	1	1	-	-	-	2	1			
CO4	1	1	-	-	-	2	1			
CO5	1	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	MSBTE	Spectrum, G Scheme and I-Scheme	MSBTE
2	Kumar, E. Suresh, Sreehari, P. Savitri	Effective English with CD	Pearson Education
3	Gnanamurli	English Grammar at a Glance	S. Chand
4	CBSE	English Communicative (class X)	Golden
5	Dr. Anjana Tiwari	Communication Skills in English	Khanna Publishers, New Delhi

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.	www.scilab.org/-SCILab	Signal processing, statistical analysis, and image enhancement.
3.	www.mathworks.com/product/matlab/-MATLAB	Applications of concepts of Mathematics to coding.
4.	Spreadsheet Applications	Use of Microsoft Excel, Apple Numbers, and Google Sheets.
5.	https://ocw.mit.edu/	MIT Courseware

Name & Signature:

Mr. V.V. Kulkarni
Lecturer in English

Dr. S.P. Palve
Lecturer in English

(Course Experts)

Name & Signature:	Name & Signature:
Dr. S. S. Bharatkar (Programme Head)	**Shri. S.B. Kulkarni** (CDC In-charge)

GOVERNMENT POLYTECHNIC, PUNE

'120 – NEP' SCHEME

PROGRAMME	DIPLOMA IN CE / EE / ME / MT
PROGRAMME CODE	01/02/04/ 05
COURSE TITLE	ENGINEERING GRAPHICS
COURSE CODE	ME11201
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	
ME11201	ENGINEERING GRAPHICS	DSC	2	-	4	-	6	3	3	-	-	-	-	50	20	50@	20	-	-	100

Total IKS Hrs for Term: 2 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:

Engineering graphics is the language of engineers. The concepts of graphical language are used in expressing the ideas and conveying the instructions, which are used in carrying out the jobs on the sites, shop floor etc. This course is useful in developing drafting and sketching skills in the student. It covers the knowledge & use of drawing instruments & also familiarizes the learner with the Bureau of Indian standards related to engineering drawing. The curriculum aims to develop the ability to draw and read various engineering curves, projections and dimensioning styles. The subject mainly focuses on the use of drawing instruments, developing imagination and translating ideas into sketches. This course also helps to develop the idea of visualizing the actual object or part based on drawings and blueprints. This preliminary course aims to build a foundation for further courses related to engineering drawing and other allied courses in the coming semesters.

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 geometrical figures and engineering curves
CO2: Apply principles of orthographic projections for drawing given pictorial views
CO3: Draw isometric views of given component from orthographic projections

CO4: Use various drawing codes, conventions and symbols as per IS SP-46 in engineering drawing.
CO5: Draw free-hand sketches of given engineering elements.

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 BASIC ELEMENTS OF DRAWING (CL Hrs-04, Marks-04)			
1.	TLO 1.1 Prepare drawing using drawing instruments. TLO 1.2 Use IS SP-46 for dimensioning TLO 1.3 Use different types of lines. TLO 1.4 Draw regular geometrical figures. TLO 1.5 Draw figures having tangency constructions.	1.1 Drawing Instruments and supporting material: method to use them with applications. 1.2 Standard sizes of drawing sheets (ISO-A series) 1.3 I.S. codes for planning and layout. 1.4 Letters and numbers (single stroke vertical) 1.5 Convention of lines and their applications. 1.6 Scale - reduced, enlarged & full size. 1.7 Dimensioning techniques as per SP-46 (Latest edition), types and applications of chain, parallel and coordinate dimensioning. 1.8 Geometrical constructions	Model Demonstration	CO1
	UNIT-II ENGINEERING CURVES & LOCI OF POINTS (CL Hrs-06, Marks-12)			
2	TLO 2.1 Explain different engineering curves with areas of application. TLO 2.2 Draw different conic sections. TLO 2.3 Draw involute and cycloidal curves. TLO 2.4 Draw helix and spiral curves from the given data TLO 2.5 Plot Loci of points from given data.	2.1 Concept and understanding of focus, directrix, vertex and eccentricity. Conic sections. 2.2 Methods to draw an ellipse by Arcs of Circle method & Concentric circles method. 2.3 Methods to draw a parabola by Directrix-Focus method & Rectangle method. 2.4 Methods to draw a hyperbola by Directrix-Focus method. 2.5 Methods to draw involutes: circle & pentagon 2.6 Methods to draw Cycloidal curve: cycloid, epicycloid and hypocycloid 2.7 Methods to draw Helix & Archimedean spiral. 2.8 Loci of points on Single slider crank mechanism with given specifications.	Demonstrations	CO1

UNIT-III ORTHOGRAPHIC PROJECTIONS (CL Hrs-08, Marks-14)				
3	TLO 3.1 Explain methods of Orthographic Projections. TLO 3.2 Draw orthographic views of simple 2D entities containing lines, circles and arcs only. TLO 3.3 Draw the orthographic views from given pictorial views. TLO 3.4 Use of IS code IS SP-46 for dimensioning technique.	3.1 Introduction of projections-orthographic, perspective, isometric and oblique: concept and applications. (No question to be asked in examination) 3.2 Introduction to orthographic projection, First angle and Third angle method, and their symbols. Conversion of pictorial view into Orthographic Views – object containing plain surfaces, slanting surfaces, slots, ribs, cylindrical surfaces. (use First Angle Projection)	Model Demonstration Video Demonstrations	CO2, CO4
UNIT- IV ISOMETRIC PROJECTIONS (CL Hrs-08, Marks-14)				
4	TLO 4.1 Prepare isometric scale. TLO 4.2 Draw isometric views of simple 2D entities containing lines, circles and arcs only TLO4.3 Interpret the given orthographic views. TLO 4.4 Draw Isometric views from given orthographic views)	4.1 Introduction to Isometric projection. 4.2 Isometric scale and Natural Scale. 4.3 Isometric view and isometric projection. 4.4 Illustrative problems related to simple objects having plain, slanting, cylindrical surfaces and slots on slanting surfaces. 4.5 Conversion of orthographic views into isometric View/projection. (For branches other than mechanical Engineering, the teacher should select branch-specific elements.	Model Demonstration	CO3, CO4
UNIT –V FREE HAND SKETCHES OF ENGINEERING ELEMENTS (CL Hrs-04, Marks-06)				
5	TLO 5.1 Sketch proportionate freehand sketches of given machine elements. TLO 5.2 Select proper fasteners and locking arrangement.	5.1 Free hand sketches of machine elements: Thread profiles, nuts, bolts, studs, set screws, washers, and Locking arrangements. (For branches other than mechanical Engineering, the teacher should select branch-specific elements for freehand sketching)	Model Demonstration	CO4, 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 Use drawing instruments	Draw horizontal, vertical, 30-degree, 45-degree, 60- & 75-degree lines using Tee and Set squares/ drafter. (Sketch Book).	2	CO1

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
2	LLO 2.1 Use IS code related to dimensioning standard LLO 2.2 Draw the given types of lines	Draw different types of lines, and dimensioning styles (Sketch Book)	2	CO1
3	LLO 3.1 Draw the figure as per the given sketch	Draw one figure showing dimensioning techniques, two problems on redrawing the figures and one problem on loci of points - slider crank mechanism. (Sketch Book)	2	CO1
4	LLO 4.1 Draw figures using IS Standard for drawing	Draw one figure showing dimensioning techniques, two problems on redrawing the figures and one problem on loci of points - slider crank mechanism. (01 Sheet)	4	CO1
5	LLO 5.1 Identify different Engineering curves LLO 5.2 Draw different types of curves	Draw any four Engineering Curves (Sketchbook)	2	CO1
6	LLO 6.1 Identify different Engineering curves LLO 6.2 Draw different types of curves	Draw any four Engineering Curves (01 Sheet)	4	CO1
7	LLO 7.1 Apply the method of projection for drawing simple orthographic views	Draw two problems on orthographic projections using the first angle method of projection having plain surfaces, slanting surfaces slots etc. (Sketchbook)	2	CO2 CO4
8	LLO 8.1 Apply the method of projection for drawing simple orthographic views	Draw two problems on orthographic projections using the first angle method of projection having plain surfaces, slanting surfaces slots etc.-(01 Sheet)	4	CO2 CO4
9	LLO 9.1 Apply the method of projection for drawing complex orthographic views	Draw two problems on orthographic projections using the first angle method of projection having cylindrical surfaces, ribs etc. (Sketchbook)	2	CO2 CO4
10	LLO 10.1 Apply the method of projection for drawing complex orthographic views	Draw two problems on orthographic projections using the first angle method of projection having cylindrical surfaces, ribs etc.- (01 Sheet)	4	CO2 CO4
11	LLO 11.1 Draw simple isometric projections	Draw two problems on the Isometric view of simple objects having plain and slanting surfaces by using natural scale. (Sketchbook)	4	CO3
12	LLO 12.1 Apply different scales for drawing isometric projections.	Draw two problems on the Isometric view of simple objects having plain and slanting surfaces by using natural scale. (01 sheet)	2	CO3

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
13	LLO 13.1 Draw simple isometric projections	Draw two problems on the Isometric Projection of objects having cylindrical surfaces and slots on slanting surfaces by using an isometric scale. (Sketchbook)	2	CO3 CO4
14	LLO 14.1 Apply different scales for drawing isometric projections	Draw two problems on the Isometric Projection of objects having cylindrical surfaces and slots on slanting surfaces by using an isometric scale. (01 sheet)	4	CO3 CO4
15	LLO 15.1 Draw Orthographic views of a given object.	Problem-Based Learning: Given the orthographic views of at least three objects with few missing lines, the student will try to imagine the corresponding objects, complete the views and draw these views (Sketchbook).	2	CO2 CO4
16	LLO 16.1 Draw standard discipline-oriented components using free hand.	Draw freehand Sketches of 12 different standard components (Sketchbook)	2	CO5
17	LLO 17.1 Draw standard discipline-oriented components using free hand.	Draw freehand Sketches of 12 different standard components (1 Sheet)	2	CO5
18	LLO 18.1 Collect information on an ancient Indian culture related to engineering graphics	Correlate ancient Indian sculptures, Indian temples, Monuments, etc. with Engineering Graphics	2	CO1 CO2 CO3 CO4 CO5

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

Micro project:

NA

Assignment: -

NA

VII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Drawing Table with Drawing Board of Full Imperial/ A1 size.	All
2	Models of objects for orthographic projections	7,8,9,10
3	Models/ Charts of objects mentioned in unit no. 5	16,17
4	Set of various industrial drawings being used by industries.	All
5	A set of drawing sheets mentioned in section 6.0 could be developed by experienced teachers and made available on the MSBTE portal to be used as references/standards.	All

6	Drawing equipment and instruments for classroom teaching-large size: a. T-square or drafter (Drafting Machine). b. Set squires (450 and 300-600) c. Protector. d. Drawing instrument box (containing set of compasses and dividers). Drawing sheets, Drawing pencils, Eraser, Drawing pins/clips	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	Basic Elements of Drawing	CO1	4	0	0	04	04
2	II	Engineering curves and loci of Points.	CO1	6	0	0	12	12
3	III	Orthographic projections	CO2,CO4	8	0	0	14	14
4	IV	Isometric Projections	CO3,CO4	8	0	0	14	14
5	V	Free Hand Sketches of Engineering Elements	CO4,CO5	4	0	0	06	06
Grand Total				**30**	**0**	**0**	**50**	**50**

IX. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)	Summative Assessment (Assessment of Learning)
1. Term Work	1. End Term Practical 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	-	-	2	-	2	2			
CO2	3	-	-	2	-	2	2			
CO3	3	-	-	2	-	2	2			
CO4	3	-	-	2	-	2	2			
CO5	3	-	-	2	-	2	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
1	Bureau of Indian Standards.	Engineering Drawing Practice for Schools and Colleges IS: SP-46	Third Reprint, October 1998 ISBN No. 81- 7061-091-2
2	Bhatt, N.D.	Engineering Drawing	Charotar Publishing House, 2010 ISBN No. 978-93-80358-17-8
3	Bhatt, N.D.; Panchal, V. M	Machine Drawing	Charotar Publishing House, 2010 ISBN No. 978-93-80358-11-6
4	Jolhe, D.A.	Engineering Drawing	Tata McGraw Hill Edu. New Delhi, 2010, ISBN No. 978-0-07-064837-1
5	Dhawan, R. K.	Engineering Drawing	S. Chand and Company New Delhi, ISBN No. 81-219-1431-0
6	Pradhan, S.K Jain, K.K	Engineering Graphics	Khanna Book Publishing CO(P) LTD, New Delhi, ISBN No. 978-93-91505-50-9

XII. LEARNING WEBSITES & PORTALS

Sr.No	Link/Portal	Description
1.	https://www.youtube.com/watch?v=dmt6_n7Sgcg	Free Hand Sketches
2.	https://www.youtube.com/watch?v=dmt6_n7Sgcg	Orthographic Projection
3.	https://www.youtube.com/watch?v=3WXPanCq9LI	Basics of Projection
4.	https://www.youtube.com/watch?v=fvjk7PlxAuo	Introduction to Engineering Graphics
5.	https://www.youtube.com/watch?v=8j7l1OWhMIE	Isometric Projection

Name &Signature:

Mr. Swapnil S Hatwalane
Lecturer in Mechanical Engineering

Mr. N B Hirlekar
Lecturer in Mechanical Engineering

(Course Experts)

Name & Signature:

Dr. S. S. Bharatkar
(Programme Head)

Name & Signature:

Shri.S.B.Kulkarni
(CDC In-charge)

GOVERNMENT POLYTECHNIC, PUNE

'120 – NEP' SCHEME

PROGRAMME	DIPLOMA IN EE/ET/CM/IT
PROGRAMME CODE	02/03/06/07
COURSE TITLE	ENGINEERING PHYSICS
COURSE CODE	SC11203
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 in 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	
SC11203	ENGINEERING PHYSICS	DSC	3	-	2	1	6	3	2	30	70*#	100	40	25	10	25@	10	25	10	175

Total IKS Hrs for Term: 2 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 Onlipe 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 in a way by which fundamental information will help the diploma engineers to apply the basic principles and concepts of physics to solve broad-based engineering problems. The study of basic principles and concepts of motion, light, electricity, and modern physics will help in understanding the technology courses where the emphasis is on the applications of these in different technology applications.

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: Estimate errors in measurement and Apply laws of motion in various applications.
CO2: Use basic principles of electrostatics in the engineering field
CO3: Apply basic principles of electricity to solve engineering problems.
CO4: Apply basic principles of magnetism to solve engineering problems
CO5: Use basic principles of light in the technical field
CO6: Apply principles of X-rays and Photoectricity in Engineering.

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-07, Marks-10)			
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.	**1.1. Units and Measurement** Introduction, Definition of unit, Fundamental and derived units, Different System of units, Errors in measurements. Dimensions and its Application Application of Vernier Caliper and Screw Gauge. **1.2 Types of Motion** Displacement, Velocity, Acceleration and retardation Angular displacement, Angular velocity, Angular acceleration and Units. Three equations of angular motion. SHM and its application.	Chalk and board Improved lecture, Tutorial Assignment, and Demonstration	**CO1**
	UNIT-II ELECTROSTATICS (CL Hrs-09, Marks-14)			
2	**TLO 2.1** Describe properties of electric lines of force. **TLO 2.2** Calculate electrostatic force, electric field and electric potential difference of the given static charge. **TLO 2.3** Calculate the equivalent capacity and energy stored in the combination of the capacitors.	**2.1 Electric charge**, Coulomb's law in Electrostatics, a unit of charge, electric field, intensity of electric field, electric lines of forces (Properties), electric flux, flux density, analytical treatment. **2.2 Electric potential:** Explanation, Definition, Potential due to a point charge, potential due to a charged sphere, potential of the earth, absolute electric potential, analytical treatment. **2.3 Electric Capacitor:** Capacitance Introduction of conductor, unit, principle of condenser, parallel plate condenser, capacitances in series and parallel, Super Capacitors and Application, analytical treatment.	Chalk and board, Improved lecture, Tutorial 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-III CURRENT ELECTRICITY (CL Hrs-09, Marks-14)			
3	**TLO 3.1.** State and Explain Ohm's law. **TLO 3.2**. Explain the principle of the potentiometer and its application.	**3.1 Current**, Resistance and its unit, Law of Parallel and Series combination of resistance, Dependence of resistance-length, area of cross-section, temperature, Ohms law, specific resistance and its unit, Whetstone's network construction and principle, Meter bridge, Balancing condition of meter bridge, Measurement of unknown resistance using meter bridge, analytical treatment. **3.2 Potentiometer,** Principle of the potentiometer, Potential gradient, Construction of potentiometer, Applications of potentiometer, E.M.F., Comparison of E.M.F. using potentiometer.	Chalk and board, Improved lecture, Tutorial Assignment, Demonstration	CO3
	UNIT- IV MAGNETISM (CL Hrs-05, Marks-08)			
4	TLO.4.1. Calculate Magnetic induction for the given conductor. TLO 4.2 Explain Electromagnetism with its applications.	**4.1 Magnetic effect of electric current,** Magnetism, Intensity of magnetic field, Magnetic induction, Magnetic Flux, Magnetic lines of force and its Properties, Analytical treatment. **4.2Electromagnetism** and its application.	Simulation, Model Display, Demonstration Chalk and board, Presentations.	CO4
	UNIT –V OPTICS AND LASER (CL Hrs-07, Marks-12)			
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. **TLO 5.3** Differentiate between properties of ordinary light and laser light. State applications of laser in different fields	**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 refraction of light, analytical treatment. **5.2 Fiber optics**: Propagation of light through optical fibre, Structure of optical fibre, Numerical aperture, Acceptance angle, Acceptance cone, Types of optical fibres, Applications of optical fibre, Comparison of optical fibre communication with electrical cable communication.	Simulation, Demonstration, Flipped Classroom, Collaborative Learning, Case Study, chalk and board etc.	CO5

		5.3 Laser: Definition, Properties of LASER, Spontaneous and Stimulated emission, Population inversion, Metastable state, Pumping, Lifetime, He-Ne laser construction and working with energy level diagram, Engineering applications of laser.		
UNIT –VI MODERN PHYSICS (CL Hrs-08, Marks-12)				
6	**TLO 6.1.** Explain the production of X-rays. Describe the properties and applications of X-rays in different fields. **TLO 6.2.** Describe properties of photon Derive Einstein's photoelectric equation. Explain the working of a given photoelectric device.	**6.1 X-ray:** principle, production of X-rays using Coolidge tube, origin of X-rays, types of X-rays, properties of X-rays, engineering applications of X-rays, analytical treatment. **6.2 Photo electricity**: photoelectric effect, Plank's quantum theory, the concept of the photon, properties of the photon, threshold frequency, threshold wavelength, stopping potential, photoelectric work function, Einstein's photoelectric equation, photocell (circuit diagram and working), applications of photoelectric cell, analytical treatment.	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	LLO2.1 Use a Vernier caliper to Measure the dimensions of given objects. Measure the dimensions of objects of known dimensions. LLO 2.2 Estimate the errors in measurement.	Measurements of dimensions of the given object by Vernier caliper.	2	CO 1
3	LLO3.1 Use a Micrometer Screw gauge to Measure the dimensions of given objects. Measure the dimensions of objects of known dimensions.	Measurements of dimensions of given objects by micrometre screw gauge.	2	CO1

	LLO 3.2 Estimate the measurement errors.			
4	LLO 4.1 Use a simple pendulum to determine acceleration due to gravity.	Determination of Acceleration due to Gravity by Simple Pendulum.	2	CO1
5	LLO5.1 Apply Ohm's law to solve circuit problems	Determination of resistance by Ohm's law.	2	CO2
6	LLO6.1 Determine the specific resistance of a given wire.	Determination of specific resistance of a given wire.	2	CO2
7	LLO7.1 Verify the law of the series connection of resistors /capacitors.	Determination of equivalent resistance in the series connection of resistors /capacitors.	2	CO2
8	LLO 8.1 Verify the law of the parallel connection of resistors /capacitors	Determination of equivalent resistance in parallel connection of resistors /capacitors.	2	CO2
9	LLO 9.1 Use meter bridge to: i) Determine the resistance of the given material of the wire. ii) Calculate the specific resistance of the given material of the wire.	Determination of i) resistance of given material of wire. ii) Calculate the specific resistance of the given material of wire by using a meter bridge.	2	CO3
10	LLO 10.1 Use a potentiometer to : i) Determine the potential gradient of the given cell (Principle of potentiometer). ii) Calibrate the given voltmeter	Calibrate the given voltmeter using a Potentiometer.	2	CO3
11	LLO 11.1 Use a potentiometer to : i) Compare the emf of two cells	Compare the emf of two cells using a Potentiometer.	2	CO3
12	LLO 12.1 Use a potentiometer to: i) Find the internal resistance of a cell.	Find the internal resistance of a cell by using a Potentiometer.	2	CO3
13	LLO 13.1 Use a magnetic compass to draw the magnetic lines of forces of magnets of different shapes and determine neutral points.	Determination of neutral points by magnetic compass.	2	CO4
14	LLO 14.1 Determine the refractive index of the glass slab using the Refraction phenomenon.	Determination of the refractive index of the glass slab.	2	CO4
15	LLO 15.1 Use of He-Ne laser beam.	Study the properties and working of the laser using a He-Ne laser beam.	2	CO4
16	LLO 16.1 Use photoelectric cells to study the effect of : i) Intensity of light on photoelectric current. ii) Applied potential on photoelectric current.	Study effect of i) Intensity of light on photoelectric current. ii) Applied potential on photoelectric current. using Photoelectric cell	2	CO4

VI. SUGGESTED MICRO PROJECT/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 Practical (PA) Assessment. 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:

- Series and parallel resistances: Prepare models for a combination of series and parallel resistances
- Series and parallel capacitors: Prepare models for a combination of series and parallel capacitors
- Magnetic flux: Prepare models to demonstrate magnetic lines of lines of forces
- Vernier Calipers: Prepare prototype vernier caliper of desired least count using card sheet
- Conductivity: Collect different materials such as metal, plastics, glass etc. and prepare models
- Carbon resistors: Determine the resistance and tolerance of carbon resistors using color codes
- Mobile applications: Use mobile applications for measurements 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.
- Magnetism: Prepare a chart on magnetic lines of force of bar magnet.
- LASER: Prepare a chart to study Total Internal Reflection/LASER.
- X-rays/Photoelectric cell. Prepare a chart showing the properties of X-rays/Photoclectric cells.
- Ohm's Law: Prepare Chart to Study Ohm's Law.

Assignment

- Convert the units of a given physical quantity from one system of units to another.
- Prepare a chart to summarize units and measurements.
- Give details about the explanation of concepts like electrostatics, and magnetic domain. 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 fibres in, engineering etc.
- Applications of X-ray in engineering etc.
- Applications of LASER in, engineering etc.
- Applications of Photoelectricity in, engineering etc

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.	1
2	Micrometer screw gauge: Range 0-25 mm, Resolution 0.01 mm.	2
3	Simple pendulum, Stop Watch.	3
4	Glass Slab 75x50x12mm.	4
5	He-Ne laser kit	14
6	Battery eliminator (0-12 V, 2 A)	4,5,6,7,8,9
7	Voltmeter(0-10 V), ammeter (0-5 A)	1,4,5
8	Meter Bridge (100 cm), Galvanometer (30-0-30) and jockey.	8
9	Potentiometer (400 cm).	9,10,11
10	Potentiometer, Daniell cell, Leclanche cell.	9,10,11
11	Bar Magnet, Magnetic Needle.	12
12	Photoelectric cell.	15
13	Parallel/Series Resistance /Capacitor Kit	6,7

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	General Physics	CO1	7	2	4	4	10
2	II	Electrostatics	CO2	9	2	6	6	14
3	III	Current Electricity	CO3	9	4	4	6	14
4	IV	Magnetism	CO4	5	2	3	3	8
5	V	Optics and Laser	CO5	7	4	4	4	12
6	VI	Modern Physics	CO6	8	4	4	4	12
		Grand Total		**45**	**18**	**25**	**27**	**70**

IX. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)	Summative Assessment (Assessment of Learning)
1. Tests 2. Rubrics for COs 3. Assignment 4. Midterm Exam 5. Self-Learning 6. Term Work 7. Seminar/Presentation	1. End-Term Exam 2. Micro-project 3. Tutorial Performance

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		2	1	1	1			
CO2	3	1	1	2	1	1	1			
CO3	3	1	1	2	1	1	1			
CO4	3	1	1	1	1	1	1			
CO5	3	1	1	2	1	1	1			
CO6	3	1	1	2	1	1	1			

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
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
5	Haliday, David; Resnik, Robert and Walker, Jearl	Fundamentals of Physics	John Wiley & Sons, Hoboken, USA, 2014 ISBN: 812650823X
6	Dr. Hussain Jeevakhan	Applied Physics - II	Khanna Book Publishing, (2021), ISBN: 978-93-91505-57-8

XIII. 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

Sr.No	Link/Portal	Description
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.	k. https://www.youtube.com/results?search_query=physics+class+11+chapter+1	Concepts of basic physics
8.	l. 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:

Smt. D.V. Saurkar
Lecturer in Physics

Mr. N.S. Salave
Lecturer in Physics

Mr A.D. Ghorpade
Lecturer in Physics

(Course Experts)

Name & Signature:

Dr. S. S. Bharatkar
(Programme Head)

Name & Signature:

Shri.S.B.Kulkarni
(CDC In-charge)

GOVERNMENT POLYTECHNIC, PUNE

'120 – NEP' SCHEME

PROGRAMME	DIPLOMA IN CE/EE/ET/ME/MT
PROGRAMME CODE	01/02/03/04/05
COURSE TITLE	BASIC MATHEMATICS
COURSE CODE	SC11205
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	
SC11205	BASIC MATHEMATICS	AEC	4	2	-	-	6	3	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:

Basic Mathematics plays a crucial role in diploma Programmes as it fosters the development of critical thinking skills, enhances quantitative literacy, prepares students for higher education, promotes problem-solving abilities, cultivates logical and abstract thinking, and fosters mathematical literacy. By engaging with Mathematics, students acquire logical reasoning, problem-solving techniques, and analytical thinking, which are valuable for lifelong learning and professional growth.

Calculus is a branch of Mathematics that calculates how matter, particles, and heavenly bodies move. Derivatives are useful for finding maxima and minima of the function; velocity and acceleration are also useful for many engineering optimization problems. Statistics can be defined as a type of mathematical analysis which involves the method of collecting and analyzing data and then summing up the data into a numerical form for a given set of factual data or real-world observations. It equips individuals with the ability to interpret numerical information, make informed decisions, and navigate real-world situations. Moreover, Mathematics provides a foundation for further studies in various disciplines and prepares students to tackle complex challenges.

By exploring abstract concepts and logical structures, students develop their ability to reason; make connections, and approach problems with clarity and precision. Furthermore, studying Mathematics helps students appreciate the historical and cultural significance of Mathematics and its applications in diverse fields, thereby fostering mathematical literacy and a deeper understanding of the world. Hence the course provides the insight to analyze engineering problems scientifically using logarithms, matrices, trigonometry, straight line, differential calculus, and statistics.

By incorporating these topics, students comprehend to approach engineering problems from a mathematical perspective, enabling them to devise efficient and effective solutions, and this leads to preparing Diploma graduates well-rounded, adaptable, and capable of making significant contributions to the branch-specific problems.

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

Studentswillbeabletoachieve&demonstratethefollowing CO'soncompletionofcourse-basedlearning

CO1 - Apply the concepts of algebra to solve engineering (discipline) related problems.
CO2 - Utilize trigonometry to solve programme-specific engineering problems.
CO3 - Solve programme-specific engineering problems under given conditions of straight lines.
CO4 - Apply differential calculus to solve programme-specific problems.
CO5 - Use techniques and methods of statistics to crack programme-specific 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 ALGEBRA (CL Hrs-12, Marks-14)			
1.	TLO 1.1 Solve the given simple problem based on laws of logarithm. TLO 1.2 Solve the given system of linear equations using the matrix inversion method. TLO 1.3 Obtain the proper and improper partial fraction for the given simple rational function. TLO 1.4 Solve simultaneous equations by using concepts given in Ancient Indian Mathematics.	1.1 Logarithm: Concept and laws of logarithm. 1.2 Matrices: Matrices, algebra of matrices, transpose, value of determinant of matrix of order 3x3, adjoint and inverse of matrices. 1.3Matrices: Solution of simultaneous equations by matrix inversion method. 1.4 Partial Fractions: Types of partial fractions based on the nature of factors and related Problems. 1.5 Algebra in Indian Knowledge System: Solution of simultaneous equations.	Improved Lecture Tutorial Assignment Demonstration Simulation	**CO1**

Sr. No	Theory Learning Outcomes (TLO'S) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
UNIT-II TRIGONOMETRY (CL Hrs-16, Marks-14)				
2	TLO 2.1: Apply the concept of Compound angle, allied angle, and multiple angles to solve the given simple engineering problem(s). TLO 2.2: Apply the concept of Sub-multiple angle to solve the given simple engineering-related problem(s). TLO 2.3: Apply the concept of factorization and de-factorization formulae to solve the given simple engineering problem(s). TLO 2.4: Investigate given simple problems by utilizing inverse trigonometric ratios. TLO 2.5: Use concepts given in Ancient Indian Mathematics for trigonometry to solve given problems.	2.1 Trigonometric ratios of allied angles, compound angles, multiple angles (2A, 3A), and submultiples angles (without proof). 2.2 Factorization and De factorization formulae (without proof). 2.3 Inverse Trigonometric Ratios and related problems. 2.4 Principal values and the relation between trigonometric and inverse trigonometric ratios. 2.5 Trigonometry in Indian Knowledge System: The Evolution of Sine Function in India. 2.6 Indian Trigonometry: Basic Indian Trigonometry - Introduction and Terminology (From Ancient Beginnings to Nilakantha). 2.7 Trigonometry in Indian Knowledge System: Pythagorean triples in Sulabasutras.	Improved Lecture Tutorial Assignment Demonstration Simulation	**CO2**
UNIT-III STRAIGHT LINE (CL Hrs-06, Marks-08)				
3	TLO 3.1 Calculate the angle between given two straight lines. TLO 3.2 Formulate equation of straight lines related to given engineering problems. TLO 3.3 Identify the perpendicular distance from the given point to the line. TLO 3.4 Calculate the perpendicular distance between the given two parallel lines. TLO 3.5 Use geometry given in Sulabasutras to solve the given problems.	3.1 Straight line and slope of a straight line: a. The angle between two lines b. Condition of parallel and perpendicular lines 3.2 Various forms of straight lines: a. General form b. Slope-point form c. Slope-intercept form d. Two-point form e. Double intercept form 3.3 Perpendicular distance from a point on the line 3.4 Perpendicular distance between two parallel lines 3.5 Geometry in Sulabasutras in Indian Knowledge System: a. Construction of square b. Circling the square	Improved Lecture Tutorial Assignment Demonstration Simulation	**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 DIFFERENTIAL CALCULUS (CL Hrs-16, Marks-20)				
4	TLO 4.1: Solve the given simple problems based on functions. TLO 4.2: Solve the given simple problems based on rules of differentiation. TLO 4.3: Obtain the derivatives of composite, implicit, parametric, inverse, logarithmic, and exponential functions. TLO 4.4: Apply the concept of differentiation to find the given equation of tangent and normal. TLO 4.5: Apply the concept of differentiation to calculate maxima, minima, and radius of curvature for a given function. TLO 4.6: Familiar with the concept of calculus given in Indian Mathematics.	4.1 Functions and Limits: Concept of function and simple examples. 4.2 Functions and Limits: Concept of limits without examples. 4.3 Derivatives: Rules of derivatives such as sum, product, and quotient of functions. 4.4 Derivatives: Derivative of composite functions (chain rule), implicit and parametric functions. 4.5 Derivatives: Derivatives of inverse, logarithmic, and exponential functions. 4.6 Applications of derivative: Second-order derivative without examples, equation of tangent and normal, maxima and minima, radius of curvature. 4.7 Calculus in Indian Knowledge System: The Discovery of Calculus by Indian Astronomers.	Improved Lecture Tutorial Assignment Demonstration Simulation	**CO4**
UNIT –V STATISTICS (CL Hrs-10, Marks-14)				
5	TLO 5.1: Obtain the range and coefficient of range of the given grouped and ungrouped data. TLO 5.2: Calculate the mean and standard deviation of ungrouped and grouped data related to the given simple engineering problem(s). TLO 5.3: Determine the variance and coefficient of variance of given grouped and ungrouped data. TLO 5.4: Justify the consistency of given simple sets of data.	5.1 Range, coefficient of range of discrete and grouped data. 5.2 Mean deviation and standard deviation from the mean of grouped and ungrouped data. 5.3 Variance and coefficient of variance. 5.4 Comparison of two sets of observation.	Improved Lecture Tutorial Assignment Demonstration Simulation	**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 Logarithms based on given applications.	Logarithm and applications.	2	CO1
2	LLO 2.1: Solve elementary problems on Algebra of matrices for branch-specific engineering-related applications.	Algebra of matrices	2	CO1
3	LLO 3.1: Apply the concept of matrix to solve engineering problems.	Simultaneous Equations using the inversion method.	2	CO1
4	LLO 4.1: Apply the concept of matrix to solve engineering problems.	Matrix Inversion method to determine currents.	2	CO1
5	LLO 5.1: Apply the concept of matrix to solve engineering problems.	Inverse of a non-singular matrix.	2	CO1
6	LLO 6.1: Apply the concept of partial fractions to solve engineering problems.	Partial fractions.	2	CO1
7	LLO 7.1: Solve problems on Compound, Allied, multiple and sub-multiple angles for related shapes.	Compound, Allied, multiple, and sub-multiple angles.	2	CO2
8	LLO 8.1: Utilize the concept of trigonometry to solve engineering problems.	Factorization and de-factorization formulae.	2	CO2
9	LLO 9.1: Utilize the concept of trigonometry to solve engineering problems.	Inverse trigonometric ratios.	2	CO2
10	LLO 10.1: Solve branch-specific engineering problems under given conditions of straight lines.	Equation of straight lines using different forms.	2	CO3
11	LLO 11.1: Solve branch-specific engineering problems under given conditions of straight lines.	Perpendicular distance, distance between two parallel lines, and angle between two lines.	2	CO3
12	LLO 12.1: Solve branch-specific engineering problems under given conditions of straight lines.	Use of a straight line to calculate the speed, distance, and time of a moving object.	2	CO3
13	LLO 13.1: Apply the concept of derivative to solve engineering problems.	Derivatives of implicit functions and parametric functions.	2	CO4
14	LLO 14.1 - Apply the concept of derivatives to solve engineering problems.	Derivative of logarithmic and exponential functions.	2	CO4
15	LLO 15.1 - Apply the concept of the equation of tangent and normal to solve engineering problems.	Equation of tangent and normal.	2	CO4

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
16	LLO 16.1 - Apply the concept of maxima, minima, and radius of curvature to solve engineering problems.	Maxima, minima of function and radius of curvature.	2	CO4
17	LLO 17.1 - Apply the concept of the equation of tangent and normal to solve engineering problems.	Concept of tangent and normal to solve the given problems of Engineering Drawing.	2	CO4
18	LLO 18.1 - Apply the concept of maxima and minima to solve engineering problems.	Maxima and Minima to obtain optimum value.	2	CO4
19	LLO 19.1 - Apply the concept of the radius of curvature to solve engineering problems.	Radius of curvature.	2	CO4
20	LLO 20.1 - Utilize the concept of derivatives to solve engineering problems.	Use of derivative to find the slope of a bending curve.	2	CO4
21	LLO 21.1 - Use the concept of range and mean deviation to crack branch-specific problems.	Range, coefficient of range and mean deviation.	2	CO5
22	LLO 22.1 - Use the concept of standard deviation and coefficient of variance to crack branch-specific problems.	Standard deviation, coefficient of variation and comparison of two sets.	2	CO5
23	LLO 23.1 - Use the concept of standard deviation to crack branch-specific problems.	Standard Deviation for Concrete with the given data.	2	CO5

Note: 1.Take any15 tutorials out of 23 and ensure that all the units are covered.
2.Take the tutorial in a batch size of 20 to 30 students.
3.Give students at least 10 problems to solve in each tutorial.

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), 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	Algebra	CO1	12	2	6	6	14
2	II	Trigonometry	CO2	16	2	6	6	14
3	III	StraightLine	CO3	6	2	2	4	8
4	IV	DifferentialCalculus	CO4	16	2	8	10	20
5	V	Statistics	CO5	10	2	6	6	14
Grand Total				**60**	**10**	**28**	**32**	**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	1			
CO2	3	1	-	-	1	1	1			
CO3	3	-	-	-	-	-	-			
CO4	3	1	1	1	-	1	-			
CO5	3	2	1	1	1	1	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	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	Marvin L. Bittinger David J. Ellenbogen Scott A. Surgent	Calculus and Its Applications	Addison-Wesley 10th Edition ISBN-13:978-0-321-69433-1

Sr. No	Author	Title	Publisher
6	C. S. Seshadri	Studies in the History of Indian Mathematics	Hindustan Book Agency, New Delhi110016. ISBN978-93-80250-06-9
7	George Gheverghese Joseph	Indian Mathematics Engaging with the World from Ancientto ModernTimes	World Scientific Publishing Europe Ltd. 57 ISBN 978-17-86340-61-0
8	Deepak Singh	Mathematics-I	Khanna Book Publishing Co.(P) Ltd. ISBN: 978-93-91505-42-4
9	Garima Singh	Mathematics-II	Khanna Book Publishing Co.(P) Ltd. ISBN: 978-93-91505-52-3
10	Gareth James, Daniela Witten, Trevor Hastie Robert and Tibshirani	An Introduction to Statistical Learning with Applications in R	Springer New York Heidelberg Dordrecht London ISBN 978-1-4614-7137-0 ISBN978-1-4614-7138-7 (eBook)
11	Gunakar Muley	Sansar Ke Mahan Ganitagya	First Edition,Rajkamal Prakashan, ISBN-10. 8126703571, ISBN-13.978-8126703579
12	T. S. Bhanumurthy	A Modern Introduction to Ancient Indian Mathematics	New Age International Private Limited, 1 January 2008 ISBN-10.812242600X, ISBN-13.978-8122426007
13	M. P.Trivedi and P.Y.Trivedi	Consider Dimension and Replace Pi	Notion Press; 1stedition (2018), ISBN-978-1644291795

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.	www.scilab.org/-SCILab	Signal processing, statistical analysis and image enhancement.
3.	www.mathworks.com/product/matlab/-MATLAB	Applications of concepts of Mathematics tc coding.
4.	SpreadsheetApplications	Use of Microsoft Excel, Apple Numbers and Google Sheets.
5.	https://ocw.mit.edu/	MIT Courseware
6.	https://www.khanacademy.org/math?gclid=CNqHuabCys4CFdOJaddHoPig	Concept of Mathematics through video lectures and notes
7.	http://ocw.abu.edu.ng/courses/mathematics/	List of Mathematical Courses.
8.	https://libguides.furman.edu/oer/subject/mathematics	Open Education Resources (OER) in Mathematics.
9.	https://phet.colorado.edu/en/simulations/filter?subjects=math&type=html,prototype	Phet Simulation for Mathematics.
10.	https://libguides.cmich.edu/OER/mathematics	Mathematics with OER.

Name & Signature:	
Shri. Vitthal B. Shinde Lecturer in Mathematics	**Shri. Sachin B. Yede** Lecturer in Mathematics
(Course Experts)	
Name & Signature: **Shri. S. S. Bharatkar** (Programme Head)	Name & Signature: **Shri.S.B.Kulkarni** (CDC In-charge)

GOVERNMENT POLYTECHNIC, PUNE

'120 – NEP' SCHEME

PROGRAMME	DIPLOMA IN EE
PROGRAMME CODE	02
COURSE TITLE	ENGINEERING WORKSHOP PRACTICE(EE)
COURSE CODE	WS11201
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	
WS11202	ENGINEERING WORKSHOP PRACTICE(EE)	SEC	-	-	4	-	4	2	-	EE	-	-	-	-	25	10	25@	10	-	-	100
										CW	-	-	-	-	25	120	25@	10	-	-	

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.
7. Candidate is detained in any one part of Engineering Workshop Practice course i.e. Central Workshop ,Electrical workshop will be declared as Detained in Engineering Workshop Practice course.
8. Candidate remaining absent in practical examination of any one part of Engineering Workshop Practice course i.e. Central Workshop ,Civil workshop will be declare as Absent in Mark List and has to appear for examination. The marks of the part for which candidate was present will not be processed or carried forward.

II. RATIONALE:

Workshop Practice is a basic engineering course. The knowledge of basic shops like wood working, fitting, welding, plumbing and sheet metal shop is essential for technician to perform his/her duties in industries. Students are able to perform various operations using hand tool equipment and machineries in various shops. Working in workshop develops the attitude of group working and safety awareness. This course provides industrial environment in the educational institute.

III. COURSE-LEVELLEARNINGOUTCOMES(CO'S)

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

CO1: Use of firefighting tools and equipment & understand the IE Rules for Electrical Safety.
CO2: Prepare various Electrical wiring
CO3: Troubleshooting of various Electrical domestic appliances
CO4: Perform various operations using plumbing tools
CO5: Prepare various welding joints.
CO6: Produce simple job using different sheet metal operations.

IV. THEORYLEARNINGOUTCOMESANDALIGNEDCOURSECONTENT

Sr. No	Theory Learning Outcomes(TLO'S) alignedtoCO's.	Learningcontentmappedwith TLO's.	Suggested Learning Pedagogics	Relevant COs
	ELECTRICAL ENGINEERING WORKSHOP			
	UNIT-I ELECTRICAL WORKSHOP PRACTICE (CL Hrs-NIL, Marks-NIL)			
1.	TLO 1.1 Follow safety practices TLO 1.2 Explain the different types of fire extinguisher and their uses. TLO 1.3 Use firefighting equipment	1.1 Safety Practices, Causes of accidents, General safety rules, Safety signs and symbols 1.2 First Aid 1.3 Fire, Causes of Fire, Basic ways of extinguishing the fire, Classification of fire, Class A, B, C, D, Firefighting equipment, fire extinguishers, and their types.	Demonstration Collaborative learning Role Play	**CO1**
	UNIT-II ELECTRICAL WIRING (CL Hrs-NIL, Marks-NIL)			
2	TLO 2.1 Identify tools for Fabrication. TLO 2.2 Explain operation of Fabrication of Switchboard. TLO 2.3 Installation of various Wiring. TLO 2.4 How to measure Resistance, Current, Voltage & Continuity of given circuit. TLO 2.5 Perform the practical for understanding Result of Open, Short & Continuity circuit test. TLO 2.6 Perform the practical for understanding Operate Fuse, Relay & MCB	2.1 Study of Fabrication of switch board 2.2 Study of various wiring systems 2.3 Study of Multimeter 2.4 Study of House wiring, Staircase wiring & Godown wiring. 2.5 Study of Open circuit, short circuit & Earthing concepts 2.6 Study the Operation of Fuse, Relay & MCB	Demonstration Collaborative learning Role Play	**CO2**

Sr. No	Theory Learning Outcomes (TLO'S) alignedtoCO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
	UNIT-III STUDY THE PRINCIPLES, WORKING & TROUBLESHOOTING OF DOMESTIC APPLIANCES (CL Hrs-NIL, Marks-NIL)			
3	TLO 3.1 Explain operation of Electrical Domestic Appliances TLO 3.2 Tools used for Electrical Domestic Appliances TLO 3.3 Test the Electrical Domestic Appliances.	3.1 Study of Principle & Working of Home appliances such as automatic electric iron, immersion water heater, Geyser, food processor (mixer), Microwave, fridge, A.C. with their specifications 3.2 Study the procedure for Troubleshooting of Domestic appliances.	Model & Video Demonstration	**CO3**
	CENTRAL WORKSHOP			
	UNIT- IV PLUMBING (CL Hrs-NIL, Marks-NIL)			
4	TLO 4.1 Identify plumbing tools. TLO 4.2 Explain operation of fitting shop machines. TLO 4.3 Use plumbing tools TLO 4.4 Operate machineries. TLO 4.5 Perform plumbing operations TLO 4.6 Maintain tools, equipment and machineries	4.1 Plumbing hand tools pipe vice, pipe bending equipment, pipe wrenches, dies and their Specifications 4.2 Pipe fittings- bends, elbows, tees, cross, coupler, socket, reducer, cap, plug, nipple, and their Specifications 4.3 Operation of Machineries in plumbing shops- pipe bending machine their specifications and maintenance. Basic process cutting, threading.	Model Demonstration	**CO4**
	UNIT –V METAL JOINTING (CL Hrs-NIL, Marks-NIL)			
5	TLO 5.1 Identify metal joining tools. TLO 5.2 Explain gas and arc welding procedure TLO 5.3 Use metal joining tools. TLO 5.4 Perform welding, soldering, brazing operations TLO 5.5 Maintain tools, equipment, and machineries.	5.1 Arc welding hand tools- electrode holder, cable connector, cable lugs, chipping hammer, earthing clamp, wire brush and their Specifications 5.2 Operation of machineries in welding shops- arc welding transformer their specifications and maintenance. 5.3 Welding Electrode, filler rod, fluxes, and solders.	Model Demonstration	**CO5**

Sr. No	Theory Learning Outcomes (TLO'S) alignedtoCO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
	UNIT –VI SHEET METAL (CL Hrs-NIL, Marks-NIL)			
6	TLO 6.1 Identify sheet metal tools. TLO 6.2 Explain operation of sheet metal machineries. TLO 6.3 Use sheet metal tools TLO 6.4 Operate sheet metal machineries. TLO 6.5 Perform bending operations Maintain tools, equipment, and machineries.	6.1 Sheet metal hand tools snip, shears sheet gauge, straight edge, L square, scriber, divider, trammel, punches, pliers, stakes, groovers, limit set and their Specifications 6.2 Operation of machineries in sheet metal shops- sheet cutting and bending machine their specifications and maintenance. Basic process- marking, bending, folding, edging, seaming, staking, riveting.	Demonstration	CO6

V. LABORATORYLEARNINGOUTCOMEANDALIGNEDPRACTICAL/TUTORIALEXPERIENCES.

Sr. No	Practical/Tutorial/LaboratoryLearningOutcome(LLO)	Laboratory Experiment / Practical Titles /TutorialTitles	Number of hrs.	RelevantCOs
1	LLO 1.1 Use fire extinguisher	Identify fire extinguisher according to their specification	2	CO1
2	LLO 2.1 Operate fire extinguisher	Perform mock drill session in group of minimum 10 students for extinguishing fire.	2	CO1
3	LLO 3.1 Identify different tools used in workshop.	Identify different tools used in workshop.	2	CO1
4	LLO 4.1 Use of Internet/ Books & Collect the Related Information for study	Study of general safety precautions, IE Rules and Various tools required for electrical wiring and electrical work	2	CO1
5	LLO 5.1 Use of Internet/ Books & Collect the Related Information for study. LLO 5.2 Understand the use of Different electrical safety devices from videos.	Study of electrical safety devices such as Hand-gloves, gumboot, insulating mats, line tester, arms panel, life safety materials with their specifications and testing as per IS code of practice	2	CO1
6	LLO 6.1 Understand the Fabrication of switch board from Demonstration & videos.	Fabrication of switch board with one socket, one fan regulator and four switches along with indicator and fuse.	2	CO2
7	LLO 7.1 Demonstration & videos of various wiring systems.	Perform the various wiring systems.	2	CO2
8	LLO 8.1 Demonstration & videos of Staircase wiring & Godown wiring.	Perform the Staircase wiring & Godown wiring.	2	CO2
9	LLO 9.1 Demonstration & videos of Dismantling, Assembling & Troubleshooting of Home appliances	Dismantling, Assembling & Troubleshooting of Home appliances such as automatic electric iron, immersion water heater, Geyser, food processor (mixer), Microwave, fridge, A.C. with their specifications	2	CO3

VII. LABORATORYEQUIPMENT/INSTRUMENTS/TOOLS/SOFTWAREREQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Fire buckets of standard size.	1,2
2	Fire extinguisher A,B and C types	1,2
3	Bench Drilling machine (up to 13 mm drill cap.) with ½ H.P. Motor, 1000 mm height.	12,16
4	Power Saw machine 350 mm mechanical with 1 HP Motor & all Accessories.	12,14,16,17
5	Bench Grinder 200 mm Grinding Disc diameter 200 mm. with 25 mm. bore 32 mm. with ½ HP/1HP Motor.	16,17
6	Vernier height Gauge 450 mm	10,11, 12,16, 17
7	Surface Plate 600 x 900 mm Grade I	16,17
8	Angle Plate 450 x 450 mm	16,17
9	Welding machine 20 KVA 400A welding current 300A at 50, 100, 200, 250, 300 with std. Accessories and Welding Cable 400 amp. ISI with holder	14,16, 17
10	Pipe Bending Machine	11,12
11	Pipe Vice – 100 mm	11,12
12	Pipe Cutter- 50 mm	11,12
13	Bench Vice 100 mm	11,12
14	Portable Hammer Drill Machine 0-13 mm A.C. 230 V, 2.5Amp, Pistol type, having different types of bits	14,16,17
15	Sheet Bending Machine	17
16	Sheet Cutting Machine	17
17	Brazing Equipment	17
18	Fitting tools - hammers, chisels, files, hacksaw, surface plate, punch, v block, angle plate, try square, marking block, steel rule, twist drills, reamers, tap set, die set.	16,17
19	Plumbing tools- pipe vice, pipe bending equipment, pipe wrenches, dies.	11,12

Sr. No.	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment/Practical Titles/Tutorial Titles	No. of Hrs.	Relevant COs
10	LLO 10.1 Collect information about ancient tools for understanding Indian Knowledge.	Draw sketches of various ancient tools	2	CO04,CO5, CO6
11	LLO 11.1 Select proper plumbing tools LLO 11.2 Use plumbing operations for preparing plumbing joints	Prepare T joint pipe fitting job as per given drawing (individually)	2	CO4
12	LLO 12.1 Select proper plumbing tools LLO 12.2 Use plumbing operations for preparing plumbing joints	Prepare elbow joint pipe fitting job as per given drawing(individually)	2	CO4
13	LLO 13.1 Develop list of different components as per the specification	Prepare bill of material for given pipeline layout (individually)	2	CO4
14	LLO 14.1 Obey safety rules employed in welding shop.	Practice different safety rules in welding shop as per given instruction.	2	CO5
15	LLO 15.1 Develop list of different components as per the specification for welding job	Prepare bill of material for given Welding Job (individually)	2	CO5
16	LLO 16.1 Assemble utility jobs using different manufacturing processes.	Prepare utility job (like stool, benches, tables, or similar jobs) involving arc welding and artificial wood as per given drawing (in group of 4 to 5 students) Fabrication operation involve measuring, marking, cutting, edge preparation, welding	2	CO5
17	LLO 17.1 Select proper sheet metal tools LLO 17.2 Prepare sheet metal component using different operations.	Prepare sheet metal utility job using following operations a. Cutting and Bending b. Edging c. End curling d. Lancing e. Soldering f. Riveting	2	CO6
18	LLO 18.1 Develop list of different components as per the specification	Prepare bill of material for given Sheet Metal work (individually)	2	CO6

VI. SUGGESTEDMICROPROJECT/ASSIGNMENT/ACTIVITIESFORSPECIFICLEARNING/SKILLS DEVELOPMENT(SELF-LEARNING)

Microproject

NOT APPLICABLE

Assignment

NOT APPLICABLE

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

NOT APPLICABLE

IX. ASSESSMENT METHODOLOGIES / TOOLS

Formative assessment (Assessmentfor Learning)	Summative Assessment (Assessmentof Learning)
Assignment and Terms work	Lab performance

X. SUGGESTED CO_S- PO_S MATRIX FORM

NOT APPLICABLE

XI. SUGGESTED LEARNIN

XII.

XIII. G MATERIALS / BOOKS

Sr.No	Author	Title	Publisher
1	Bawa, H.S.	Workshop Practice	McGraw Hill Education, Noida; ISBN-10: 0070671192 ISBN-13: 978- 0070671195
2	Gupta, J.K.; Khurmi, R.S.	A Textbook of Manufacturing Process (Workshop Tech.)	S.Chand and Co. New Delhi ISBN:81-219-3092-8
3	Hegde, R.K.	Workshop Practice Manual For Engineering Diploma & ITI Students	Sapna Book House, 2012, ISBN:13: 9798128005830
4	Singh, Rajender	Introduction to Basic Manufacturing Process & Workshop Technology	New Age International, New Delhi; 2014, ISBN: 978-81-224-3070-7
5	Hajra; Choudhary	Elements of Workshop Technology	Media Promoters and Publishers Mumbai, 2009, ISBN: 10-8185099146
6	Sarathe, A.K	Engineering Workshop Practice	Khanna Book Publishing CO(P) LTD, New Delhi, ISBN No. 978-93-91505- 51-6

XIII. LEARNING WEBSITES & PORTALS

Sr.No	Link/Portal	Description
1.	http://www.asnu.com.au	Basic engineering tools.
2.	http://www.abmtools.com/downloads/Woodworking%20Carpentry%20Tools.pdf	Wood working
3.	http://www.weldingtechnology.org	Welding techniques
4.	http://www.newagepublishers.com/samplechapter/001469.pdf	Basic engineering tools.
5.	http://www.youtube.com/watch?v=TeBX6cKKHWY	Welding techniques

Sr.No	Link/Portal	Description
6.	http://www.youtube.com/watch?v=QHF0sNHnttw&feature=related	Welding techniques
7.	http://www.youtube.com/watch?v=Kv1zo9CAxt4&feature=relmfu	Wood working
8.	http://www.piehtoolco.com	Basic engineering tools.
9.	http://sourcing.indiamart.com/engineering/articles/materials-used-hand-tools/	Basic engineering tools.
10.	https://www.youtube.com/watch?v=9_cnkaAbtCM	Basic engineering tools.

Name & Signature:

12/10/2023

Mr. P.U. Garge
Lecturer in Mechanical Engineering &
I/C Workshop Superintendent

Mr. Makarand L. Bhagwat
Lecturer in Electrical Engineering

(Course Experts)

Name & Signature:

Dr. S. S. Bharatkar
(Programme Head)

Name & Signature:

Shri. S.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	FUNDAMENTALS OF ICT
COURSE CODE	CM21201
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	
CM21201	FUNDAMENTALS OF ICT	SEC	1	-	2	1	4	2	--	--	--	--	--	25	10	25@	10	25	10	75

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:

In any typical business set up to carry out routine tasks related to creating business documents, performing data analysis and its graphical representations and making electronic slide show presentations, the student needs to learn various software such as office automation tools like word processing applications, spreadsheets and presentation tools. They also need to use these tools for making their project reports and presentations. The objective of this course is to develop the basic competency in students for using these office automation tools to accomplish the job. This course also presents an overview of emerging technologies so that students of different disciplines can appraise the applications of these technologies in their respective domains.

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: Use a computer system and its peripherals for a given purpose.
CO2: Prepare Business documents using a Word Processing Tool.
CO3: Analyze Data and represent it graphically using Spreadsheet.
CO4: Prepare professional Slide Show presentations.
CO5: Explain the concept and application of emerging technology.

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 TO COMPUTER SYSTEM (CL Hrs-2, Marks-NIL)			
1.	**TLO 1.1** Explain the functions of components in the block diagram of the computer system. **TLO 1.2** Classify the given type of software. **TLO 1.3** Explain the characteristics of the given type of network. **TLO 1.4** Describe the application of the given type of network connecting device. **TLO 1.5** Describe the procedure to manage a file /folder in the given way.	**1.1 Basics of Computer System:** Overview of Hardware and Software: block diagram of Computer System, Input/output unit CPU, Control Unit, Arithmetic logic Unit (ALU), Memory Unit. **1.2 Internal components:** processor, motherboards, random access memory (RAM), read-only memory (ROM), video cards, sound cards and internal hard disk drives). **1.3 External Devices:** Types of input/output devices, types of monitors, keyboards, mouse, and printers: Dot matrix, Inkjet and LaserJet, plotter and scanner, external storage devices CD/DVD, Hard disk and pen drive. **1.4 Application Software:** word processing, spreadsheet, database management systems, control software, measuring software, photo-editing software, video-editing software, graphics manipulation software System Software compilers, linkers, and device drivers. **1.5 Network environments:** network interface cards, hubs, switches, routers and modems, the concept of LAN, MAN, WAN, WLAN, Wi-Fi and Bluetooth. **1.6 Working with Operating Systems:** Creating and managing files and folders, Copying a file, renaming and deleting files and folders, Searching files and folders, application installation, and creating shortcuts of applications on the desktop.	Hands-on Demonstration Presentations	**CO1**

Sr. No	Theory Learning Outcomes (TLO'S) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
		UNIT-II WORD PROCESSING (CL Hrs-3, Marks-NIL)		
2	**TLO 2.1** Write the steps to create the given text document. **TLO 2.2** Explain the given feature for document editing. **TLO 2.3** Explain the given page setup features of a document. **TLO 2.4** Write the given table formatting feature. **TLO 2.5** Write the steps to set the given type of document layout	**2.1 Word Processing:** Overview of Word processor Basics of Font type, size, colour, Effects like Bold, italic, underline, Subscript and superscript, Case changing options, Previewing a document, Saving a document, Closing a document and exiting the application. **2.2 Editing a Document:** Navigate through a document, Scroll through text, Insert and delete text, Select text, Undo and redo commands, Use drag and drop to move text, Copy, cut and paste, Use the clipboard, Clear formatting, Format and align text, Formatting. **2.3 Changing the Layout of a Document:** Adjust page margins, Change page orientation, Create headers and footers, Set and change indentations, and Insert and clear tabs. **2.4 Inserting Elements to Word Documents:** Insert and delete a page break, Insert page numbers, Insert the date and time, Insert special characters (symbols), Insert a picture from a file, and Resize and reposition a picture. **2.5 Working with Tables:** Insert a table, Convert a table to text, Navigate and select text in a table, Resize table cells, Align text in a table, Format a table, Insert and delete columns and rows, Borders and shading, repeat table headings on subsequent page. 2.6 **Working with Columned Layouts and Section Breaks:** Columns, Section breaks, Creating columns, Newsletter style columns, changing part of a document layout or formatting, Remove section breaks, Adding columns to the remainder of a document, Column widths.	Hands-on Demonstration Presentations	**CO2**
		UNIT-III SPREADSHEETS (CL Hrs-03, Marks-NIL)		
3	**TLO 3.1** Write the steps to create the given spreadsheet. **TLO 3.2** Explain the given formatting feature of a worksheet. **TLO 3.3** Write steps to insert formulas and functions in the given worksheet. **TLO 3.4** Write steps to create charts for the given data set.	**3.1 Working with Spreadsheets:** Overview of workbook and worksheet, Create Worksheet Entering sample data, Save, Copy Worksheet, Delete Worksheet, Close and open Workbook. **3.2 Editing Worksheet:** Insert and select data, adjust row height and column width, delete, move data, insert rows and columns, Copy and Paste, Find and Replace, Spell Check, Zoom In-Out, Special Symbols, Insert Comments, Add Text Box, Undo Changes, - Freeze **3.3 Formatting Cells and sheet:** Setting Cell Type, Setting Fonts, Text options, rotating cells, Setting Colors, Text Alignments, Merge and Wrap, applying Borders and Shades, Sheet Options, Adjust Margins,	Hands-on Demonstration Presentations	**CO3**

	TLO 3.5 Explain steps to perform data filter, sort and validation operations on the given data set. **TLO 3.6** Write steps to set up and print a spreadsheet.	Page Orientation, Header and Footer, Insert Page Breaks. **3.4 Working with Formula:** Creating Formulas, Copying Formulas, Common spreadsheet Functions such as sum, average, min, max, date, In, And, or, mathematical functions such as sqrt, and power, applying conditions using IF. **3.5 Working with Charts**: Introduction to charts, an overview of different types of charts, Bar, Pie, and Line charts, creating and editing charts. Use chart options: chart title, axis title, legend, data labels, Axes, grid lines, and moving chart in a separate sheet. **3.6 Advanced Operations:** Conditional Formatting, Data Filtering, Data Sorting, Using Ranges, Data Validation, Adding Graphics, Printing Worksheets, print area, margins, header, footer and other page setup options.		
	UNIT- IV PRESENTATION TOOL (CL Hrs-04, Marks-NIL)			
4	**TLO 4.1:** Write the steps to create the given slide presentation. **TLO 4.2:** Write the steps to insert multiple media in the given presentation. **TLO 4.3:**Explain the method of including animation, and transition effects in a slide show. **TLO 4.4:**Write steps to apply table features in the given presentation **TLO 4.5:** Write steps to manage charts in the given presentation.	**4.1 Creating a Presentation:** Outline an effective presentation, identify the elements of the User Interface, Create New Presentation Files, Create a Basic Presentation, Work with textboxes, Apply Character Formats, and Format Paragraphs. **4.2 Inserting Media Elements:** Adding and Modifying Graphical Objects to a Presentation - Insert Images into a Presentation, insert audio clips, video/animation, Add Shapes, Add Visual Styles to Text in a Presentation, Edit Graphical Objects on a Slide, Format. **4.3 Working with Tables:** Insert a Table in a Slide, Format Tables, and Import Tables from Other Office Applications. **4.4 Working with Charts:** Insert Charts in a Slide, Modify a Chart, and Import Charts from Other Office Applications.	Hands-on Demonstration Presentations	**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 BASICS OF INTERNET AND EMERGING TECHNOLOGIES (CL Hrs-04, Marks-NIL)				
5	**TLO 5.1** Explain the use of the given setting option in browsers. **TLO 5.2** Explain the given option used for effective searching in search engine **TLO 5.3** Explain the features of the given web service. **TLO 5.4** Explain concepts and applications of emerging technologies **TLO 5.5** Use various elementary cloud-based tools	**5.1 World Wide Web:** Introduction, Internet, Intranet, Cloud, Web Sites, web pages, URL, web servers, basic settings of web browsers- history, extension, default page, default search engine, creating and retrieving bookmarks, use search engines effectively. **5.2 Web Services:** e-Mail, Chat, Video Conferencing, e-learning, e-shopping, e-Reservation, e-Groups, Social Networking. **5.3 Emerging Technologies:** IoT, AI and ML, Drone Technologies,3D Printing. **5.4 Tools:** Docs, Drive, forms, quiz, Translate and other Apps.	Hands-on Demonstration Presentations	**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 Identify various Input/output devices, connections and peripherals of the computer system. LLO 1.2 Work with Computer systems, Input/output devices, and peripherals to manage files and folders for data storage.	a) Work with Computer Systems, Input/output devices, and peripherals. b) Work with files and folders	2	CO1
2	LLO 2.1 Create and manage Word document. LLO 2.2 Apply formatting features on text at line, paragraph and page level.	Work with document files: a) Create, edit and save documents in Word Processing. b) Text, lines and paragraph-level formatting	2	CO2
3	LLO 3.1 Insert and edit images, and shapes in a document file.	Work with Images and Shapes in Word Processing.	2	CO2
4	LLO 4.1 Insert table and apply various table formatting features on it.	Work with tables in Word Processing.	2	CO2
5	LLO 5.1 Apply page layout features in word processing. LLO 5.2 Print a document by applying various print options LLO 5.3 Use mail merge in word processing	Working with layout and printing a) Document page layout, Themes, and printing. b) Use of mail merge with options.	2	CO2

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
6	LLO 6.1 Enter and format data in a worksheet. LLO 6.2 Insert and delete cells, rows and columns LLO 6.3 Apply alignment feature on cell	Create, open and edit Worksheet.	2	CO3
7	LLO 7.1 Create formula and "If" condition on cell data LLO 7.2 Apply various functions and named ranges in the worksheet.	Formulas and functions in Worksheet.	2	CO3
8	LLO 8.1 Implement data Sorting, Filtering and Data validation features in a worksheet.	Sort, Filter and validate data in Spreadsheet.	2	CO3
9	LLO 9.1 Create charts using various chart options in a spreadsheet.	Charts for Visual Presentation in Spreadsheet.	2	CO3
10	LLO 10.1 Print the worksheet by applying various print options for the worksheet	Worksheet Printing.	2	CO3
11	LLO 11.1 Apply design themes to the given presentation. LLO 11.2 Insert pictures text/images/shapes in slide LLO 11.3 Use pictures text/images/shapes editing options.	Make Slide Show Presentation.	2	CO4
12	LLO 12.1 Add tables and charts in the slides. LLO 12.2 Run slide presentation in different modes LLO 12.3 Print slide presentation as handouts/notes	Use Tables and Charts in Slide	2	CO4
13	LLO 13.1 Apply animation effects to the text and slides LLO 13.2 Add/set audio and video files in the presentation.	a) Insert Animation effects into Text and Slides. b) Insert Audio and Video files in the presentation	2	CO4
14	LLO 14.1 Configure internet connection on a computer system LLO 14.2 Use different web services on the internet	a) Internet connection configuration b) Use Internet and Web Services.	1	CO5
15	LLO 15.1 Configure different browser settings LLO 15.2 Use browsers for the given purpose	Working with Browsers.	1	CO5
16	LLO 16.1 Create web forms for surveys using different options.	Prepare Web Forms for Survey.	1	CO5
17	LLO 17.1 Create web forms for Quiz using different options	Prepare Web Forms for Quiz	1	CO5

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

Self-Learning

Following are some suggestive self-learning topics:

1) Use ChatGPT/any other AI tool to explore information.
2) Use Calendar to Schedule and edit activities.
3) Use the Translate app to translate the given content from one language to another.
4) Use a cloud-based storage drive to store and share your files.

Micro project

The micro project has to be industry application-based, internet-based, workshop-based, laboratory-based or field-based as suggested by the Teacher.

1) Perform a survey on various inputs and output devices available in the market and make its report.
2) Prepare a table, Prepare Notes on Technical Topics, Reports, and Bio data with a cover letter (The subject teacher shall assign a document to be prepared by each student)
3) Prepare slides with all Presentation features such as classroom presentation, presentation about the department, and presentation of Technical Topics. (The subject teacher shall assign a presentation to be prepared by each student).
4) Student Mark sheet, Prepare Pay bills, tax statements, and student assessment records using a spreadsheet. (The teacher shall assign a spreadsheet to be prepared by each student).
5) Carry out Surveys on different web browsers.
6) Generate resumes for different job profiles, and survey reports of any industry using ChatGPT/any other AI tool.

Assignment

Prepare a journal of practicals performed in the laboratory.

VII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED

Sr. No	Equipment Name with Broad Specifications	Relevant LLO Number
1	a) Computer System with all necessary Peripherals and Internet connectivity. b) Any Office Software c) Any Browser (Any General Purpose Computer available in the Institute)	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	Introduction to Computer System	CO1	2	--	--	--	--
2	II	Word Processing	CO2	3	--	--	--	--
3	III	Spreadsheets	CO3	3	--	--	--	--
4	IV	Presentation Tool	CO4	4	--	--	--	--
5	V	Basics of Internet and Emerging Technologies	CO5	3	--	--	--	--
Grand Total				15	--	--	--	--

IX. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)	Summative Assessment (Assessment of Learning)
Lab performance, Assignment, Self-learning and Seminar/Presentation	Lab. Performance, viva voce

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	1	-	-	-	-	-	1	2	-	-
CO2	-	-	-	3	-	-	1	-	-	1
CO3	-	2	1	3	-	-	1	-	3	1
CO4	-	-	-	3	-	-	1	-	-	1
CO5	1	-	-	3	-	-	3	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	Goel, Anita	Computer Fundamentals	Pearson Education, New Delhi, 2014, ISBN-13: 978-8131733097
2	Miller, Michael	Computer Basics Absolute Beginner's Guide, Windows 10	QUE Publishing; 8th edition August 2015, ISBN: 978-0789754516
3	Alvaro, Felix	Linux: Easy Linux for Beginners	Create Space Independent Publishing Platform- 2016, ISBN-13: 978-1533683731
4	Johnson, Steve	Microsoft Office 2010: On Demand	Pearson Education, New Delhi India, 2010. ISBN:9788131770641
Sr. No	**Author**	**Title**	**Publisher**
5	Schwartz, Steve	Microsoft Office 2010 for Windows: Visual Quick Start	Pearson Education, New Delhi India, 2012, ISBN: 9788131766613
6	Leete, Gurdy, Finkelstein Ellen, Mary Leete	OpenOffice.org for Dummies	Wiley Publishing, New Delhi, 2003 ISBN : 978-0764542220

XIII. LEARNING WEBSITES & PORTALS

Sr. No	Link/Portal	Description
1.	https://www.microsoft.com/en-in/learning/office-training.aspx	Office
2.	http://www.tutorialsforopenoffice.org/	Open Office

3.	https://s3-ap-southeast-1.amazonaws.com/r4ltue295xy0d/Special_Edition_Using_StarOffice_6_0.pdf	Open Office
4.	https://ashishmodi.weebly.com/uploads/1/8/9/7/18970467/computer_fundamental.pdf	Computer Fundamental
5.	http://www.tutorialsforopenoffice.org/	Open Office
6.	https://www.tutorialspoint.com/computer_fundamentals/index.htm	Computer Fundamental
7.	https://www.tutorialspoint.com/word/	Word Processing
8.	https://www.javatpoint.com/ms-word-tutorial	Word Processing
9.	https://support.microsoft.com/en-au/office/word-for-windows-training-7bcd85e6-2c3d-4c3c-a2a5-5ed8847	Word Processing
10.	https://www.javatpoint.com/excel-tutorial	Spreadsheet
11.	https://support.microsoft.com/en-au/office/excel-video-training-9bc05390-e94c-46af-a5b3-d7c22f6990bb	Spreadsheet
12.	https://www.javatpoint.com/powerpoint-tutorial	Powerpoint Presentation
13.	https://support.microsoft.com/en-au/office/powerpoint-for-windows-training-40e8c930-cb0b-40d8-82c4-b	Powerpoint Presentation
14.	https://www.geeksforgeeks.org/ms-dos-operating-system/	Operating System

Name & Signature:

Mrs. Priyanka L Sonwane
Lecturer in Information Technology

Mrs. Aafiya A Shaikh
Lecturer in ~~Information Technology~~ Computer Engineering

(Course Experts)

Name & Signature:	Name & Signature:
Dr. S. S. Bharatkar (Programme Head)	**Shri. S.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	YOGA AND MEDITATION
COURSE CODE	HU21201
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	
HU21201	YOGA AND MEDITATION	VEC	-	-	1	1	2	1	-	-	-	-	-	25	10	-	-	25	10	50

Total IKS Hrs for Term: 1Hr

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 Graduate needs a sound body and mind to face the challenging situations in a career as an employee or as an entrepreneur. Yoga and Meditation bring about the holistic development of an individual and equip him with the necessary balance to handle the challenges. The age of polytechnic students is appropriate to get introduced to yoga practice as this will help them in their studies as well as their professional lives. Moreover, Yoga inculcates discipline in all walks of the life of students. Pranayama practice regulates the breathing practices of the student to improve stamina and resilience.

Meditation empowers a student to focus and keep calm to get peace of mind. World Health Organization (WHO) has also emphasized the role of yoga and meditation as stress prevention measures. National Education Policy 2020 highlights the importance of yoga and meditation amongst students of all ages. Therefore, this course for Diploma students is designed for the overall well-being of the student and aims to empower students to adopt and practice "Yoga" in daily life.

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 - Practice basic Yoga and Pranayama in daily life to maintain physical and mental fitness.
CO2 - Practice meditation regularly to improve concentration and better handling of stress and anxiety.
CO3 - Follow a healthy diet and hygienic practices for maintaining good health.

IV. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

NOT APPLICABLE

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 Practice warming up for Yoga.	Introduction:- Presentations on Introduction to Yoga and its History. Lab Exp: 1. Perform warming-up exercises to prepare the body from head to toe for Yoga.	5	CO1
2	LLO 2.1 Practice Surya Namaskar	Lab Exp: 2. Perform all the postures of Surya Namaskar one by one at a very slow pace, after warm-up. Lab Exp 3. Perform multiple Surya Namaskar (Starting with three and gradually increasing it to twelve) in one go. Experiments 2 to 4 must be followed by Shavasana for self-relaxation.	7	CO1, CO2
3	LLO 3.1 Practice basic Asanas	Lab Exp: 4 Perform Sarvangasna, Halasana, Kandharasana (setubandhasana) Lab Exp: 5 Perform Bhujangasana, Naukasana, Mandukasana Lab Exp: 6 Perform Paschimottasana, Baddhakonasana,Bharadwajasana. Lab Exp: 7 Perform Veera Bhadrasana, Vrukshasana, Trikonasana. Follow-up experiments 5 to 7 with Shavasana for self-relaxation	8	CO2
4	LLO 4.1 Practice basic Pranayama	Lab Exp: 8 Perform Bhastrika, Anulom Vilom Pranayam Kriya Lab Exp: 9 Practice Kapalbhati Pranayam Kriya Lab Exp: 10 Practice Bhramary Pranayam.	5	CO3

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
5	LLO 5.1 Practice Meditation	Lab Exp: 11 Perform sitting in Dhyan Mudra and meditating.Star with five minutes and slowly increasing to higher durations. The trainer will explain the benefits of Meditation before practice	5	CO3

Note :

1. The start and end of each session can be with appropriate Yoga prayers and chanting of Omkar.
2. Trainers can add similar asanas in practical sessions.
3. Students are to be instructed to practice the experiment performed at least twice a week as part of self learning practices.
4. A live demonstration by the trainer needs to be carried out during practical hours. Yogic Videos can be used as well.

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

Micro project

- Maintain a diary indicating date-wise practice done by the student with a photograph of self in yogic posture.

Assignment

- Prepare a Diet and nutrition chart for Self.

Learning

- Practice at least thrice a week.
- Read books on different methods to maintain health, and wellness and to enhance mood.
- Watch videos on Yoga Practices.

VII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Yoga and Meditation kits : Yoga Mats, Yoga Rollers, Yoga Blocks, Aero Yoga Clothing Blankets, Cloth Straps, Bolsters Wheels	ALL

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)
Lab performance, Self-learning and Terms work	Actual Practical Performance

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	-	-			
CO2	-	-	-	-	3	-	-			
CO3	-	-	-	-	3	-	-			
CO4	-	-	-	-	3	-	-			
CO5	-	-	-	-	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	Swami Vivekananda	Patanjalis Yoga Sutras	Fingerprint Publishing (2019) ISBN-10 9389567351
2	Luisa Ray (Author), Angus Sutherland (Illustrator)	Yoga for Every Body: A beginner's guide to the practice of yoga postures, breathing exercises and meditation.	Vital Life Books (2022) ISBN-13: 9781739737030, ISBN-10: 1739737032
3	Swami Saradananda	Mudras for Modern Life: Boost your health, re-energize your life, enhance your yoga and deepen your meditation	Watkins Publishing ISBN: 9781780289984, Edition: 2018
4	Martha Davis, Elizabeth Robbins, Matthew McKay, Eshelman MSW	The Relaxation and Stress Reduction Workbook	A New Harbinger Self-Help Workbook (2019)
5	SWANSON, ANN	Science of Yoga: Understand the Anatomy and Physiology to Perfect Your Practice	Penguin Random House, ISBN 13 9780241341230

XIII. LEARNING WEBSITES & PORTALS

Sr.No	Link/Portal	Description
1.	https://onlinecourses.swayam2.ac.in/aic19_ed28/preview	Introduction to Yoga and Applications of Yoga - Course (swayam2.ac.in)
2.	https://onlinecourses.swa am2.ac.in/aic23 review	Yoga for Creativity
3.	https://onlinecourses.swayam2.ac.in/aic23 ge05/preview	Yoga for concentration
4.	https://onlinecourses.swayam2.ac.in/aic23_ge06/previe w	Yoga for Memory Development
5.	https://onlinecourses.nptel.ac.in/noc21_hs29/preview	Psychology of Stress, Health and Well-being
6.	https://onlinecourses.swayam2.ac.in/nce19_sc04/previe w	Food Nutrition for Healthy Living

Name & Signature: **Shri. Sunil P. Date** (Course Expert)	
Name & Signature: **Dr. S. S.Bharatkar** (Programme Head)	Name & Signature: **Shri. S.B. Kulkarni** (CDC In-charge)

GOVERNMENT POLYTECHNIC, PUNE

'120 – NEP' SCHEME

PROGRAMME	DIPLOMA IN EE/ET
PROGRAMME CODE	02/03
COURSE TITLE	APPLIED CHEMISTRY
COURSE CODE	SC11202
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	
SC11202	APPLIED CHEMISTRY	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:

Applications of Material Science and Chemical Principles have resulted in the development of new materials used in modern medicines and automobiles, synthetic fibers, polymers, alloys, new energy sources and many other important products and processes. Material Science is an important and expanding branch in the scientific engineering and economic field of our society.

The topic of atomic structure includes the basic structure of matter, which governs the Mechanical, Electrical and Magnetic properties of matter. Corrosion and methods of prevention will make students realize the importance of care and maintenance of machines and equipment. The study of different polymers, insulators, and adhesives and their chemical behaviour will be useful in their applications in electrical appliances and electronics industries. The study of impurities and hardness in water and methods for water softening will help the students make proper use of water.

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

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: Distinguish materials based on atomic structure.
CO2: Apply the concepts of electrochemistry to solve engineering problems
CO3: Select metals and non-metals for given applications.
CO4: Select the relevant insulating material for various engineering problems.
CO5: Use corrosion preventive measures in the industry.
CO6: Use the appropriate engineering material in 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 ATOMIC STRUCTURE (CL Hrs-6, Marks-12)			
1.	**TLO 1.1** Explain the Characteristics of fundamental particles of an atom. **TLO 1.2** Distinguish between atomic number and atomic mass number **TLO1.3** Distinguish between orbit and orbital. **TLO 1.4** Explain the significance of quantum numbers. **TLO 1.5** Explain the formation of a given molecule **TLO 1.6** State Aufbau's principle and Hund's rule. **TLO 1.7** Define Electrovalent and covalent bonds with examples. .	1.1.**Indian Chemistry:** -Philosophy of atom by Acharya Kanad. 1.2.Definition of an atom, structure of atom, Characteristics of fundamental particles of an atom, definition of atomic number, atomic mass number and their difference 1.3.Orbits: Bohr's energy levels, sub-energy levels, s, p, d, f orbital, shapes and description of s and p orbital. Definition and significance of quantum numbers 1.4.Aufbau's principle, Hund's rule, orbital electronic configurations (s, p, d, f) of elements having atomic numbers 1 to 30. 1.5.Definitions of valence electrons, valency, types of valencies, Definition of electrovalency, positive and negative electrovalency 1.6. Formation of Electrovalent compounds-Nacl Alcl3 Definition of covalency, single, double and triple covalent bonds, formation of Covalent compounds H2O, CO2, N2	Chalk and board Improved lecture, Tutorial Assignment Demonstration	CO1
	UNIT-II ELECTROCHEMISTRY (CL Hrs -8, Marks-14)			
2	**TLO 2.1** Explain the assumptions of Arrhenius's theory of electrolytic dissociation. **TLO 2.2.** Describe the process of electroplating taking a suitable example **TLO 2.3** Explain the mechanism	2.1. Definition of electrolyte, electrolysis, ionization, Arrhenius theory, Difference between atom and ion 2.2. Activity series, mechanism of electrolysis of CuSO4 using Pt electrode and Cu electrode 2.3. Applications of electrolysis: electroplating, electro-refining,	Chalk and board Improved lecture, Tutorial 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
	of electrolysis for the given electrolyte. **TLO 2.4** Calculate CE, ECE, the weight of substance deposited or liberated, and time in the given numerical. **TLO 2.5** Distinguish between metallic conductor and electrolytic conductor. **TLO 2.6** Describe the construction and working of cells. **TLO 2.7** Explain applications of Cells **TLO 2.8** Explain the care and maintenance of a battery	2.4. Faraday's laws of electrolysis and numerical. 2.5. Types of conductors: metallic conductors, electrolytic Conductors (definition and difference) 2.6. Conductance in metals, conductance in electrolytes, Factors affecting conductance: nature of solute, nature of the solvent, temperature, concentration of solution. 2.7. Primary and secondary cell: Difference between primary cell and secondary cell, Construction, working and applications of Daniel cell (porous vessel and salt bridge), Dry cell, lead acid cell, Ni-Cd cell, Lithium-ion battery Maintenance of battery		
UNIT-III METALS AND ALLOYS (CL Hrs-08, Marks-10)				
3	**TLO 3.1** Draw the flow chart showing different processes in metallurgy. **TLO 3.2** Classify carbon steel giving properties and application of each **TLO 3.3**. Explain the purposes of heat treatment methods. **TLO 3.4** Explain the purposes of making alloys. **TLO 3.5** Classify alloys with suitable examples of each. **TLO 3.6** Write the composition, properties and uses of alloys. .	3.1. Occurrence of metals, definitions of mineral, ore, flux, matrix, slag and metallurgy, mechanical properties of metal. 3.2. Flow chart showing different processes in metallurgy, classification, properties and application of carbon steel, heat treatment (definition, purposes and methods) 3.3. Definition of alloy, purposes of making alloys with examples, classification of alloys(ferrous and non-ferrous), 3.4 Composition properties application of copper-zinc alloy, cadmium copper alloy, chromium copper alloy, brass, bronze, duralumin, wood's metal, and babbit metal.	Chalk and board Improved lecture, Tutorial Assignment Demonstration	CO3
UNIT- IV INSULATING MATERIALS (CL Hrs-8, Marks-12)				
4	**TLO 4.1** Describe the formation of a given polymer **TLO4.2**.Distinguish between thermo-softening and thermosetting plastics. **TLO 4.3.** Explain the applications of Plastic based on its properties **TLO 4.4** Explain the vulcanization process of natural rubber. **TLO 4.5** Distinguish between synthetic and natural rubber. **TLO 4.6** Explain the preparation, properties and applications of given	**Plastic** 4.1. Definition of monomer and polymer, polymerization, classification of plastic based on monomer, based on thermal behaviour, on basis of monomer structure, 4.2. Types of polymerization (Addition, and Condensation) applications of Plastic based on its properties. 4.3. Synthesis, properties and applications of- polythene, PVC, Teflon, Bakelite, and polystyrene. **Rubber:** 4.4. Types of rubber, processing of natural rubber, properties of rubber, drawbacks of	Chalk and board Improved lecture, Tutorial Assignment Demonstration	CO4

Sr. No	Theory Learning Outcomes (TLO'S) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
	synthetic rubber **TLO 4.7** Explain the properties and application of thermal insulators **TLO 4.8** Explain the properties and application of electrical insulators	natural rubber, vulcanization of rubber. 4.5. Synthetic rubber – preparation, properties and application of BUNA-S, BUNA-N, neoprene, Thiokol. **Thermal insulators :** 4.6. Properties and application of thermocol and glass wool. **Electrical insulators:** 4.7. Properties and applications of Ceramics, silicon fluid, nitrogen gas.		
	UNIT –V CORROSION (CL Hrs-7, Marks-10)			
5	**TLO 5.1** Explain different types of oxide films. **TLO 5.2** Explain the mechanism of electrochemical corrosion **TLO 5.3** Explain the factors affecting the rate of atmospheric corrosion and electrochemical corrosion. **TLO 5.4** Describe the galvanization process of protection of metal from corrosion. **TLO 5.5** Distinguish between galvanizing and tinning **TLO 5.6** Describe the given process of protection of metal from corrosion.	5.1. Definition, causes of corrosion types of corrosion definition (atmospheric and electrochemical) Types of oxide films 5.2. Mechanism of atmospheric and electrochemical corrosion (evolution of hydrogen, absorption of oxygen). 5.3. Factors affecting the rate of atmospheric corrosion and electrochemical corrosion. 5.4. Protection Methods-anodic and cathodic protection, galvanizing and tinning process, sherardizing process.	Chalk and board Improved lecture, Tutorial Assignment Demonstration	CO5
	UNIT - VI ENGINEERING MATERIALS (CL Hrs-8, Marks-12)			
	TLO 6.1 Explain the properties and applications of nanomaterials. **TLO6.2** Explain the properties and applications of Magnetic Material. **TLO 6.3** Distinguish between diamagnetic and paramagnetic materials. **TLO 6.4** Explain the properties and applications of semiconducting materials. **TLO 6.5** Differentiate between N-type and P-type semiconductors. **TLO 6.6** Describe the properties	6.1. **Nanomaterials-** properties and application of fullerene, graphene. 6.2. **Magnetic Material:** properties and applications of diamagnetic materials, paramagnetic materials and ferromagnetic materials. 6.3. **Semiconducting materials:** Definition, Applications of Semiconducting materials, Examples of Semiconductors commonly used, Intrinsic and extrinsic semiconductors, N-type and P-type semiconductors, Difference between N-type and P-type semiconductors, **6.4 Resistor material**: Definition, Properties of three groups of resistor materials, Properties and applications of resistor materials: Tungsten, Carbon, Nichrome, Manganin, Eureka, and Platinum.	Chalk and board Improved lecture, Tutorial Assignment Demonstration	CO6

Sr. No	Theory Learning Outcomes (TLO'S) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
	of three groups of resistor materials. **TLO 6.7** Describe the properties and applications of Resistor material			

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 Write the electronic configuration of atoms from Z=1 to Z=30	Write the electronic configuration of atoms from Z=1 to Z=30	2	CO1
2	LLO 2 Write the formation of compounds NaCl, $AlCl_3$, H_2O, CO_2, N_2	Write the formation of compounds NaCl, AlCl3, H2O, CO2, N2	2	CO 1
3	LLO 3 Determine basic radicals from given ionic solutions by performing a selective test	Determination of basic radical from given ionic solution	2	CO 1
4	LLO 4 Determine acidic radicals given ionicsolutions by performing a selective test	Determination of acidic radical from given ionic solution.	2	CO 1
5	LLO 5 Determine the electrochemical equivalent of copper metal using Faraday's first law and Faraday's second law.	Determination of electrochemical equivalent of copper metal using Faraday's first law and Faraday's second law.	2	CO 2
6	LLO 6 Use a Hydrometer for testing the Battery	Use a Hydrometer for testing Battery	2	CO 2
7	LLO 7 Measure the voltage developed due to chemical reactions by setting up of Daniel cell	Measurement of the voltage developed due to chemical reactions by setting up of Daniel cell	2	CO 2
8	LLO 8 Determine the percentage of iron in a given steel sample by redox titration.	Determination of the percentage of iron in a given steel sample by redox titration.	2	CO3
9	LLO 9 Prepare phenol formaldehyde resin.	Preparation of phenol formaldehyde resin.	2	CO 4
10	LLO 10 Determine the acid value of the given resin	Determination of acid value of given resin	2	CO4
11	LLO 11 Determine the electrode potential of various metals to study their tendency to corrosion.	Determination of electrode potential of various metals to study their tendency to corrosion.	2	CO 5

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
12	LLO 12 Determine the rate of corrosion of Aluminium in acidic and basic medium.	Determination of the rate of corrosion of Aluminium in acidic and basic medium.	2	CO 5

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 Compulsory 12 experiments or more for chemistry practicals for 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)

Micro Project /Assignment/Activity 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 Practical (FA-PR) Assessment. 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:

- Types of bonds: Prepare a chart and models displaying different types of bonds with examples.
- Metals and Alloys: Prepare a chart showing the composition, properties application of Ferrous Alloys & non ferrous alloys.
- Insulating materials: Prepare a chart including different synthetic materials Plastic and Rubber and list their uses.
- Cells & batteries: Prepare a chart including the mechanism of different cells & batteries.
- Batteries: Collect and analyse different types of batteries.
- Corrosion: Prepare a Chart displaying images of observed corrosion processes in the surrounding
- Materials: Collect information by library survey regarding engineering materials used in various industries.
- Engineering material: Collect information by library survey regarding engineering materials used in various industries.

Assignment:

1. Explain covalent bonds and ionic bonds with examples
2. Distinguish between plastic and rubber.
3. Write the electronic configuration of atoms
4. Write the formation of compounds NaCl, $AlCl_3$, H_2O, CO_2, N_2
5. Compare between Thermoplastics and Thermosetting
6. State properties and applications of thermocol and glass wool.
7 Explain types of alloys with examples.
8. Demonstrate the Mechanism of the Hydrogen Evolution process.
9. Write properties and applications of engineering materials.
10. Write properties and applications of insulating materials.

VII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED

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

VIII. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS AND ASSESSMENT PURPOSE

(Specification Table)

Sr. No	Unit	Unit Title	Aligned COs	Learning Hours	R - Level	U - Level	A - Level	Total Marks
1	I	Atomic structure	CO 1	06	04	06	02	12
2	II	Electrochemistry	CO 2	08	04	04	06	14
3	III	Metals and alloys	CO 3	08	02	02	06	10
4	IV	Insulating materials	CO 4	08	04	02	06	12
5	V	Corrosion	CO 5	07	04	02	04	10
6	VI	Engineering Materials	CO 6	08	02	04	06	12
Grand Total				**45**	**20**	**20**	**30**	**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. SLA assessment of 25 marks.	End Semester assessment of 25 marks for laboratory learning. End Semester assessment of 70 marks (Online)

X. SUGGESTED COs- POsMATRIXFORM

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	-	2			
CO2	3	2	-	-	1	1	2			
CO3	3	-	-	2	-	-	1			
CO4	3	2	-	2	1	1	1			
CO5	3	-	-	1	1	1	1			
CO6	3	2	-	3	1	1	1			

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	Dara S.S. Umare S.S.	Engineering Chemistry	S. Chand and Co publication, New Delhi, 201, ISBN: 8121997658
2	Jain and Jain	Engineering Chemistry	Dhanpat Rai and Sons, New Delhi,2015, ISBN: 9352160002
3	Vairam. S	Engineering Chemistry	Wiley Indian Pvt. Ltd, New Delhi, 2013 ISBN: 9788126543342
4	Agnihotri, Rajesh	Chemistry for Engineers	Wiley Indian Ptd. Ltd, New Delhi, 2014, ISBN: 9788126550784
5	Agrawal Shikha	Engineering Chemistry	Cambridge University Press, New Delhi, 2015 ISBN: 97811074764
6	V. P. Mehta	Polytechnic Chemistry	Jain brothers, New Delhi.2012818360093X

XII. LEARNING WEBSITES & PORTALS

Sr.No	Link/Portal	Description
1	www.chemistryteaching.com	Physical, inorganic and organic chemistry.
2	www.chemcollective.org	Virtual Labs, simulation
3	www.chem1.com	Chemistry instruction and education
4	www.onlinelibrary.wiley.com	Materials and corrosion
5	www.chemcollective.org	Collection of virtual labs, scenario-based learning activities

Sr.No	Link/Portal	Description
6	https://www.ancient-origins.net/history-famous-people/indian- sage-acharya-Kanad-001399	IKS Philosophy of atom by AacharyaKanad.

Name & Signature: **Smt. Rupali S. Patil** Lecturer in Chemistry (Course Experts)	
Name & Signature: **Dr. S. S. Bharatkar** (Programme Head)	Name & Signature: **Shri. S.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	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)

Studentswillbeabletoachieve&demonstratethefollowing CO'soncompletionofcourse-basedlearning

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 equation 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 substitution method. TLO1.3 Integrate given simple functions using the integration by parts TLO1.4 Solve the given simple integral bypartial 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 denominator of 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 DefiniteIntegration. TLO2.2 Use properties of definite integration tosolve given problems	**Unit - II Definite Integration** 2.1 Definite Integration: Definition, 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 givendifferential equations. TLO3.2 Form simple differential equation for given elementary engineering problems. TLO3.3 Solve given differential equations using the methods of Variable separable and Exact Differential Equation (Introduce the concept of partial differential equation). TLO3.4 Solve 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 Bakhshali iterative method for finding approximate square root. (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 Seidal and Jacobi's method. 4.3 Bakhshali iterative method for finding 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 number of trials are large and probability is very small. TLO5.3 Utilize the concept of normal distribution to solve related engineeringproblems	**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 by parts	*Integration by parts	1	CO1
3	LLO 3.1 Solve integration by partial fractions(only linear non repeated factors at denominator of 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 mean value 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 equation.	Order, degree and formation of differential equation.	1	CO3
9	LLO 9.1 Solve first order first degree differential equation using variable separable method.	Variable separable method.	1	CO3
10	LLO 10.1 Solve 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 differential equation.	*Applications of differential equations.(Take programme specific problems)	1	CO3
12	LLO 12.1 Solve problems on Bisection method and Regula falsimethod.	*Bisection method and Regula falsi method.	1	CO4
13	LLO 13.1 Solve problems on Newton-Raphson method.	Newton- Raphson method.	1	CO4
14	LLO 14.1 Solve problems on Jacobi's method and Gauss Seidal Method.	Jacobi's method and Gauss Seidal Method.	1	CO4
15	LLO 15.1 Use Bakhshali iterative methods for finding approximate value of square root. (IKS)	*Bakhshali iterative methods for finding 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 above suggestive LLOs –

1. '*' Marked Practicals (LLOs) Are mandatory.
2. Minimum 80% of above list of Tutorials are to be performed.
3. Judicial mix of LLOs are to be performed to achieve 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), 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 text book 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/	Comprehensive set of notes and tutorials covering 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:
Shri. S. S. Bharatkar (Programme Head)	**Shri.S.B.Kulkarni** (CDC In-charge)

GOVERNMENT POLYTECNIC, PUNE

'120–NEP' SCHEME

PROGRAMME	DIPLOMA IN ELECTRICAL ENGINEERING
PROGRAMME CODE	02
COURSE TITLE	FUNDAMENTALS OF ELECTRICAL ENGINEERING
COURSE CODE	EE21201
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 in 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	
EE21201	FUNDAMENTALS OF ELECTRICAL ENGINEERING	DSC	4	0	4	2	10	5	3	30	70	100	40	25	10	25@	10	25	10	175

Total IKS Hrs for Term:0Hrs

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:@-InternalAssessment,#-ExternalAssessment,*#-OnlineExamination,@$-InternalOnlineExamination

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. **1credit** 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 is an entry course to Electrical Engineering Diploma Programme. The basic concepts, rules and laws of Electric and Magnetic Circuits must be studied and understood by students before studying Electrical Engineering Diploma Course. This course covers fundamentals of D.C. Circuits, Electrostatics, Magnetic Circuits and Electromagnetic Induction. The outcome of this course is useful in linking the further courses of diploma curriculum.

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: Use the basic principles and different effects of electrical current in electrical Engineering field.

CO2: Solve simple D.C. circuits by applying different methods and theorems.

CO3: Determine the value of capacitor in electrical circuit using basic concepts and principles

CO4: Use the principles of magnetism & electro magnetism in electrical circuits.

CO5: Determine various parameters of A.C. quantities.

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 BASIC ELECTRICAL PARAMETERS		**(CL Hrs-12, Marks-12)**	
1.	**TLO 1.1** Define & calculate the various basic electrical parameters. **TLO 1.2** Apply ohm's law to calculate internal resistance of the given circuit. **TLO 1.3** Calculate work, power & energy for the given circuit. **TLO 1.4** Describe the effects of electric current with relevant applications. **TLO 1.4** Explain the concept of ideal and practical voltage and current sources. **TLO 1.5** Convert the given Voltage source into Current source and Current source into Voltage source	1.1 Review of the definitions- Charge, Current, Potential, Potential difference, Voltage, Electrical Resistance, Electromotive force, Terminal voltage and their Units. 1.2 Ohm's Law : applications and limitations 1.3 Specific Resistance and its unit 1.4 Definitions of Work, Power and Energy 1.5 Effects of electric current with relevant applications- Chemical effect, Magnetic effect, Heating effect 1.6 Parameters affecting the resistance, Effect of temperature on resistance of Conductors, Insulators and Alloys, Temperature co-efficient of resistance 1.7 Different types of resistors and their application. 1.8 Concept of Ideal and Practical Current Source and voltage source. 1.9 Source conversion. 1.10 Simple numerical on all above topics.	• Chalk-Board • Presentations • Demonstration • Video	**CO1**
	UNIT-II D.C. CIRCUITS & ELECTROSTATICS		**(CL Hrs-14, Marks-16)**	
2	**TLO 2.1** Identify various types of networks. **TLO 2.2** Apply voltage division rule for series circuit and current division rule for parallel circuits. **TLO 2.3** Apply Kirchhoff's laws to determine current and voltage of the given circuits. **TLO 2.4** Define dielectric strength, breakdown voltage, permittivity. **TLO 2.5** Calculate the capacitance and the energy stored in Capacitors. **TLO 2.6** Plot the charging & discharging curves of given capacitor / capacitive circuit	**D.C. CIRCUITS** 2.1 Definitions- Circuit, Network, Mesh, Node, Active and passive circuit, Unilateral and bilateral circuit, Linear and nonlinear circuit. 2.2 Series circuit- Effective resistance, Voltage division rule (for two series resistances only), Applications. 2.3 Parallel circuit- Effective resistance, Current division rule (for two parallel resistances only) , Applications. 2.4 Kirchhoff's current law, Kirchhoff's voltage law (Upto two simultaneous equations i. e. two loop circuit) **ELECTROSTATICS** 2.5 Define : Dielectric strength, Breakdown voltage and Permittivity with respect to capacitor. 2.6 Energy stored in capacitance (No Derivation). 2.7 Charging and discharging of a capacitor through resistor. 2.8 Simple Numerical on all above topics.	• Chalk-Board • Presentations • Demonstration • Video	**CO1, CO2, CO3**

	UNIT- III MAGNETIC CIRCUITS		**(CL Hrs-12, Marks-16)**	
4	**TLO 3.1** Describe the various basic parameters of Magnetic field. **TLO 3.2** Explain Laws and Rules applicable to the magnetic field produced by current carrying conductor. **TLO 3.3** Give the comparison between Electric and Magnetic circuit. **TLO 3.4** Compare Series and parallel magnetic circuits. **TLO 3.5** Describe Leakage Flux, Useful Flux & Fringing. **TLO 3.6** Describe the significance of Magnetization curve and Hysteresis loop. **TLO 3.7** State and explain Fleming's left hand rule with its application.	3.1 Definitions -Magnetic field, Magnetic flux, Magnetic flux density, Magnetic field strength, Magneto motive force, Reluctance, Permeability, Factors affecting Reluctance. 3.2 Rules applied to magnetic field: -Right hand Gripping rule, Corkscrew rule. 3.3 Magnetic field produced by a straight current Carrying Conductor 3.4 Comparison between Electric and Magnetic circuit. 3.5 Series magnetic circuits 3.6 Concept of Leakage Flux, Useful Flux & Fringing, Leakage Coefficient. 3.7 Relation between B and H, Magnetization curve, Practical importance of magnetization curve 3.8 Hysteresis loop, Practical importance of Hysteresis loop , Hysteresis loss. 3.9 Force on current carrying conductor and its correlation with motor action. 3.10 Fleming's left hand rule. 3.11 Simple Numerical on all above topics.	• Chalk-Board • Presentations • Demonstration • Video	**CO1, CO4**
	UNIT–IV ELECTROMAGNETIC INDUCTION		**(CL Hrs-10, Marks-14)**	
5	**TLO 4.1** Define phenomenon of Electromagnetic induction. **TLO 4.2** State and apply Faraday's law, Lenz's law, Fleming's right hand rule. **TLO 4.3** Differentiate between Statically and Dynamically induced EMF, self and mutual inductance & numerical. **TLO 4.4** Identify the different types of inductors and explain their Applications. **TLO 4.5** Calculate the energy stored in magnetic field. **TLO 4.6** Define Eddy current and eddy current loss.	4.1 Electromagnetic Induction. 4.2 Faraday's laws of Electromagnetic Induction. 4.3 Lenz's law 4.4 Fleming's right hand rule for Generator. 4.5 Statically and dynamically induced EMF. 4.6 Self and Mutually induced EMF 4.7 Self and Mutual inductance, coefficient of coupling. 4.6 Inductances in series. 4.7 Types of Inductors and their Applications:- Air Cored Inductors, Iron Cored Inductors, Ferrite Cored Inductors 4.8 Energy stored in Magnetic field. (No derivation). 4.9 Concept of Eddy current and eddy current loss. 4.10 Simple Numerical on all above topics.	• Chalk-Board • Presentations • Demonstration • Video	**CO1, CO4**

UNIT–V AC FUNDAMENTALS (CL Hrs-12, Marks-12)				
	TLO 5.1 State the Advantages of AC over DC **TLO 5.2** Describe Generation of alternating voltage by simple generator and define the related terminologies from generated voltage waveform & Numerical. **TLO 5.3** Explain the representation of alternating quantity by rotation of vector method **TLO 5.4** Explain the concept of Phase, Phase difference, Lagging and Leading quantity	5.1 Advantages of AC over DC 5.2 Generation of alternating voltage by simple generator. Derivation of EMF equation 5.3 Terminologies like Amplitude, Frequency, Time Period, Angular frequency, Cycle, Instantaneous value, RMS value, Average value, Form Factor, Peak factor. 5.4 Representation of alternating quantity by vector rotation method 5.5 Concept of Phase, Phase difference, Lagging and Leading quantity with equation, waveform representation & phasor diagram. 5.6 Simple Numerical on all above topics.	• Chalk-Board • Presentations • Demonstration • Video	**CO1, CO5**

V. LABORATORY LEARNING OUT COME AND ALIGNED PRACTICAL/TUTORIAL EXPERIENCES. (ANY 20)

Sr. No	Practical/Tutorial/ Laboratory Learning Outcome(LLO)	Laboratory Experiment / Practical Titles/Tutorial Titles	Number of hrs.	Relevant COs
1	LLO1 Draw layout of electrical laboratory.	Know your Electrical engineering laboratory.	2	CO1
2	LLO2 Verify Ohm's Law	Verification of Ohm's Law	2	CO1
3	LLO3 Connect and read multi range analog meters(Ammeter, Voltmeter)	Read analog meters for measurement of various electrical quantities in AC/DC circuits.	2	CO1
4	LLO4 Use of Multimeter for the measurement of AC/DC Current, Voltage and Resistance in the given circuit	Operate Multimeter for the measurement of AC/DC Current, Voltage and Resistance in the given circuit	2	CO1 CO2
5	LLO5 Observe frequency, Time period, Peak Value and Average Value of the given A.C. wave on CRO	Observe and note the frequency, Time period, Peak Value and Average Value of the given A.C. wave on CRO.	2	CO1 CO5
6	LLO6 Verify Kirchoff's Voltage Law	Verification of Kirchoff's Voltage Law for the given circuit.	2	CO1 CO2
7	LLO7 Verification of Kirchoff's Current Law.	Verification of Kirchoff's Current Law for the given circuit.	2	CO1 CO2
8	LLO8 Use the rheostat as current regulator and potential divider	Use rheostat as current regulator and potential divider in the given circuit.	2	CO1 CO2
9	LLO9 Determine relation between EMF, Terminal Voltage and internal resistance of DC source .	Determination of relation between EMF, Terminal Voltage and internal resistance of DC source .	2	CO1 CO2
10	LLO10 Verify the properties of series connected resistive circuit.	Verification of parameters of two / three resistances connected in series.	2	CO1 CO2
11	LLO11 Verify the properties of parallel connected resistive circuit.	Verification of parameters of two/three resistances connected in Parallel.	2	CO1 CO2

Sr. No	Practical/Tutorial/ Laboratory Learning Outcome(LLO)	Laboratory Experiment / Practical Titles/Tutorial Titles	Number of hrs.	Relevant COs
12	LLO12 Determine the time constant(RC) by plotting the charging curves of a capacitor(C) through resistor (R)	Plot the charging characteristics of capacitor and find the time constant(RC) for the given circuit.	2	CO1 CO3
13	LLO13 Determine the time constant (RC)by plotting the discharging curves of a capacitor(C) through resistor (R)	Plot the discharging characteristics of capacitor and find the time constant(RC) for the given circuit. (Use different value of time constant)	2	CO1 CO3
14	LLO14 Find the equivalent capacitance in the series connected capacitive circuits.	Verification of the equivalent capacitance in series connected capacitive circuits.	2	CO1 CO3
15	LLO15 Find equivalent capacitance of the parallel connected capacitive circuits	Verification of equivalent capacitance of the parallel connected capacitive circuits	2	CO1 CO3
16	LLO16 Find B-H curve for the given magnetic material	Plot B-H curve for the given magnetic material (Use DC generator with suitable prime mover) .	2	CO1 CO4
17	LLO17 Obtain magnetization curve for magnetic material	Plot magnetization curve for magnetic core (Use Transformer).	2	CO1 CO4
18	LLO18 Plot Hysteresis Loop for the given transformer coil	Study of Hysteresis loop for the given transformer coil	2	CO1 CO4
19	LLO19 Verify Faraday's Law of Electromagnetic Induction (Statically Induced EMF)	Verification of Faraday's Law of Electromagnetic Induction (Statically Induced EMF)	2	CO1 CO4
20	LLO20 Verify Faraday's Law of Electromagnetic Induction (Dynamically Induced EMF)	Verification of Faraday's Law of Electromagnetic Induction (Dynamically Induced EMF)	2	CO1 CO4
21	LLO21 Verify Fleming's Right Hand Rule	Verification of Fleming's Right Hand Rule	2	CO1 CO4
22	LLO22 Verify Fleming's Left Hand Rule	Verification of Fleming's Left Hand Rule	2	CO1 CO4
23	LLO23 Verify the effect of temperature on resistance of conductor.	Verification of effect of temperature on resistance of conductor.	2	CO1

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

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

Assignment

a. Numerical based on Voltage and Current Source.
b. Numerical based on Resistance, Resistivity, Effect of temperature on Resistance.
c. Numerical based on Equivalent Resistance of Series and Parallel connection of Resistances in given D.C. Circuits.
d. Numerical based on Equivalent Capacitance in given D.C. Circuits.
e. Numerical based on calculation of various parameters of given magnetic circuit.
f. Numerical based on calculation of self Inductance.
g. Numerical based on Energy Stored in Magnetic Field.

Suggested Student Activity

a. Prepare power point presentation related to basics of electrical engineering related to various topics stated above.
b. Prepare a chart of electric circuit elements and relevant industrial application.
c. Prepare question bank referring previous examination question papers.

Micro-project

a. Types of Electrical equipment: Prepare chart showing real-life examples indicating various types of electrical equipment
b. Resistance: Collect samples of resistances and prepare models of simple series circuit and parallel circuit.
c. Capacitance: Collect samples of capacitance and prepare models of simple series circuit and parallel circuit.
d. Inductance: Collect samples of inductance and prepare models of simple series circuit and parallel circuit.

Note :
"These are the just suggestive topics. Faculty must design Microproject/Activities/Assignments based on Course Outcome requirements".

VII. LABORATORYEQUIPMENT/INSTRUMENTS/TOOLS/SOFTWAREREQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	1.DC Supply, AC Supply of suitable range 2 .Voltmeter: Suitable Voltage range,1No. 3 Ammeter: Suitable current range,1No. 4 Single phase dimmerstat, 1 No. 5 Multimeter, 1 No. 6. Lamp load	3, 4
2	1.CRO with probe,10Hz-30MHz,01No 2.Rheostat of suitable rating 3. Autotransformer of suitable rating	5
3	1.DC Supply of suitable range 2.Voltmeter:Suitable Voltagerange,2No. 3.Ammeter: Suitable current range,1 No 4. Resistor: Suitable range resistance in ohm,2 or 3 No.	10,11
4	1.DC Supply of suitable range 2Voltmeter: Suitable voltage,1No. 3Ammeter: Suitable current,1 No. 4.Capacitors: Suitable capacitor,1 No. 5.Resistance: Suitable resistance ,1 No. 6.Stop watch: Suitable stop watch 1 No.	12,13
5	1.DC Supply of suitable range 2.Voltmeter : Suitable Voltage,1No. 3.Ammeter :Suitable Current,1 No. 4.Capacitor:SuitableCapacitor in Farad,3No.	14,15
6	1.AC Supply of suitable range 2.Voltmeter: Suitable voltage,1No. 3.Ammeter: Suitable current,1 No. 4.Inductive coil: Suitable Inductor1No.	16
7	1.AC Supply of suitable range 2Voltmeter: Suitable Voltage,1No. 3Ammeter : Suitable current,1 No. 4.Transformer.: Transformer of Suitable range 1No.	17
8	1.DC Supply of suitable range 2.DC motor: Suitable motor:1No	22

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
9	1.AC Supply of suitable range 2:Voltmeter: Suitable Voltage,1 No. 3:Ammeter: Suitable current,1 No. 4.Transformer:(0.5/1kVA)Suitable transformer,1No. 5Single phase dimmerstat, 1 No.	19
10	1. Centre zero galvanometer:1No. 2.Bar magnet: 1 No. 3.No volt coil / Suitable inductor,1No.	20
11	1: AC Supply of suitable range 2:Voltmeter: Suitable Voltage,1 No. 3:Ammeter: Suitable current,1 No. 4.Transformer:(0.5/1kVA)Suitable transformer,1No. 5.Single phase dimmerstat, 1 No.	18
12	Various meters to understand Make, Rating, Least count	1
13	1.DC Supply of suitable range 2.VoltmeterSuitablevoltage1No. 3.Ammeter: Suitable current1 No. 4.Rheostat : Suitable load in ohm,1 No. 5. Resistive Load,1No	9
14	1.DC Motor Generator set: Suitable rating,1No	21
15	1.DC Supply of suitable range 2.D.C.Voltmeter of SuitableRange,3No 3. Rheostat of Suitable Range,3No	6,7
16	1.DC Supply of suitable range 2.Voltmeter: Suitablevoltage1No. 3.Ammeter: Suitable current1 No. 4.Rheostat : Suitable load in ohm,1 No. 5.Motor field winding or any suitable conductor	23
17	1.DC Supply of suitable range 2.Voltmeter: Suitablevoltage1No. 3.Ammeter: Suitable current1 No. 4.Rheostat : Suitable load in ohm,2 No.	2
18	1.DC Supply of suitable range 2.Voltmeter Suitable voltage1No. 3.Ammeter: Suitable current1 No. 4.Rheostat : Suitable load in ohm,1 No. 5.Resistive Load,1No	8

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

Sr. No	Unit	Unit Title	AlignedCOs	LearningHours	R-Level	U-Level	A-Level	TotalMarks
1	I	Basic electrical parameters	CO1	12	4	4	4	12
2	II	D.C.circuits & Electrostatics	CO2, CO3	14	4	6	6	16
3	III	Magnetic circuits	CO4	12	4	6	6	16
4	IV	Electromagnetic induction	CO4	10	4	6	4	14
5	V	AC Fundamentals	CO5	12	4	4	4	12
			GrandTotal	**60**	**20**	**26**	**24**	**70**

X. ASSESSMENTMETHODOLOGIES/TOOLS

Formative assessment(Assessment for Learning)	Summative Assessment(Assessment of Learning)
1. Tests 2. Rubrics for COs 3. Assignment 4. Mid term Exam 5. Self-Learning 6. Term Work 7. Seminar/Presentation	1. End Term Exam 2. Micro-project 3. Tutorial Performance

XI. SUGGESTED CO-PO- PSO MATRIX FORM

Course Outcomes (COs	Programme Outcomes(POs)								Programme Specific Outcomes *(PSOs)		
	PO-1Basic and Discipline-Specific Knowledge	PO-2 ProblemAnalysis	PO-3 Design/ Development of Solutions	PO-4 EngineeringTools	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	1		2	1		2				1
CO2	3	2	1	2	1		1				
CO3	3	1	1	2	1		2				
CO4	3	1	1	1	2		2				
CO5	3	1	1	2	1		2				

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

XIII. SUGGESTEDLEARNINGMATERIALS/BOOKS

Sr. No	Author	Title	Publisher
1	B. L .Theraja	Electrical Technology Vol.I	S. Chand Publication, Delhi ISBN-9788121924405
2	V.N. Mittle	Basic Electrical Engineering	Tata McGraw Hill Publishing Company Ltd., New Delhi. ISBN- 0074516329, 9780074516324
3	Edward Hughes	Electrical Technology	Low Price Edition ISBN-9780582405196
4	H. Cotton	Electrical Technology	CBS Publishers& Distributors ISBN-8123909284, 9788123909288
5	S.B. Lal Saksena and Kaustuv Dasgupta	Fundamentals of Electrical Engineering Part-1	Cambridge University Press, New Delhi ISBN : 9781107464353

XIII. LEARNING WEBSITES & PORTALS

Sr.No	Link/Portal	Description
1.	https://www.electrical4u.com/electrical-engineering-articles/basic-electrical/	Basic Electrical Parameters
2.	https://en.wikipedia.org/wiki/Capacitor	Capacitor
3.	https://www.corsi.univr.it/documenti/OccorrenzaIns/matdid/ma tdid441904.pdf	D.C. Circuits
4.	https://www.slideshare.net/ChetanPatil396/basic-electrical-parameters-basic-electrical-engineering	Basic Electrical Parameters
5.	https://www.britannica.com/science	Magnetic Circuits
6.	https://en.wikipedia.org/wiki/Magnetic_circuit	Magnetic Circuits
7.	https://en.wikipedia.org/wiki/Electromagnetic_induction	Electromagnetic Induction
8.	https://youtu.be/XT-UmPviH64?si=MLIZBB5BgOA2SWBk	Electromagnetic Induction
9.	https://youtu.be/M-QfX2fvpp4?si=xpZDAiX3-_7xrnnr	Basics Magnetic Circuits
10.	https://archive.nptel.ac.in/courses/117/106/117106108/	Basic Electrical Circuits

Name & Signature:

1) **Smt. Sujala P. Phadnaik**
Lecturer in Electrical

2) **Smt. Madhuri H. Bilgi**
Lecturer in Electrical

(Course Experts)

Name & Signature:	Name & Signature:
Dr. S .S. Bharatkar (Programme Head)	**Shri. S. B .Kulkarni** (CDC In-charge)

GOVERNMENT POLYTECHNIC, PUNE

'120 – NEP' SCHEME

PROGRAMME	DIPLOMA IN EE
PROGRAMME CODE	02
COURSE TITLE	COMPUTATIONAL LABORATORY
COURSE CODE	EE21205
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
EE21205	COMPUTATIONAL LABORATORY	SEC	2	0	2	0	4	2	-	0	0	0	0	50	20	50@	20	-	-	100

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:

For any engineering, computer software skills are mandatory. Computer has become important part of any learning process. Therefore, it is necessary for any engineering student to have basic idea about computer languages. 'C' is most widely used general purpose powerful, efficient and compact language. This subject covers C as a basic logic development language. SCILAB is said to be the language of engineers. It is widely used in mathematics, science and engineering. The SCILAB is used in this subject to solve common mathematical problems and to write simple program for analysis of electrical circuits and to plot simple response graph.

III. COMPETENCY :

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

• Using C Programming and SCILAB Software to analysis the electrical circuit and build the mathematical model of electrical system.

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

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

1. Know the basic concepts of C programming.
2. Execute the C programs
3. Debug different types of errors.
4. Know the main features and importance of programming environment of the SCILAB.
5. Draw plots and subplots of electrical different waveforms and response using SCILAB
6. Apply working knowledge of SCI LAB Simulink package to simulate and \ solve Electrical Circuits.

V. 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 1. BASICS OF C(CL HRS-4)			
1	TLO 1a. Learn the basic concepts of C programming. TLO1b.Distinguish different programming approaches.	1.1 History of C. 1.2 Steps involved in problem solving using Algorithms and Flowcharts. 1.3 Basic structure of C program, Steps to be followed for– Creation, Compilation and Execution of a C program, use of simple scanf( ) and printf( ) functions. 1.4 C Character set, keywords and identifiers, constants, variables, data types. 1.5 Operators and expressions, Library functions. (Arithmetic, Relational, Logical). 1.6 Managing input-output operations – using functions like get char( ) – reading a character, putchar( ) –writing a character, scanf( ) – formatted input and printf( ) – formatted output	Hands-on Demonstration	CO1
	UNIT 2 DECISION MAKING(CL HRS-4)			
2	TLO 2a. Distinguish different programming approaches. TLO 2b.Write C programs and execute. TLO 2c. Debug different types of errors..	2.1 Decision making & branching using If, If-Else, multi branch If, nested If statement, switch -case statement. 2.2 Decision making using loop statements like while, do while, for.	Hands-on Demonstration	CO2
	UNIT 3 ARRAYS(CL HRS-6)			
3	TLO 3a. Distinguish different programming approaches. TLO 3b.Write C programs and execute. TLO 3c.Debug different types of errors..	3.1Declaring one dimensional array. 3.2 Simple programs on arrays such as largest of array, sorting array. 3.3 Strings – initializing string, manipulating strings of charaters.	Hands-on Demonstration	CO3
	UNIT-4 SCILAB ENVIRONMENT (CL HRS-4)			
4	TLO 4 Learn the basic concepts of SCILAB/MATLAB.	4.1 Command window, Command history, Workspace, Edit window, Help window 4.2 SCILAB/MATLAB Basic: common operators, common functions, special constants, command line, data structures, string, saving and loading variables. 4.3. Commands, general, directory, workshop, termination	Hands-on Demonstration	CO4

		UNIT-5 MATRICES IN SCILAB(CL HRS-04)		
5	**TLO** 5.a.Distinguish different programming approaches. **TLO** 5b.Write programs and execute it. **TLO** 5c Debug different types of errors.	5.1 Entering data in Matrices, calculating sum, mean, length, max and min. Matrix Subscripts, Colon operator. 5.3 Solving Linear system	Hands-on Demonstration	**CO5**
		UNIT 6 PROGRAMMING & GRAPHICS IN SCILAB(CL HRS-06)		
6	**TLO** 6a Distinguish different programming approaches. **TLO** 6b Write programs and execute it. **TLO** 6c Debug different types of errors. **TLO** 6d Distinguish different plotting approaches 6f Program based on plot and subplot command	6.1 Editor: Creating Function file and subprograms 6.2 PLOTS : printing labels, grid and axes box, entering text in a plot , axis control 6.3 Subplot, Multiple plots using plot , hold ,line commands, Specialized 2 D plots using Polar, area, bar, pie, stem function	Hands-on Demonstration	**CO6**
		UNIT 7 FUNDAMENTALS OF SIMULINK IN SCILAB USING XCOS(CL HRS-4)		
7	TLO 7a. Program to create simulink model by using XCOS.	7.1 Collecting blocks to create a model. 7.2 Modifying block parameters, labeling blocks. 7.3 Simulink the model.	Hands-on Demonstration	**CO6**

VI. 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 1a. Learn the basic concepts of C programming. LLO 1b. Distinguish different programming approaches.	1) Write a Program to print the text "Welcome to C programming"	2	CO1
		2) Write a program to find the area and circumference of a circle.	2	CO1,2, 3
2	LLO 2a. Distinguish different programming approaches. 2b.Write C programs and execute. LLO 2c. Debug different types of errors.	3) Write a program to calculate the instantaneous value of an AC quantity like v=Vm sinωt	2	CO1,2, 3
		4) Write a program to display the electrical units in the following format:	2	CO1,2, 3
		Electrical quantity | Unit Resistance | Ohm Current | Ampere Voltage | Volt Power | Watt		
3.	LLO 3a.Write C programs and execute. LLO 3b. Debug different types of errors.	5) Write a program to find equivalent resistance when resistors are connected in series, equivalent capacitance when capacitors are connected in parallel.	2	CO1,2, 3

		6) Write a program to find impedance in series RLC circuit	2	CO1,2, 3
		7) Write a program to generate the electricity bill according to the units consumed for lighting installation as per present tariff	2	CO1,2, 3
		8) Write a program using switch – case to calculate i. Power dissipated in resistance ii. Energy stored in capacitor iii. Energy stored in inductor	2	CO1,2, 3
		9) A. Using for loop find the current through a resistor, for voltage varying from 5V to 20V in steps of 5V, using Ohm's Law	2	CO1,2, 3
		10) B. Using while loop find the current through a resistor, for voltage varying from 50V to 100V in steps of 10V, using Ohm's Law	2	CO1,2, 3
		11) C. Using do While loop find the current through a resistor, for voltage varying from 16V to 8V in steps of 4V, using Ohm's Law	2	CO1,2, 3
		12) Write a program to input 10 numbers to an array and display the greatest number	2	CO1,2, 3
4	**LLO 4.** Learn the basic concepts of SCILAB/MATLAB	**13)** Understand general, Directory, Workspace, Termination, Help commands in SCILAB, Such as General Commands, clock, date, ver Directory commands, wd,cd,dir,ls,path,mk dir Workspace commands , who, whos, clearall, clc, clf Termination commands. Ctrl C, quit, exit Help Commands, help, help topic, demo.	2	CO4
		14) Use SCILAB to enter a data in matrix and practice the functions such as sum, mean, length, max and min	2	CO4
5	**LLO** 5.a.Distinguish different programming approaches. **LLO** 5b.Write programs and execute it. **LLO** 5c Debug different types of errors	**15)** Write commands to create two matrices of 3 * 3 size and perform addition, subtraction, multiplication, right division, left division using SCILAB	2	CO5
		16) Write a program in SCILAB to plot a curve given by equation y = sin(x), y=cos(x), y=x^2 (Use hold command)	2	CO5
6	**LLO** 6a Distinguish different programming approaches. **LLO** 6b Write programs and execute it. **LLO** 6c Debug different types of errors. **LLO** 6d Distinguish different plotting approaches **LLO** 6e Program based on plot and subplot command	17) Create a Simulink model to analyze the performance of R L, RC, and RLC circuits	2	CO6

Perform any 12 practical. All CO's should be covered in the perform practical.

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

NA

VIII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED

Sr. No	Equipment Name with Broad Specifications	Relevant LLO Number
1	C- Programming Software	1-12
2	PC , 8GB RAM, 80 GB HDD, i5 Processor	1-17
3	SCILAB Software	13-17

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

NA

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)	Summative Assessment (Assessment of Learning)
Lab performance, Assignment, Self-learning and Seminar/Presentation	Lab. Performance, viva voce

XI. 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	1	1	1	--	--	1	2	--	1	--	--
CO2	1	2	2	--	1	2	2	1	1	--	--
CO3	1	2	2	--	--	1	1	1	--	--	--
CO4	1	--	--	--	1	1	2	1	--	--	--
CO5	1	2	1	--	--	--	1	1	--	--	--
CO6	1	1	1	1	--	--	--	--	--	--	--

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

XII. SUGGESTED LEARNING MATERIALS/BOOKS

Sr. No	Author	Title	Publisher
1	Brian W. Kernighan, Dennis M. Ritchie, 2nd Edition, Prentice Hall of India	The C Programming Language	ISBN-81-203-0596-5
2	Yashavant P. Kanetkar , Twelfth edition , BPB Publications,	Let Us C	ISBN- 978-81-8333-163-0
3	E. Balagurusamy , Seventh Edition , Mc. Graw Hill Education	Programming in Ansi C	ISBN -978-93-392-1966-6 ISBN-93-392-1966-x
4	Henry Mullish, Herbert L. Cooper , Fifth Edition, Jaico Publishing House	The spirit of C , An Introduction to Modern Programming	ISBN- 81-7224-040-6
5	Er Hema Ramachandran , Dr Achutsankar S. Nair.	Scilab (A Free Software to Matlab)	S. Chand & Co. Ltd. ISBN: 9788121939706, 9788121939706
6	Sandeep Nagar,	Introduction to Scilab: For Engineers and Scientists	Apress; 1st ed. edition (11 November 2017) ASIN: B077GCH7KH

XIII. LEARNING WEBSITES & PORTALS

Sr. No	Link/Portal	Description
1.	www.scilab.org	Open Source
2.	www.nptel.com	Open source with registration
3	https://www.tutorialspoint.com/python/index.htm	Open source with registration
4	https://spoken-tutorial.org/	Open source with registration
5	https://www.programiz.com/	Open source with registration
6	http://fresh2refresh.com/cprogramming	Open source with registration
7	http://www.learn-c.org/	Open source with registration

Name & Signature:

Smt. Nilambari V. Devarkar
Lecturer in Electrical Engineering

Smt. Archana A. Patole
Lecturer in Electrical Engineering

(Course Experts)

Name & Signature:	Name & Signature:
Dr. S. S. Bharatkar (Programme Head)	**Shri. S. B. Kulkarni** (CDC In-charge)

GOVERNMENT POLYTECHNIC, PUNE
'120-NEP' SCHEME

PROGRAMME	DIPLOMA IN EE
PROGRAMME CODE	02
COURSE TITLE	ELECTRICAL MATERIALS AND DRAWING
COURSE CODE	EE31201
PREREQUISITE COURSE CODE & TITLE	NA

I. LEARNING AND ASSESSMENT SCHEME:

Course Code	Course Title	Course Type	Learning Scheme					Credits	Assessment Scheme										
			Actual Contact Hrs./Week						Paper Duration(hrs.)	Theory				Based on LL & TL				Based on Self Learning		Total Marks
														Practical						
			CL	TL	LL	SLH	NLH			FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
										Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
EE31201	ELECTRICAL MATERIAL AND DRAWING	SEC	03	01	02	02	08	04	03	30	70	100	40	25	10	--	--	25	10	150

Total IKS Hrs. for Semester: 0 Hrs.

Abbreviations: CL-Class Room 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 average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shallbedeclared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course, then the candidate shall bedeclared 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 Time Table.
7. * Self-learning includes micro project/assignments / other activities.

RATIONALE:

The course is aimed to provide exposure to the various electrical materials that are used in electrical engineering and their applications in designing electrical equipment and it gives the fundamental knowledge of various materials used in electrical engineering. This course provides essential knowledge in the selection of conducting, dielectric, insulating, magnetic, semiconductor and superconductor materials during the design of electrical engineering equipment.

An electrical drawing is a type of technical drawing that shows information about power, lighting, and communication for an engineering project. Introduction of Latest Software like EPLAN will help for Electrical circuit Design.

COURSE LEVEL LEARNING OUTCOMES (CO's)

1. Recall different materials and their properties which are used in electrical equipment as conductors and their properties in electrical equipment.
2. Illustrate various types of dielectric materials, special purpose materials and their properties in various conditions.
3. Evaluate types of magnetic materials and their behavior.
4. Analyze semi-conductor and superconducting materials used in electrical engineering and the different effects associated with the materials.
5. Able to Drawing Electrical Symbols, Circuits also by using EPLAN Software

I. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr. No.	Theory Learning Outcomes(TLO's) aligned to CO's.	Learning content mappedwith TLO's	Suggested Learning Pedagogies	Relevant Cos
UNIT 1: CONDUCTORS (CL Hrs.- 10, Marks –14)				
1	TLO 1.1 Explain the Classification of conductor TLO 1.2 Explain high conductivity materials and high resistivity materials TLO 1.3 Describe the Thermoelectric Effect TLO 1.4 Explain about High conducting materials TLO 1.5 Explain characteristics and applications of conductors TLO 1.6 Describe material used in AC and DC machine	1.1 Conductors Classification: High conductivity, high resistivity materials 1.2 Fundamental requirements of high conductivity materials and high resistivity materials. 1.3 Mobility of electrons in metals, factors affecting conductivity and resistivity of electrical material. 1.4 Thermoelectric Effect: Seeback effect, Peltier effect, 1.5 Commonly used high conducting materials: copper, aluminum, bronze brass properties and characteristics, constantan, platinum and nichrome properties, characteristics and applications, the material used for AC and DC machine	Chalk-Board, Presentations, Demonstration, Videos	CO1
UNIT 2: DIELECTRIC MATERIALS AND INSULATORS (CL Hrs. – 10, Marks 18)				
2	TLO 2.1 Describe the properties of Dielectric materials TLO 2.2 Explain breakdown in dielectric, mechanical & electrical materials TLO 2.3 Describe the effect of temperature on dielectric materials TLO 2.3 Explain the insulating oils, transformer oil, and capacitor oils properties. TLO 2.4 Describe the classification of insulations TLO 2.5 Explain the insulating materials	2.1 Properties of gaseous, liquid, and solid dielectric, dielectric as a field medium, electric conduction in gaseous, liquid, and solid dielectric. 2.2 Breakdown in dielectric materials, mechanical and electrical properties of dielectric materials, 2.3 Effect of temperature on dielectric materials, polarization, loss angle and dielectric loss 2.4 Petroleum-based insulating oils, transformer oil, capacitor oils and their properties. 2.5 Classification of insulation (Solid) and application in AC and DC machines 2.6 Solid electrical insulating materials, fibrous, paper boards, yarns, cloth tapes, sleeving wood, impregnation, plastics, filling, and bounding materials, fibrous, film, mica, rubber, mica-based materials, ceramic materials.	Chalk-Board, Presentations, Demonstration, Videos	CO 2

UNIT-3 MAGNETIC MATERIALS (CL Hrs.- 10, Marks-18)				
3	TLO 3.1 Define the basic term related to magnetic materials. TLO 3.2 Describe the classification of Magnetic materials TLO 3.3 Explain Hysteresis loop, magnetic susceptibility, Coercive force, curie temperature, magneto-striction. TLO 3.4 Explain the Common magnetic materials	3.1 Magnetic Materials Basic terms 3.2 Classification of magnetic material: diamagnetic, paramagnetic, ferromagnetic, anti-ferromagnetic and amorphous material, 3.3 Hysteresis loop, magnetic susceptibility. 3.4 Coercive force, curie temperature, magneto-striction. 3.5 Factors affecting permeability and hysteresis loss 3.6 Common magnetic materials: soft and hard magnetic materials, electric steel, sheet steel, cold rolled grain-oriented silicon steel, hot rolled grain-oriented silicon steel	Chalk-Board, Presentations, Demonstration, Videos	CO 3
UNIT-4 SEMI-CONDUCTORS AND SUPERCONDUCTORS (CL Hrs. -10, Marks-10)				
4	TLO 4.1 Describe the types of semiconductors TLO 4.2 Explain the Hall effect, drift, mobility, and diffusion in Semiconductors TLO 4.3 Describe Superconductivity, critical field, Meisser effect of superconductor TLO 4.4 Explain the properties of superconductors TLO 4.5- Describe the concept of Critical field, Meissner effect, type-I and type-II Superconductors	4.1 General concepts, energy bands 4.2 Types of semiconductors: intrinsic Semi-conductors, extrinsic Semiconductors, compound semiconductors, amorphous semiconductors, 4.3 Hall effect, drift, mobility, diffusion in Semiconductors, semiconductors, and their applications. 4.4 **Superconductors:** Superconductivity, properties of superconductors 4.5 Critical field, Meissner effect, type-I and type-II Superconductors	Chalk-Board, Presentations, Demonstration, Videos	CO 4

UNIT-5 ELECTRICAL DRAWING & EPLAN SOFTWARE (CL Hrs-08, Marks-10)				
5	TLO 5.1 Explain Electrical diagram concept also describe types of Electrical symbols TLO 5.2 Draw the different Electrical and Electronics Symbols, RLC series & Parallel circuits, types of earthing, Bridge circuits TLO 5.3 Explain the basics of EPLAN software TLO 5.4 Compare EPALN & AutoCAD Software TLO 5.5 Explain the uses of EPLAN Software TLO 5.6 Explain the EPLAN user interface & shortcut Keys	5.1 Introduction of Electrical diagram 5.2 Type of Electrical Diagram 5.3 Drawings of Different Electrical and Electronics Symbols 5.4 Drawing of RL, RC, RLC series circuit. 5.5 Drawing of RL, RC, RLC Parallel circuit. 5.6 Drawing of Types of Earthing 5.7 Drawing of Types of Bridge Circuits **EPLAN Software** 5.7 Introduction of EPLAN 5.8 Comparison of EPLAN & Similar Software 5.9 Uses of EPLAN Software 5.10 User interface: - Toolbars, Workspace 5.11 Shortcut keys used in EPLAN	Chalk-Board, Presentations, Demonstration, Videos	CO 5

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

.Sr. No.	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment/Practical Titles/Tutorial Titles	No. of Hrs.	RelevantCOs
1	LLO1.1 - Collect the information regarding Conducting material	Study of Conducting material, its property, characteristics & Application	2	CO1
2	LLO 2.1 Measure insulation resistance of cables using insulation tester	Measurement of insulation resistance of cables using insulation tester	2	CO2
3	LLO 3.1 Test insulating oil for its dielectric strength.	Dielectric strength test of given insulating oil sample.	2	CO2
4	LLO 4.1 - Collect the information regarding Magnetic material	Study of Magnetic materials used in industrial area its property, characteristics & Application	2	CO3
5	LLO 5.1 - Collect the information regarding Semiconductor & Super conductor materials	Study of Semiconductor & Super conductor materials its property, characteristics & Application	2	CO4
6	LLO 6.1 - Identify different Electrical Symbols	Drawing Sheet of the Electrical Symbols	2	CO5
7	LLO 7.1 - Identify different Electronics Symbols	Drawing Sheet of the Electronics Symbols	2	CO 5
8	LLO 8.1 - Interpret the RL, RC, RLC series and Parallel circuit	Drawing Sheet of RL, RC, RLC series and Parallel circuit	2	CO 5

9	LLO 9.1- Interpret the type of earthing	Drawing sheet of Types of Earthing	2	CO 5
10	LLO 10.1- Interpret the Electrical Machine Parts	Drawing Sheet of Electrical Machine Parts	2	CO 5
11	LLO 11.1- Interpret the types of transformers	Drawing sheet of Single-phase transformer, Three-phase transformer, and Autotransformer	2	CO 5
12	LLO 12.1- Identify the Different electrical components, machines in the Electrical Laboratory	Drawing Sheet on Electrical laboratory layout	2	CO 5
13	LLO 13.1- Identify the location & Points used in the Earth mat	Drawing sheet of Earth mat used in 66kV/11kV Substation also Draw Single line diagram of 66kV/11kV Substation.	2	CO5
14	LLO 14.1- Interpret the interface of EPLAN software	Demonstration of EPLAN Software	2	CO5
15	LLO 15.1- Identify the different models used in Substation	Make a Model of any one equipment used in the Substation (i.e. Isolator, Insulator etc.)	2	CO1,2,3,4

Perform Any 12 Practical. All COs should be covered in the Perform practical.

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

Micro project:

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her. In the first four semesters, the micro-projects are group-based. However, in the fifth and sixth semesters, it should preferably be individually undertaken to build up the skill and confidence in every student to become a problem solver so that he/she contributes to the projects of the industry. In special situations where groups must be formed for micro-projects, the number of students in the group should **not exceed Six students** or an individual taking into consideration the capabilities and circumstances at that time.

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 16 (sixteen) student engage hours** during the course. The student ought to submit a micro-project by the end of the semester to develop the industry-oriented COs.

List of Micro-projects.

1) Model of Electrical Parts.
2) Reports on Electrical symbols with Functions & Its use
3) Reports on Electronics symbols with Functions & Its use
4) Draw the Single line diagram of any substation
5) Draw any Electrical parts with the help of EPLAN software
6) Collect information from internet or otherwise on the different Conducting materials along with the forms in which they are available and submit report on it
7) Collect information from internet or otherwise on the different Insulating materials along with the forms in which they are available and submit report on it
8) Collect information from internet or otherwise on the different electromagnetic materials along with the forms in which they are available and submit report on it
9) Collect information from internet or otherwise on the different Semiconductors & Superconductors materials along with the forms in which they are available and submit report on it

Note:- "These are the just suggestive topics. Faculty must design Micro project / Activities / Assignments based on Course Outcome requirement"

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr. No.	Equipment Name with broad specifications	Relevant LLO
1	Computer with EPLAN Electrical P8 software	14.1
2	Half imperial board	6.1 to 13.1
3	Manual Drawing tools: Drafter, set squares, Compasses, Lead pencil HB	6.1 to 13.1

IX. SUGGESTED FOR WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE

(Specification Table)

Unit	Unit Title	Aligned COs	Learning Hours	R Level	U Level	A Level	Total marks
1	**Conductors**	CO 1	10	2	8	4	14
2	**Dielectric Materials and Insulators**	CO 2	10	2	10	6	18
3	**Magnetic materials**	CO3	10	2	10	6	18
4	**Semi-Conductors and Superconductors**	CO4	10	2	6	2	10
5	**Electrical Drawing & EPLAN Software**	CO5	08	2	2	4	10
Total			48	10	50	20	70

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment of learning)	Summative Assessment (Assessment of learning)
• Two-unit tests of 30 marks and an average of two-unit tests. • For laboratory learning 25 marks	• End semester assessment of 70 marks Theory examination.

XI. SUGGESTED COS- POs –PSOs MATRIX FORM

Course Outcome (COs)	Programme Outcomes(POs)						
	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
CO1	3	2	3	1	1	1	2
CO2	3	2	3	1	1	1	2
CO3	3	2	3	1	1	1	2
CO4	3	2	1	1	1	1	2
CO5	3	1	2	2	2	1	2

Course Outcome (COs)	Programme Specific Outcomes(PSOs)			
	EE			
	PSO1	PSO2	PSO3	PSO4
CO1	01	01	--	01
CO2	01	01	--	01
CO3	01	01	--	01
CO4	01	01	--	01
CO5	--	02	02	--

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr. No	Author name	Title	Publisher
1	A.J. Dekker	Electrical Engineering Materials	PHI Publication.
2	C. S. Indulkar and S. Thiruvengadam	An Introduction to Electrical Engineering Materials	S. Chand & Co., India.
3	R K Rajput	A Course in Electrical Engineering Materials	Laxmi Publications
4	S. P. Seth and P. V. Gupta	A Course in Electrical Engineering Materials	Rai & Sons Publication
5	S.K. Bhattacharya	Electrical and Electronic Engineering Materials	Khanna Publishers, New Delhi.
6	Bernd Gischel	EPLAN Electric P8 Reference Handbook	Hanser Publishers, Munich Hanser Publications, Cincinnati
7	K.L. Narang	Electrical Engineering Drawing	Satya Publication, New Delhi

XIII. LEARNING WEBSITES & PORTALS

Sr. No.	Link/Portal	Description
1	https://www.dfliq.net/electrical-materials-products/	Information of Various Electrical materials
2	https://www.youtube.com/watch?v=vKKhxwn4P4o&list=PLz_2HXKfre3aHIfDKkNeRIcc348APdzkX	Basic information of Electrical materials
3	www.bharatskills.gov.in Directorate general of training - central repository for skills in NSQF curriculum	www.bharatskills.gov.in Directorate general of training - central repository for skills in NSQF curriculum

Name & Signature: **Mr. Makarand L. Bhagwat** Lecturer in Electrical (Course Experts)	 **Mr. Ravi B. Chauthmal** Lecturer in Electrical (Course Experts)
Name & Signature **(Dr. S.S. Bharatkar)** (Program Head)	Name & Signature: **Shri. S.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 (PCO)	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 METHODOLOGIES/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

XIII. 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:

Dr. S. S. Bharatkar
(Programme Head)

Name & Signature:

Shri.S.B.Kulkarni
(CDC In-charge)

GOVERNMENT POLYTECHNIC, PUNE

'120 – NEP' SCHEME

PROGRAMME	DIPLOMA IN EE
PROGRAMME CODE	02
COURSE TITLE	BASIC MECHANICAL ENGINEERING
COURSE CODE	ME21202
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	
ME21202	BASIC MECHANICAL ENGINEERING	AEC	2	-	2	-	4	2	-	-	-	-	-	50	20	25@	10	-	-	75

Total IKS Hrs for Term: 2 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:

Electrical engineering is the basic engineering branch. Electrical power supply systems are needed for operating various mechanical equipment. Hence, in mechanical industry, the electrical engineer must take care of various electrical installations with its maintenance of refrigeration and air conditioning, portable generators, industrial material handling system and power generation plants. This course will help us to understand various mechanical systems for identifying different mechanical faults.

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

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

CO1: Understand the working of Power Plant equipment's.
CO2: Select different components used in Material handling system.
CO3: Use of Hydraulic turbine and Hydraulic pumps.
CO4: Understand working of Air compressor and Refrigeration system.
CO5: Identify different faults in the above mechanical equipment.

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 Power plants equipment and prime movers (CL Hrs.- 06)			
1.	TLO 1.1. List components of steam boilers and turbines. TLO 1.2 Explain working of portable generator. TLO 1.3 Identify different faults in different power plant equipment.	1.1 Layout of Thermal Power Plant, Major thermal power plants in India 1.2 Introduction to steam boilers- Babcock-Wilcox boilers, Lamont and Loeffler boilers 1.3 Introduction to steam Turbines- Impulse and reaction turbine 1.4 Introduction, Classification of I.C Engines, working of four stroke cycle petrol and diesel engine, Working of two stroke cycle petrol engine. 1.5 Introduction to portable generators: Basic elements of Portable Generator, Manufacturers, and specifications of portable generator 1.6 Mechanical parameters measurement- Introduction to Pressure measurement: Bourdon tube pressure gauge, *Temperature measurement: Optical pyrometer, Thermocouple, Heat measurement: Calorimeter Speed measurement of rotating elements: Tachometer, Stroboscope 1.7 Preliminary mechanical faults occurred in steam boilers, turbines, and IC engines.	Demonstrate various models/Charts of boilers and turbines.	CO1
	UNIT-II Industrial Material handling systems (CL Hrs-06)			
2.	TLO 2.1 Use mechanical components in simple Machines/ equipment. TLO 2.2 Select appropriate material handling system. TLO 2.3 Identify faults in Industrial Material handling systems.	2.1 Mechanical components for motion and power transmission: Types and uses of • Gears • Belt drives • Chain drives, • Bearings • Couplings 2.2 Introduction to material handling systems: Manufacturers, specifications, construction and working of • Material transfer lifts, • Conveyors, • Overhead cranes. 2.3 Preliminary mechanical faults occurred in Industrial Material handling systems.	Demonstration of various mechanical components using charts and models	CO2 CO5

Sr. No	Theory Learning Outcomes (TLO'S) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
	UNIT-III Hydraulic Machines (CL Hrs- 06)			
3.	TLO 3.1 List different components of hydraulic turbines and Pumps. TLO 3.2 Explain working of hydraulic pumps. TLO 3.3 Identify faults in hydraulic equipment.	3.1 Layout of Hydraulic Power Plant, Major hydraulic power plants in India 3.2 Introduction to hydraulic turbines: construction and working of Pelton wheel, Franci's turbine, Kaplan turbine 3.3 Introduction to hydraulic pumps: construction and working centrifugal pump, reciprocation pump and submersible pump. 3.4 Preliminary mechanical faults occurred in Centrifugal, reciprocating, and submersible pumps	Demonstrate working of Hydraulic power plant. /Pumps using Chart/models	CO3 CO5
	UNIT- IV Refrigeration and Air conditioning (CL Hrs- 06)			
4.	TLO 4.1 Explain working of air compressor. TLO 4.2 List different components of refrigerator and air conditioner. TLO 4.3 Explain working of refrigerator and air conditioner. TLO 4.4 Identify faults in Refrigeration and air conditioning equipment system	4.1 Introduction to Compressor-Manufacturers, Specifications, construction and working of reciprocating compressor, screw compressor. Hermetically sealed compressor. 4.2 Introduction to Refrigeration and Air conditioning: Vapor compression cycle, Construction and working of simple domestic refrigerator and window air conditioner, Manufacturers, and specification. 4.3 Preliminary mechanical faults occurred in reciprocating compressor and Refrigeration and air conditioning equipment	Demonstrate air compressor, Refrigeration system and air conditioning system using charts.	CO4 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 Identify different components of Thermal Power Plants	Identify steam boilers using models and charts.	2	CO1
2	LLO 2.1 Use temperature, pressure, and speed measuring devices.	Measure temperature, pressure and speed of different equipment using appropriate measuring devices.	2	CO1
3	LLO 3.1 Observe working of portable generator.	Demonstrate working of steam turbine.	2	CO1
4	LLO 4.1 Select different drive system for given application with justification	Calculate speed ratio of Belt Drive used in air compressor and Driven Motor.	2	CO2

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
5	LLO 5.1 Identify different components of material handling system used in Industry.	Demonstrate working of lift / conveyor used in Industry.	2	CO2
6	LLO 6.1 Observe working of material handling system used in Industry.	Demonstrate working of Overhead Crane used in Industry	2	CO2
7	LLO 7.1 Observe working of Hydraulic power plant.	Demonstrate Working of Hydraulic Power plant.	2	CO3
8	LLO 8.1 Use of centrifugal pump for given application	Identify different components of Centrifugal Pump.	2	CO3 CO5
9	LLO 9.1 Use of reciprocating pump for given application.	Identify different components of Reciprocating Pump.	2	CO3 CO5
10	LLO 10.1 Use of reciprocating compressor for given application.	Identify different components of Reciprocating compressor.	2	CO4 CO5
11	LLO 11.1 Identify different components of refrigeration and air conditioning system.	Demonstrate working of household refrigerator and window air conditioner for identifying different components and type.	2	CO4 CO5
12	LLO 12.1. Collect information related to water lifting systems in ancient India.(IKS)	Collect information of water lifting systems in ancient India relation with Hydraulic pumps (IKS).	2	CO4

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

Micro project:

a. **Steam boiler and Turbines:** Draw electrical layout of any one power plant.
b. **I C Engine:** collect leaflet of diesel engine generator sets from the market. Analyze and compare the specifications.
c. **Hydraulic Turbine:** Prepare a chart showing parts of different type of commonly used hydraulic turbine from reference book.
d. **Refrigeration system:** student will make chart of wiring diagram of latest 02 each refrigeration/ Window air conditioner available in market.
e. **Refrigeration control:** - make model of refrigeration controls demonstrating their functioning (at least 02) in the institute / laboratory under the guidance of teacher.

Assignment: -

a. Prepare seminar on boilers used in power plants.
b. Prepare seminar on Application of I.C. Engine.
c. Make troubleshooting chart for Refrigerator and Air conditioners.
d. Collect manufacturer specification for various Refrigerator and Air conditioners
e. Prepare power point presentation for Hydraulics and Steam turbine.
f. Make troubleshooting chart for Centrifugal Pump.

VII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Model of Babcock Wilcox Boiler	1
2	Charts of Thermal power Plant, Steam Boilers, Steam turbines	1
3	Mercury/Alcohol Thermometers (Range 0 to 150 °C)	2
4	Optical Thermometer/Pyrometer (Range 30 to 400 °C)	2
5	Bourdon Tube Pressure Gauge (Range 0 to 15 bar)	2
6	Portable generator with load bank minimum capacity 2.2 kVA	3
7	Digital Tachometer (Max. speed 10000 rpm)	2
8	Stroboscope (Max. speed 10000 rpm)	2
9	Models of Different gears- Spur, Helical, Bevel, Worm and worm, Rack and Pinion	4,5,6
10	Models of Belt drive- Open and Cross Flat Belt, V belt	4,5,6
11	Models of Chain Drive- Sprockets and chain	4,5,6
12	Deep groove Ball bearings – Single row, self-aligned, Roller	4,5,6
13	Centrifugal pump -minimum up to single phase 0.5 HP	7,8,9
14	Reciprocating pump-minimum up to 1 HP	7,8,9
15	Household refrigerator- minimum up to 165 liter	10,11
16	Air Compressor- Multistage reciprocating, pressure up to 12 bar, Motor- 1 HP	10,11
17	Window air conditioner capacity minimum1.5 TR	11

VIII. SUGGESTED FOR WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE : NOT APPLICABLE

IX. ASSESSMENT METHODOLOGIES/TOOLS:

NOT APPLICABLE

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	2	-	-	2	-	-	2			
CO2	2	-	-	2	-	-	2			
CO3	2	-	-	2	-	-	2			
CO4	2	-	-	-	-	-	2			
CO5	2	2		2	2	2	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	P.K.Nag	Power Plant Engineering	McGraw Hill Education ,ISBN: 978-9339204044
2	R.K. Rajput	Power Plant Engineering	Tata-McGraw Hill Education. ISBN : 9788131802557
3	K. Subramanya	Hydraulic Machines	McGraw Hill Education (India) Private, ISBN, 1259006840, 9781259006845
4	S.S.Rattan	Theory of Machines	Tata-McGraw Hill Education. ISBN, 1283187124, 9781283187121
5	C. P. Arora	Refrigeration and Air conditioning	Tata-McGraw Hill Education ISBN-13: 978-0-07-008390-5

XII. LEARNING WEBSITES & PORTALS

Sr.No	Link/Portal	Description
1.	https://www.youtube.com/watch?v=IdPTuwKEfmA	Steam Power Plant working animation
2.	https://www.youtube.com/watch?v=fk3DjD9gSsk	Principle and working of Steam boiler animation
3.	https://www.youtube.com/watch?v=dVBoZ4PfZmE	Working of Steam boiler animation
4.	https://www.youtube.com/watch?v=SPg7hOxFItI	Working of Steam turbine animation
5.	https://www.youtube.com/watch?v=N70vbRbF36A	Mechanical Drive System
6	https://www.youtube.com/watch?v=hhE_2oVIZiI	Manual Material Handling system
7	https://www.youtube.com/watch?v=o_C2XISZ3Uc	Belt conveyor animation

8	https://www.youtube.com/watch?v=-hooifWJ1jY	Hydraulic Power Plant animation
9	https://www.youtube.com/watch?v=BaEHVpKc-1Q	Principle of Centrifugal Pump
10	https://www.youtube.com/watch?v=XpcCUtYzwy0	Centrifugal Pump working animation
11	https://www.youtube.com/watch?v=41vb6T42_Tk	Reciprocating Pump - Construction and working
12	https://www.youtube.com/watch? v=3BCiFeykRzo&t=155s	Water turbine (Francis)
13	https://www.youtube.com/watch?v=7NwxMyqUyJw	Refrigerator system working animation
14	https://www.youtube.com/watch?v=FzydmAmZM54	Window Air Conditioner working animation
15	https://www.youtube.com/watch?v=PjcdqAkP0UA	Vapour compression system construction and working
16	https://www.youtube.com/watch?v=_qyF1yolDgY	Problems & Remedies of Centrifugal Pump
17	https://www.youtube.com/watch?v=k0NOLbZXSNc	Refrigeration - System Troubleshooting

Name &Signature: **Dr. Sunil Adhau** Lecturer in Mechanical Engineering (Course Experts)	**Mr. B. B. Dome** Lecturer in Mechanical Engineering
Name & Signature: **Dr. S. S. Bharatkar** (Programme Head)	Name & Signature: **Shri.S.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.
2. 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.
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** Emphasizing 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** Waste 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).**

7. **Detention/ Fail:**

The student shall be declared as "Detained" if he belongs to any of the following cases.

Case 1: If a candidate does not secure minimum passing marks in the SLA (Self Learning Assessment) course due to incomplete submission of assignments in offline mode despite producing 4 certificates from online mode, then the candidate shall be declared as **"Detained"** and will have to repeat and resubmit assignments in offline mode as SLA work in next semester.
Case 2: If a candidate does not submit 4 certificates from online mode though he/she has submitted all assignments in Offline mode, then the candidate shall be declared as **"Detained"** and will have to produce 4 certificates before the End-term Examination of the subsequent term.
Case 3: If a candidate fails to produce 4 certificates from online mode as well as fails to submit assignments in offline mode, then the candidate shall be declared as **"Detained"** and will have to repeat and resubmit assignments in offline mode as SLA work and he/she will be required to submit 4 certificates from the online mode in next semester.
Most Important Note: Students must complete any 3 individual activities among the list of activities 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).

(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: **Dr.S.S.Bharatkar** (Programme Head)	Name & Signature: **Shri.S.B.Kulkarni** (CDC In-charge)	

GOVERNMENT POLYTECHNIC, PUNE
'120 – NEP' SCHEME

PROGRAMME	**DIPLOMA IN ELECTRICAL ENGINEERING**
PROGRAMME CODE	**02**
COURSE TITLE	**ELECTRICAL CIRCUITS AND NETWORK**
COURSE CODE	**EE31202**
PREREQUISITE COURSE CODE & TITLE	**EE 21201 FUNDAMENTALS OF ELECTRICAL ENGINEERING**
CLASS DECLARATION COURSE	**NO**

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	
EE31202	ELECTRICAL CIRCUIT AND NETWORK	DSC	3	2	2	1	8	4	3	30	70	100	40	25	10	25@	10	25	10	175

Total IKS Hrs for Term: 00 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 course.
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:

Electrical Circuits and Networks are integral parts of the power system. This is one of the most important core electrical engineering courses and a prerequisite to learning advanced electrical courses. This course develops skills to apply the principle of single and three-phase AC circuits and network theorems to analyze and solve simple electric circuit-related problems.

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 - Analyze the parameters of single-phase AC series circuits.
- CO2 - Analyze the parameters of single-phase AC parallel circuits.
- CO3 - Analyze the parameters of polyphase AC circuits.
- CO4 - Apply network reduction methods to solve DC circuits.
- CO5 - Apply network theorems to solve basic 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 SINGLE PHASE A.C SERIES CIRCUITS(CL Hrs- 10, Marks- 16)				
1.	TLO 1.1 Determine the current, and voltage and draw a phasor diagram for the given AC series circuit. TLO 1.2 Calculate inductive, capacitive reactance and impedance for the given AC series circuit. TLO 1.3 Determine active, reactive, apparent power and power factor for the given AC series circuit. TLO 1.4 Determine the resonant frequency and Q-factor for the given R-L-C series circuit.	1.1 Overview of AC Fundamentals. 1.2 R, L, C circuit elements, its voltage and current response. Phasor diagram. 1.3 R-L, R-C, R-L-C series A.C. circuits, current and voltage relation, phasor diagram, impedance and impedance triangle, active, reactive, apparent power, power triangle and power factor. 1.4 Resonance in R-L-C series circuit, Graphical Representation, Resonance curve, Quality (Q) Factor. (Simple Numerical on above)	Lecture Using Chalk-Board, Video Demonstrations, Flipped Classroom, Case Study, Collaborative learning, Presentations	CO1
UNIT-II SINGLE PHASE A.C PARALLEL CIRCUITS (CL Hrs- 8, Marks- 10)				
2	TLO 2.1 Determine the current, and voltage and draw a phasor diagram for the given AC parallel circuit. TLO 2.2 Calculate inductive, capacitive susceptance and admittance for the given AC parallel circuit. TLO2.3 Determine active, reactive, apparent power and power factor for the given AC parallel circuit. TLO 2.4 Determine the resonant frequency and Q-factor for the given RL-C parallel circuit.	2.1 R-L, R-C and RL-C parallel combination of A.C. circuits. Admittance, admittance triangle, phasor diagram. 2.2 Use of admittance method for solving parallel circuit. 2.3 Active, reactive, apparent power and power factor 2.4 Resonance in parallel circuit-Graphical Representation, Quality (Q) Factor. (Simple Numerical)	Lecture Using Chalk-Board, Video Demonstrations, Flipped Classroom, Case Study, Collaborative learning, Presentations	CO2

UNIT-III THREE PHASE CIRCUITS (CL Hrs- 9, Marks- 16)				
3	TLO 3.1 Explain the principle of generation of the 3-phase waveform. TLO 3.2 Compare 3-phase circuit with 1-phase circuit. TLO 3.3 Calculate line, phase values and 3-phase power for star and delta connection. TLO 3.4 Explain the concept of balanced and unbalanced load conditions.	3.1 Generation of 3-phase emf, Phasor diagram, Phase Sequence. 3.2 Advantages of the 3-phase circuit over single-phase circuit. 3.3 Types of 3 phase connections,star and delta, Relation between phase and line values, phasor diagram. 3.4 3-Phase power- active, reactive and apparent power in star and delta connected system. Concept of balanced and unbalanced load (Numerical on balanced load only)	Lecture Using Chalk-Board, Video Demonstrations, Flipped Classroom, Case Study, Collaborative learning, Presentations	CO3
UNIT- IV NETWORK REDUCTION METHODS FOR DC CIRCUITS(CL Hrs- 8 , Marks- 12)				
4	TLO 4.1 Define the given terms related to electrical networks. TLO 4.2 Reduce the given network by applying Star/delta and delta/star transformation. TLO 4.3 Apply Mesh analysis to solve the given network. TLO 4.4 Apply Node analysis to solve the given network.	4.1 Definitions like circuit, network, loop, mesh, node, active and passive network, linear and non linear network, unilateral and bilateral network 4.2 Star to delta and delta to star transformation. 4.3 Mesh Analysis. 4.4 Node Analysis. (Simple numerical on above up to two loops)	Lecture Using Chalk-Board, Video Demonstrations, Flipped Classroom, Case Study, Collaborative learning, Presentations	CO4
UNIT –V NETWORK THEOREMS(CL Hrs- 10, Marks- 16)				
5	TLO 5.1 Apply the superposition theorem to determine the current in the given branch of a circuit. TLO 5.2 Draw Thevenin's equivalent circuit and determine the load current in the given branch of a circuit. TLO 5.3 Draw Norton's equivalent circuit and determine the load current in the given branch of a circuit. TLO 5.4 Apply the maximum power transfer theorem to determine the maximum power in the given network. TLO 5.5 Apply Reciprocity theorem for the given network. TLO 5.6 Describe the procedure to solve the AC network theorem.	DC Network theorems 5.1 Superposition theorem. 5.2 Thevenin's theorem. 5.3 Norton's theorem 5.4 Maximum power transfer theorem 5.5 Reciprocity Theorem (Simple numerical on above up to two loops) 5.6 Superposition theorem for AC Network (no numerical)	Lecture Using Chalk-Board, Video Demonstrations, Flipped Classroom, Case Study, Collaborative learning, Presentations	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 Trace the output waveforms across a given series circuit to identify the phase difference and measure the amplitude. LLO 1.2 Observe the nature of current with respect to voltage in the R-L / R-C series circuit. LLO 1.3 Operate various controls of CRO	*Determination of the phase difference between A.C voltage and current in a given R-L / R-C series circuit by using a dual trace oscilloscope.	2	CO1
2	LLO 2.1 Measure voltage, current and draw a phasor diagram to find pf and verify the same. LLO 2.2 Measure active power and calculate reactive and apparent power for the R-L series circuit and verify the same.	*Determination of voltage, current and pf in a given R-L series circuit. Draw a phasor diagram. Determination of active, reactive and apparent power consumed in a given R-L series circuit.	2	CO1
3	LLO 3.1 Measure voltage, current and draw a phasor diagram to find pf and verify the same. LLO 3.2 Measure active power and calculate reactive and apparent power for the R-C series circuit and verify the same.	*Determination of voltage, current and pf in a given R-C series circuit. Draw a phasor diagram. Determination of active, reactive and apparent power consumed in a given R-C series circuit.	2	CO1
4	LLO 4.1 Measure voltage, current and draw a phasor diagram to find pf and verify the same. LLO 4.2 Observe the nature of current with respect to voltage for $X_L > X_C$ or $X_L < X_C$ and interpret the nature of the circuit. LLO 4.3 Measure active power and calculate reactive and apparent power for the R-L-C series circuit and verify the same.	*Determination of voltage, current and pf in a given R-L-C series circuit. Draw a phasor diagram. *Determination of active, reactive and apparent power consumed in a given R-L-C series circuit.	2	CO1

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
5	LLO 5.1 Measure the resonant frequency and verify it by calculation. LLO 5.2 Using variable frequency supply obtain the resonant condition for R-L- C series circuit OR LLO 5.1 Measure the inductance and capacitance to obtain the resonant condition. LLO 5.2 Measure current, and voltage and draw vector diagram to obtain pf at resonance in R-L-C series circuit	Resonance in given R-L-C series circuit using variable frequency supply. OR *Resonance in given R-L-C series circuit using variable inductor or capacitor.	2	CO1
6	LLO 6.1 Measure voltage, current and draw a phasor diagram to find pf and verify the same. LLO 6.2 Measure active power and calculate reactive and apparent power for a given parallel circuit and verify the same.	*Determination of voltage, current, p.f., active, reactive and apparent power for a given R-L **OR** R-C parallel circuit.	2	CO2
7	LLO 7.1 Measure line and phase values for the balanced star-connected load. LLO 7.2 Draw a phasor diagram with the help of phase values and verify the line values.	*Determination of line and phase quantities of voltage and current for balanced three-phase star-connected load. Draw a phasor diagram.	2	CO3
8	LLO 8.1 Measure line and phase values for the balanced delta-connected load. LLO 8.2 Draw a phasor diagram with the help of phase values and verify the line values.	*Determination of line and phase values of voltage and current for balanced three-phase delta-connected load. Draw a phasor diagram.	2	CO3
9	LLO 9.1 Measure line and phase values for unbalanced three-phase star OR delta-connected inductive/capacitive load.	*Determination of line and phase values of voltage and current for unbalanced three-phase star OR delta-connected inductive/capacitive load.	2	CO3
10	LLO 10.1 Measure current through the branch for a given DC network & verify by applying mesh analysis.	*Verification of Mesh analysis.	2	CO4
11	LLO 11.1 Measure current through the branch for a given DC network and verify by applying node analysis.	*Verification of Node analysis.	2	CO4
12	LLO 12.1 Measure current through the branch for a given DC network and verify by applying the superposition theorem.	*Verification of Superposition theorem.	2	CO5
13	LLO 13.1 Measure Thevenin's and Norton's equivalent circuit parameters for a given DC circuit and verify by		2	CO5

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
	applying Thevenin's theorem. LLO 13.2 Draw the Thevenin's and Norton's equivalent circuits and verify the load current.	*Verification of Thevenin's and Norton's theorem.		
14	LLO 14.1 Measure load resistance to transfer maximum power for a given DC circuit and verify by applying the maximum power transfer theorem.	*Verification of Maximum Power Transfer theorem.	2	CO5
15	LLO 15.1 Measure current through the branch for a given AC network and verify by applying the superposition theorem.	*Verification of Superposition theorem for AC network.	2	CO5

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

Micro project: The teacher should give the topic on theory/lab contents

a) Single Phase A.C. series and parallel Circuits: Prepare series and parallel LED lamp load (R, L, C) circuit. Measure the response and draw a vector diagram. Calculate the power factor for the circuit.
b) Three-Phase Balanced Circuit: Prepare three three-phase networks of balanced load at 230 volts determine phase and line quantities and also calculate active and reactive power for the given load.
    i) Star Connection
    ii) Delta Connection
c) Three-Phase Unbalanced Circuits: Prepare the three-phase network of unbalanced load determine phase and line quantities and also calculate active and reactive power for a given load.
    i) Star Connection
    ii) Delta Connection
d) Principles of circuit analysis and network theorem: Prepare a PowerPoint presentation on source transformation, star delta transformation, mesh and nodal analysis, and network theorems for the given network.

Assignment: - Numericals to be solved by students as self-learning and the teacher should assess the same

VII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Digital Storage Oscilloscope: Dual Trace 50Mhz	1
2	Single phase variable Inductor of suitable range	1,2,4,5
3	Variable Frequency Generator	5
4	Three phase Capacitor Bank 5A, 250 V or suitable range	9
5	Three phase Inductor Bank 5A, 250 V or suitable range	9
6	Load Bank: Resistive, 3-Phase, 5 kW, 415 V	7,8,9
7	Dimmer: 3-Phase, 5 kVA or suitable range	7,8,9
8	Capacitor 50 µF (micro-Farad) 250 V or suitable range	3,4,5
9	DC Regulated Power Supply	10 to 14
10	Low Power Factor Wattmeter of suitable range	2,3,4,5
11	Wattmeter of suitable range	2 to 9
12	Rheostat- 10 ohm /10A, 50 ohm / 5A, 100 ohm /5 A, or suitable range	1 to 6 And 10 to 15
13	Ammeters MI Type: AC/DC, of suitable range	All
14	Voltmeter MI Type: AC/DC, of suitable range	All
15	Dimmer: 1-Phase,1kVA, 230V	1,2,3,4,5,6, 15
16	Multimeter of suitable range	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	**SINGLE PHASE A.C SERIES CIRCUITS**	**CO1**	**10**	**4**	**4**	**8**	**16**
2	II	**SINGLE PHASE A.C PARALLEL CIRCUITS**	**CO2**	**08**	**2**	**2**	**6**	**10**
3	III	**THREE PHASE CIRCUITS**	**CO3**	**09**	**4**	**4**	**8**	**16**
4	IV	**NETWORK REDUCTION METHODS FOR DC CIRCUITS.**	**CO4**	**08**	**2**	**4**	**6**	**12**
5	V	**NETWORK THEOREMS**	**CO5**	**10**	**2**	**4**	**10**	**16**
Grand Total				**45**	**14**	**18**	**38**	**70**

IX.ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)	Summative Assessment (Assessment of Learning)
Two unit tests of 30 marks will be conducted and an average of two unit tests considered. For formative assessment of laboratory learning 25 marks. Each practical will be assessed considering the appropriate % weightage to process and product and other instructions of assessment.	End semester assessment of 70 marks through offline mode of examination. End semester summative assessment of 50 marks for laboratory learning.

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	3	2	3	--	--	3	2	2	2	--
CO2	3	3	2	3	--	--	3	2	2	2	--
CO3	3	3	2	3	--	--	3	3	2	3	--
CO4	3	3	2	2	--	--	3	--	--	2	--
CO5	3	3	3	3	--	--	3	--	--	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	Gupta, B. R. Singhal, Vandana	Fundamentals of Electrical Networks	S.Chand and Co., New Delhi, 2005 ISBN: 978-81-219-2318-7
2	Theraja, B. L. , Theraja, A. K.	A Text Book of Electrical Technology Vol-I	S. Chand and Co. Ramnagar, New Delhi, 2012; ISBN: 9788121924405
3	Saxena, S.B lal, Dasgupta, K.	Fundamentals of Electrical Engineering	Cambridge University Press Pvt. Ltd., New Delhi, 2016, ISBN: 978-11-0746-435-3
4	Mittle, V.N. , Mittle, Arvind	Basic Electrical Engineering	McGraw Hill Education, Noida, 2005 ISBN: 978-00-705-9357-2
5	Sudhakar, A Shyammohan, S.Palli	Circuit and network	McGraw Hill Education, New Delhi, 2015, ISBN: 978-93-3921-960-4
6	Joseph Edminister	Schaum online series- Theory and problems of electric circuits	McGraw Hill Education, Newyork, 2013, ISBN: 978-00-701-8999-7

Sr.No	Author	Title	Publisher with ISBN Number
7	David A. Bell	Electric Circuits	Oxford University Press New Delhi, 2009; ISBN: 978-01-954-2524-6
8	M.E. Van Valkenburg	Network Analysis	Pearson Education ISBN: 9789353433123

XII. LEARNING WEBSITES & PORTALS

Sr.No	Link/Portal	Description
1	www.cesim.com/simulations	Graphical representation of series and parallel resonance
2	https://ndl.iitkgp.ac.in/	NeworkTheorems
3	https://nptel.ac.in/	Single phase Series and Parallel Circuit, Three Phase Circuit
4	http://vlabs.iitkgp.ac.in/asnm/	Series and Parallel Resonance, Network Theorems, Reduced Network Methods
5	https://vlab.amrita.edu	Single phase Series and Parallel Circuit, Three Phase Circuit, Series and Parallel Resonance
6	www.dreamtechpress.com /ebooks	Free reference books for more practice
7	www.nptelvideos.in/electrical engineering/ circuit theory	Network Circuit Theory
Note: Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students		

Name & Signature: **Shri. Sunil S. Ashtaputre** Lecturer in Electrical Engineering **Shri. Sunil P. Date** Lecturer in Electrical Engineering (Course Experts)	
Name & Signature: **Dr. Sachin. S. Bharatkar** (Programme Head)	Name & Signature: **Shri.S.B.Kulkarni** (CDC In-charge)

GOVERNMENT POLYTECHNIC, PUNE

'120 – NEP' SCHEME

PROGRAMME	**DIPLOMA IN ELECTRICAL ENGINEERING**
PROGRAMME CODE	**02**
COURSE TITLE	**ELECTRICAL AND ELECTRONIC MEASUREMENT**
COURSE CODE	**EE31203**
PREREQUISITE COURSE CODE & TITLE	**EE 21201 FUNDAMENTALS OF ELECTRICAL ENGINEERING**
CLASS DECLARATION COURSE	**NO**

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	
EE31203	ELECTRICAL AND ELECTRONIC MEASUREMENT	DSC	3	--	2	1	6	3	3 Hrs.	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 course.
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 have to carry out many tests on electrical machines and equipment. For testing, meters and instruments are required to be used, operated and handled. Construction, working principle and operation of such meters, instruments equipment should be known to electrical technicians, which is required lifelong in the student's job profile.

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: Apply the basics of measurement to the measuring instruments.
CO2: Measure electric circuit parameters by different methods.
CO3: Measure electrical power for single phase & 3-phase circuits.
CO4: Use analog as well as digital meters to measure electrical energy,
CO5: Use various special measuring instruments considering the construction & working.

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 FUNDAMENTALS OF MEASUREMENT (CL Hrs- 12, Marks- 18)				
1.	TLO 1.1 Describe the necessity of measurement and electrical measuring Instruments TLO 1.2 State the different qualities of instruments and define the terms sensitivity, accuracy, Precision, reliability, stability TLO 1.3 Give the classification of instruments and compare between Indicating, integrating and recording, absolute and secondary instrument TLO 1.4 Differentiate between deflecting, controlling and damping torques TLO 1.5 Different types of errors with examples TLO 1.6 State the different types of Ammeter and Voltmeter and explain the principle of operation, construction, merits and demerits of each type of meter TLO 1.7 Illustrate the use of shunts and multipliers for range extension of ammeter and voltmeter TLO 1.8 Illustrate the use of an Instrument transformer like C.T and P.T with constructional details TLO 1.9 Describe the ways to extend the ranges of meters using CT and PT	1.1 Need for measurement and electrical measuring instruments 1.2 Qualities of electrical measuring instruments: sensitivity, accuracy, precision, reliability, stability 1.3 Classification of instruments based on : a) Methods of measurement as absolute and secondary instruments b) Limits of percentage error Instrument classes - Standard and sub-standard instruments c) Principle of operation. Nature of operation as indicating, recording and integrating type 1.4 Essential torques in indicating instruments:-Deflecting, Controlling and damping torques. 1.5 Types of errors. 1.6 Types of Ammeter and Voltmeter:- PMMC, MI, & dynamometer type 1.7 Construction, principle of operation, merits and demerits of above types of meters 1.8 Extension of range of voltmeter and ammeter using multiplier & shunt respectively 1.9 Introduction of Instrument Transformers- C.T. and P.T. with regard to their application, and construction 1.10 Precautions to be taken in their use 1.11 Extension of range A.C. Ammeter and A.C. Voltmeter using CT and PT 1.12 Advantages of CT and PT over shunt and multiplier 1.13 Calibration: Need, significance and general procedure 1.14Simple numerical on the extension of the range of voltmeter and ammeter	Chalk-Board, Video Demonstrations, Model Demonstration, PowerPoint Presentations, Charts	CO1

UNIT-II MEASUREMENT OF RESISTANCE, INDUCTANCE AND CAPACITANCE (CL Hrs- 10, Marks- 16)				
2	TLO 2.1 Classify different types of Resistances TLO 2.2 Explain the procedures used to measure low, medium and high resistances TLO 2.3 Draw the general circuit diagram of the A.C. bridge and obtain its equation for the bridge at balance condition TLO 2.4 Determine inductance and capacitance using Maxwell's inductance bridge and Schering bridge TLO 2.5 Know the precautions & limitations of A.C. bridges	2.1 Classification of electrical resistances based on magnitude range as low, medium & high. 2.2 Potentiometer method used for measurement of low resistance 2.3 Methods and procedure used for measurement of medium resistance by a) Whetstone's bridge method b) Ammeter-voltmeter method 2.4 Measurement of insulation resistance by Megger 2.5 General A.C. bridge circuit and equation for the bridge at balance 2.6 Measurement of Inductance and capacitance using (No derivation, No phasor Diagram, only formula & simple numerical) a) Maxwell's inductance bridge b) Schering bridge for capacitance measurement 2.7 Precautions & limitations of A.C. bridges.	Chalk-Board, Video Demonstrations, Model Demonstration, PowerPoint Presentations, Charts	CO2
UNIT-III MEASUREMENT OF ELECTRICAL POWER (CL Hrs- 08, Marks- 12)				
3	TLO 3.1 Explain the use of dynamometer type wattmeter TLO 3.2 Determine the Error due to pressure coil connections TLO 3.3 Know the construction and operation of polyphase watt-meter TLO 3.4 Select the appropriate method for measurement of power in three-phase circuit	3.1 Construction and Principle of Operation of Dynamometer type wattmeter 3.2 Error due to pressure coil connections 3.3 Low power factor wattmeter (Electrodynamometer type) and its use 3.4 Construction and operation of polyphase watt-meter 3.5 Measurement of active power in three-phase circuits for balanced and unbalanced loads using Two wattmeter method, Calculation of p.f. from wattmeter readings, Effect of p.f. a variation on wattmeter readings 3.6 Measurement of active & reactive power in three three-phase balanced loads by using One wattmeter method 3.7 Simple numerical on-power measurement using the above methods	Chalk-Board, Video Demonstrations, Model Demonstration, PowerPoint Presentations, Charts	CO3

UNIT- IV MEASUREMENT OF ELECTRICAL ENERGY (CL Hrs- 08, Marks- 12)				
4	TLO 4.1 Describe the construction and working of single-phase and three-phase energy meters (Induction Type) TLO 4.2 Know the recent trends in energy meters TLO 4.3 Describe different errors occurring during the measurement of energy. Also, describe the methods for reducing these errors TLO 4.4 Carry out calibration and testing of Energy meter	4.1 Principle of operation and Construction of single-phase and three-phase induction type energy meter 4.2 Errors occurring in induction-type energy meters and their corrective measures 4.3 Digital Energy meter, Smart Energy meter 4.4 Procedure for Calibration of energy meter as per I.S. 4.5 Testing of energy meter as per I.S.	Chalk-Board, Video Demonstrations, Model Demonstration, PowerPoint Presentations, Charts	CO4
UNIT –V SPECIAL MEASURING INSTRUMENTS (CL Hrs-07, Marks-12)				
5	TLO 5.1 Know the special measuring Instruments. Describe the construction, working and applications .	5.1 Digital Multimeter:-Block Diagram, Advantages and Applications 5.2 Clip-on ammeter –construction and working 5.3 Construction and working principle of single phase electrodynamometer type power factor meter 5.4 Weston-type synchroscope 5.5 Phase sequence indicator-Static type and rotating type 5.6 Weston-type frequency meter 5.7 L.C.R. meter	Chalk-Board, Video Demonstrations, Model Demonstration, PowerPoint Presentations, Charts	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 Identify measuring instruments based on symbols on the dial, type, accuracy, class, position and scale	Identification of measuring instruments based on symbols on dial, type, accuracy, class, position and scale.	02	CO1
2	LLO 2.1 Identify the components of PMMC and MI instruments.	Identification of the components of PMMC and MI instruments.	02	CO1
3	LLO 3.1 Calibrate the ammeter /voltmeter for measurement.	Calibration of the ammeter /voltmeter for measurement of electrical parameters.	02	CO1
4	LLO 4.1 Measure medium resistance by using Whetstone's bridge.	Measurement of medium resistance by Whetstone's bridge.	02	CO2
5	LLO 5.1 Measure insulation resistance by Megger.	Measurement of Insulation Resistance by Megger.	02	CO2
6	LLO 6.1 Extend the range of ammeter and voltmeter by using CT, PT. Take the safety Precautions while using CT.	Extension range of meters using CT and PT.	02	CO1

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
7	LLO 7.1 Measure power in a single-phase circuit by electro-dynamic watt-meter and determining the multiplying factor of a wattmeter also change the current range of the wattmeter by making changes in the current	Measurement of power in a single-phase circuit using an electrodynamic watt-meter.	02	CO3
8	LLO 8.1 Measure active power in three three-phase balanced loads by using one wattmeter method.	Measurement of active power in three-phase balanced load by one wattmeter method.	02	CO3
9	LLO 9.1 Measure reactive power in three three-phase balanced loads by using one wattmeter method.	Measurement of reactive power in three-phase balanced load by one wattmeter method.	02	CO3
10	LLO 10.1 Measure active power in three three-phase balanced loads by using two wattmeter method.	Measurement of active power in three-phase balanced load by two wattmeter method.	02	CO3
11	LLO 11.1 Calibrate single-phase energy meter by direct loading.	Calibration of single-phase energy meter by direct loading.	02	CO4
12	LLO 12.1 Determine the phase sequence of the phase supply using the Phase Sequence Indicator.	Determination of phase sequence of three-phase supply using phase Sequence Indicator.	02	CO5
13	LLO 13.1 Measure A.C. current by using Clip on ammeter.	Measurement of A.C. current by using Clip on ammeter.	02	CO5

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

Micro project:

- PMMC and MI instrument: Dismantle any PMMC and MI instrument each available in the laboratory/workshop and identify different parts, materials and functions i.e. coil, spring, magnets, former, dial scale etc. and again assemble the same.
- Wattmeter: Dismantle a wattmeter available in the laboratory identify the pressure coil, current coil, spring, magnets, former, dial scale etc. and again assemble the same.
- Electronic energy meter: Collect data on the power consumption of the equipment in the departmental laboratories/workshops of your polytechnic using an electronic energy meter.
- DMM: Use DMM for measurement of current, voltage, and resistance of different ranges and check the continuity.

Assignment: -

- Compare analog and digital meters.
- Compare PMMC with MI meters.
- Determine earth resistance using a digital earth tester and compare it with the ideal earth resistance.
- Determine the multiplying factor of a wattmeter.
- Compare analog energy meter with digital energy meter.

Suggested Student Activity -

- Prepare a chart showing real-life examples indicating various types of electrical measuring equipment.
- Collect photographs of PMMC and MI instruments showing internal parts.
- Prepare a PowerPoint presentation for different types of wattmeters.
- Collect photographs of the electronic energy meter and prepare a report on it.
- Prepare the report on smart energy meters.

Note: A suggestive list of micro-projects and assignments is given here. Similar activities could be added by the course teacher. By considering allotted self-learning hours the course teacher has to allocate a judicial mix of tasks may be a combination of assignments and/or micro projects. The micro project is expected to be completed as a group activity. Course teachers can assign specific learning or any other skill development task. According to the task assigned, the course teacher can set rubrics for continuous (formative) type assessment. SLA marks shall be awarded as per continuous assessment records.

VII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Different (analog) measuring instruments	1
2	Model of PMMC and PMMI type instrument	2
3	Ammeter / voltmeter - 1 standard and 1 to be calibrated / potentiometer etc.	3
4	Wheatstone's bridge and Kelvin's double bridge, Megger	4,5,6
5	Voltmeter, Ammeter, CT (15A/5A, 25A/5A), PT (230V/110V, 440V/110V)	7
6	Voltmeter, Ammeter, Wattmeter (5/10A, 110/ 230V), Wattmeter (5/10A, 300/ 600V), Balanced load	8, 9, 10, 11
7	Energy meter, wattmeter and stopwatch	12
8	Phase sequence indicator	13
9	Clip on meter	14

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**	**FUNDAMENTALS OF MEASUREMENT**	CO1	12	6	8	4	18
2	**II**	**MEASUREMENT OF RESISTANCE, INDUCTANCE AND CAPACITANCE**	CO2	10	4	6	6	16
3	**III**	**MEASUREMENT OF ELECTRICAL POWER**	CO3	08	4	4	4	12
4	**IV**	**MEASUREMENT OF ELECTRICAL ENERGY**	CO4	08	4	4	4	12
5	**V**	**SPECIAL MEASURING INSTRUMENTS**	CO5	07	4	4	4	12
			Grand Total	**45**	**26**	**26**	**22**	**70**

IX. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)	Summative Assessment (Assessment of Learning)
Two unit tests of 30 marks will be conducted and the average of two unit tests considered. For formative assessment of laboratory learning 25 marks. Each practical will be assessed considering the appropriate % weightage to process and product and other instructions of assessment.	End semester summative assessment of 25 marks for laboratory learning. End semester assessment of 70 marks through offline mode of examination.

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	--	3	--	--	--	2
CO2	3	2	--	2	2	--	3	2	2	--	--
CO3	3	2	--	--	--	--	3	--	--	--	--
CO4	3	--	--	2	2	--	3	2	2	--	2
CO5	2	--	--	--	--	--	3	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	A.K.Sawhney	A Course in Electrical and Electronic Measurements and Instrumentation	Dhanpatrai and Co.Pvt.Ltd.Delhi ISBN 9788177001006
2	E.W.Golding & F.C.Widdis	Electrical measurement and Measuring Instruments	AH Wheeler & Company ISBN 9788185614311
3	N.V.Suryanarayana	Electrical Measurements and Measuring Instruments	Tata McGraw-Hill Publishing Company Ltd.ISBN 9780074517512
4	M.L.Anand	Electrical Measurements & Measuring Instruments	S. K. Kataria& Sons ISBN 9789350143636

XII. LEARNING WEBSITES & PORTALS

Sr.No	Link/Portal	Description
1.	https://ndl.iitkgp.ac.in/	Free source of reference books on electrical measurement and instrumentation.
2.	https://nptel.ac.in/	Fundamentals of Measurement.
3.	https://swayam.gov.in/nc_details/NPTEL	Concepts of electrical and electronics measurements.

Name & Signature:

Smt. Sujala Parimal Phadnaik
Lecturer in Electrical Engineering

Smt. Madhuri Hemat Bilgi
Lecturer in Electrical Engineering

(Course Experts)

Name & Signature:

Dr. Sachin. S. Bharatkar
(Programme Head)

Name & Signature:

Shri.S.B.Kulkarni
(CDC In-charge)

GOVERNMENT POLYTECHNIC, PUNE

'120 – NEP' SCHEME

PROGRAMME	**DIPLOMA IN ELECTRICAL ENGINEERING**
PROGRAMME CODE	**02**
COURSE TITLE	**ELECTRICAL POWER GENERATION AND TRANSMISSION**
COURSE CODE	**EE31204**
PREREQUISITE COURSE CODE & TITLE	**NA**
CLASS DECLARATION COURSE	**NO**

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	
EE31204	ELECTRICAL POWER GENERATION AND TRANSMISSION	DSC	3	2	--	1	6	3	3	30	70	100	40	25	10	--	--	25	10	150

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 course.
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:

Electrical power system plays a significant role in the development of the Urban, Rural, Industries and Agriculture sectors. This course aims to develop the basic knowledge and required skills to maintain the proper functioning of the power system.

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

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

CO1 - Know the advancement in technology to generate electrical power commercially using wind and solar energy

CO2 - Maintain the optimized working of the thermal power plant and hydropower plant.
CO3 - Select the relevant power generation technology based on economic operation.
CO4 - Interpret the normal operation and parameters of the electric transmission system.
CO5 - Interpret the parameters of the extra high voltage transmission system.

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- 1: INTRODUCTION (CL HRS- 02, MARKS-04)				
1	TLO 1.1. List the various sources of Energy and give a comparison between them	1.1 Importance of Electrical Energy. 1.2 Sources of Energy: conventional and renewable 1.3 Comparison of Energy Sources 1.4 Types of fuels: solid, liquid and gaseous, their calorific values, advantages and disadvantages of these fuels	. Chalk-Board	.CO1
UNIT - II THERMAL POWER PLANT, HYDRO POWER PLANT AND NUCLEAR POWER PLANT (CL HRS- 13, Marks- 20)				
2	TLO 2.1 Describe the layout of the electric power generating process with a labelled block diagram of the specified power plant. TLO 2.2 State the functions of a given type of major auxiliaries of specified power plants. TLO 2.3 Distinguish between Thermal Power Plant, Hydro Power Plant and Nuclear Power plant. TLO 2.4 Describe the specified safe practices to be followed for a specified power plant.	2.1 Site selection, Layout and working of a typical Thermal Power Plant. 2.2 Functions of the following major auxiliaries used in Thermal Power Plants: Coal-fired boilers: fire tube and water tube and Heat recovery system (Superheater, Economizer and Air pre-heater). 2.3 Site selection, Layout and working of a typical Hydropower plant. 2.4 Classification of hydropower plant: Run off-river Power Plant without Pondage, Runoff River Power Plant with Pondage, Reservoir Power Plant and Pumped Storage Power Plant. 2.5 Site selection, Layout and working of a typical Nuclear Power Plant. 2.6 Functions of all major auxiliaries used in Nuclear Power Plant 2.7 Comparison between Thermal Power Plant, Hydro Power Plant and Nuclear Power plant. 2.8 Locations of these different types of Large and Micro-Hydro Power Plants in Maharashtra. 2.9 Safe Practices of Thermal Power Plants and Hydro Power Plants (Large and Micro)	Chalk-Board Presentations Model Demonstration Demonstration Video Flipped Classroom	CO2
UNIT - III ECONOMICS OF POWER GENERATION AND INTERCONNECTED POWER SYSTEM (CL Hrs.- 12, Marks-18)				
3	TLO 3.1 Interpret the given Load curve, Load duration curve, and Integration duration curve.	3.1 Base load and Peak load Plants: Load curve, Load duration curve, Integrated Load duration curve. Related terms: connected load, firm power, cold reserve, hot reserve,	Chalk-Board Presentations Model Demonstration	CO3

	TLO 3.2 Interpret the given values of the demand factor, plant capacity factor, and plant use factor. TLO 3.3 Interpret the given values of the diversity factor, load factor and plant load factor. TLO 3.4 State the causes and impact of the given grid system fault.	spinning reserve. 3.2 Cost of generation: average demand, maximum demand, demand factor, plant capacity factor, plant use factor, diversity factor, load factor and plant load factor,(Problem-based on it.) 3.3 Choice of size and number of Generator units, the combined operation of the power station. 3.4 Causes, Impact and Reasons of Grid system fault: State Grid, National Grid, brownout and blackout; sample blackouts at National and International level	Video Demonstrations Flipped Classroom	
UNIT --IV TRANSMISSION LINE COMPONENTS, PARAMETERS AND PERFORMANCE (CL HRS 10, Marks-16)				
4	TLO 4.1 Classify the given Transmission Line. TLO 4.2 Describe the construction and functioning of the given Transmission Line Components. TLO 4.3 Explain the concept of the given Transmission Line parameters. TLO 4.4 Evaluate the performance of the short transmission Line based on the given criteria. TLO 4.5 Explain the given method(s) for the representation of the Medium Transmission Line. TLO 4.6 Describe the need for Transposition of Conductors.	4.1 Electric power transmission systems: Single line diagrams. 4.2 Classification of transmission lines: Primary and Secondary transmission; standard voltage level used in India. 4.3 Transmission line Components: Types of Line supports, Line Insulators and Overhead/ Underground Conductors with their function. 4.4 Method of construction of electric supply transmission system – 110 kV, 220 kV, 400 kV. 4.5 Transmission Line Parameters: R, L and C and types of lines. 4.6 Performance of short line: Efficiency, Regulation, Effect of Power Factor. (Simple Numericals on it) 4.7 Introduction of medium and short transmission line(No derivation 4.8 Skin effect and Proximity Effect, Transposition of conductors and its necessity.	Chalk-Board Presentations Model Demonstration Video Flipped Classroom	CO4
UNIT - V EXTRA HIGH VOLTAGE TRANSMISSION (HVAC AND HVDC) (CL Hrs- 08, Marks-12)				
5	TLO 5.1 State the Rating and functions of the given type of transmission line. TLO 5.2 State the Rating and functions of the given High voltage Substation components. TLO 5.3 Explain the specified effects occurring in the given type of high-voltage transmission line . TLO 5.4 Explain the importance of line compensation in High voltage transmission line. TLO 5.5 Describe the layout of	5.1 Extra High Voltage AC (EHVAC) transmission line: 5.2 Necessity of UHV, EHV AC/ DC lines. 5.3 High voltage substation components: Transformers, Bus, Circuit breaker, Reactor, Lightning arrester, Relays, FACTs Devices. 5.4 High-Temperature Low Sag (HTLS) Conductor in High Voltage Transmission Lines: Features. 5.5 Ferranti and Corona effect 5.6 Line compensation: Need and benefits. 5.7 High Voltage DC (HVDC)	Chalk-Board Presentations Model Demonstration Video Demonstrations Flipped Classroom	CO5

	the given HVDC transmission lines with sketches. TLO 5.6 Explain the concept of wireless transmission of electrical power.	Transmission Line: 5.8 Necessity and HVDC Lines in India. 5.9 HVDC Transmission lines: Components, applications, advantages, and limitations 5.10 Monopolar, bi-polar and homo-polar transmission lines: Layout 5.11 EHVAC and HVDC transmission line: Features and Comparison. 5.12 Wireless transmission of electrical power.		

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 layout of the typical Thermal Power Plant LLO 1.2 Identify the different components of a typical Thermal Power Plant LLO 1.3 Observe the operation of the Thermal Power Plant	Demonstration of a Thermal Power Plant using Visit/Animations/ Video programme.	2	CO1
2	LLO 2.1 Identify components of the Heat Recovery System. LLO 2.2 Describe the function of the Components of the Heat Recovery System.	Process of Heat Recovery System in Thermal Power Plant	2	CO1
3	LLO 3.1 Draw layout of the typical Hydro Power Plant. LLO 3.2 Identify the different components of a typical Hydro Power Plant. LLO 3.3 Observe the operation of the Hydro Power Plant.	Demonstration of a Hydro Power Plant using Visit/Animations/ Video programme.	2	CO1
4	LLO 4.1 Draw layout of the typical Pumped Storage Hydro Power Plant	Demonstration of a Pumped Storage Hydro Power Plant using Visit/Animations/ Video programme.	2	CO1
5	LLO 5.1 Draw layout of the typical Hydro Power Plant	Demonstration of Different types of Hydro Power Plant using Animations/ Video programs.	2	CO1
6	LLO 6.1 Draw load curve of Campus/ Institute building(s) LLO 6.2 Calculate various economic factors from the above load curve.	Load curve of Campus/ Institute building(s) and calculation of the following economic factors: Maximum demand, Average load, Load Factor, Reserve capacity, Plant capacity factor, utilization factor, Plant use factor and Diversity factor.	2	CO1 CO2
7	LLO 7.1 Select appropriate power generation technology as per variation in load demand.	Selection of power generation technology as per variation in load demand of a given load curve	2	CO1 CO2
8	LLO 8.1 Draw the Load Duration curve and Integrated load curve from a given load curve.	Load Duration curve and Integrated load curve	2	CO2

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles/Tutorial Titles	Number of hrs.	Relevant COs
9	LLO 9.1 List the components of the electric supply system. LLO 9.2 Prepare a single-line diagram with vertical and horizontal clearances of the Electric supply system.	Single line diagram of the Electric supply system.	2	CO3 CO5
10	LLO 10.1 Prepare a single-line diagram of the 400 kV transmission line substation. LLO 10.2 Prepare a plan and elevation diagram of the 400 kV transmission line substation.	Layout of 400kV transmission line substation.	2	CO3
11	LLO 11.1 Prepare a single-line diagram of the 132 kV transmission line substation. LLO 11.2 Prepare a plan and elevation diagram of the 132 kV transmission line substation	Layout of 132 kV transmission line substation.	2	CO3
12	LLO 12.1 Identify the components of Ultra High Voltage (UHV) Transmission lines.	Demonstration of an Ultra High Voltage (UHV) Transmission line using Animations/ Video Programme.	2	CO4
13.	LLO 13.1 Identify the components of Extra High Voltage (EHV) Transmission lines.	Demonstration of Extra High Voltage (EHV) Transmission lines using Visit/Animations/ Video Programme.	2	CO4
14	LLO 14.1 Prepare a single-line diagram of the HVDC transmission line. LLO 14.2 Prepare a plan and elevation diagram HVDC transmission line.	Layout of HVDC transmission line.	2	CO4
	LLO 15.1 Prepare a list of components of the distribution substation. LLO 15.2 Prepare a single-line diagram of the distribution substation. LLO 15.3 Prepare a plan and elevation diagram with clearances of the distribution substation.	Components of Distribution Substation.	2	CO5
16	LLO 16.1 Calculate load for Commercial and Residential Consumers. LLO 16.2 Prepare a feeder scheme for consumers.	Distribution scheme for Commercial and Residential Consumers.	2	CO5
17	LLO 17.1 Calculate load for Industrial Consumer. LLO 17.2 Prepare a feeder scheme for industrial Consumer	Distribution scheme for Industrial Consumers.	2	CO5

Perform any 12 practicals. All CO's should be covered in the perform practical.

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

Assignment

*Calculate various Economic factors from the given Load Curve.
*Prepare a list of materials used for the Transmission line.
* Calculation on Commercial and Residential Consumers' Load Demand
*Prepare a list of materials used for the Transmission line.
* Prepare a list of materials used for the Distribution line/ substation.
* Prepare a list of materials used for the Transmission line substation.
* Calculation on Industrial Consumers Load Demand.

* Numerical on Economics of Power generation.

Micro project

P*repare a model of a Pumped Storage Hydropower Station.

* Prepare a model of the Hydropower Station.

* Prepare a model of a Thermal Power Station.

* Prepare a comparative chart for UHVAC and HVAC Transmission lines considering their Strength, Limitations, Capital cost

* Involvement, Running Costs, Losses, Voltage regulation, Construction details etc.

* Prepare a comparative chart for HVAC and HVDC Transmission lines on the basis of their Strength, Limitations, Capital cost involvement, Running Cost, Losses, Voltage regulation, Construction details etc.

***** Write Detail complete technical specification of all the elements of Ultra high voltage AC (UHVAC) Transmission line.

*Also write the functions of each element of the UHVAC Transmission line and submit the report.

VII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED

Sr. No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Video Programme/Animation/Demonstration Model of Thermal Power Plant.	1,2
2	-Video Programme/Animation/Demonstration Model of Hydro Power Plant.	3,4,5
3	Video Programme/Animation/Demonstration Model/Chart Demonstration of Electric Power System.	9
4	Video Programme/Animation/Demonstration Model of different Supporting Structures / Insulators/ Conductors of Transmission Line.	9,10,13,14,16, 17
5	Video Programme/Animation/Demonstration Model of Transmission Substation.	10,11,15

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

Sr. No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	**1**	**INTRODUCTION**	**CO1**	**02**	**4**	**--**	**---**	**04**
2	**II**	**THERMAL POWER PLANT, HYDRO POWER PLANT AND NUCLEAR POWER PLANT.**	**CO2**	**13**	**10**	**2**	**8**	**20**
3	**III**	**ECONOMICS OF POWER GENERATION AND INTERCONNECTED POWER SYSTEM**	**CO3**	**12**	**4**	**6**	**8**	**18**
4	**IV**	**TRANSMISSION LINE COMPONENTS, PARAMETERS AND PERFORMANCE**	**CO4**	**10**	**2**	**8**	**6**	**16**
5	**V**	**EXTRA HIGH VOLTAGE TRANSMISSION (HVAC AND HVDC)**	**CO5**	**08**	**2**	**6**	**4**	**12**
			Grand Total	**45**	**10**	**32**	**28**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)	Summative Assessment (Assessment of Learning)
Each practical will be assessed considering - - 60% weightage to process and - 40% weightage to product Continuous assessment based on process and product-related performance indicators, and laboratory experience.	End-of-semester exam based on observations and recording of the particular experiments.

XI. 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	1	2	2	2	2	--	--	--	--
CO2	3	3	2	2	2	2	2	1	--	1	2
CO3	3	2	1	2	2	2	2	1	2	1	2
CO4	3	2	1	2	2	1	2	1	2	1	2
CO5	3	3	1	2	2	1	2	--	2	1	2

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

XII. SUGGESTED LEARNING MATERIALS/BOOKS

Sr. No	Author	Title	Publisher
1	Nag P K	Power Plant Engineering	McGraw Hill, New Delhi, 2017 ISBN: 978-9339204044
2	Gupta J.B.	A course in Electrical Power.	S. K Kataria and Sons, New Delhi. 2014, ISBN: 9789350143742
3	Mehta V.K., Rohit Mehta	Principles of Power System	S.Chand & Co. New Delhi, 2005, ISBN: 9788121924962
4	Sivanagaraju S.; Satyanarayana S.	Electrical Power Transmission and Distribution	Pearson ISBN: 8131707911, 9788131707913
5	Kamraju V.	Electrical Power Distribution System	Tata Mc.McGraw-Hill, New Delhi ISBN: 9780070151413

XII. LEARNING WEBSITES & PORTALS

Sr. No	Link/Portal	Description
1.	www.ntpc.co.in	National Thermal Power Corporation is the authority that controls India's Thermal Power Sector.
2.	https://www.powergrid.in	Power Grid Corporation of India Limited (POWERGRID), a Schedule 'A', 'Maharatna' Public Sector Enterprise of the Government of India.
3.	https://energy.gov/sites/prod/files/2013/07/f2/Transmission_Woodall_0.pdf	Transmission Line Basics
4.	https://www.electrical4u.com/performance-of-transmissionline/	Performance of Transmission Line

Name & Signature:

Shri. M.L. Bhagwat
Lecturer in Electrical Engineering

Smt. N.V.Devarkar
Lecturer in Electrical Engineering

(Course Experts)

Name & Signature:	Name & Signature:
Dr. S. S.Bharatkar (Programme Head)	**Shri. S.B. Kulkarni** (CDC In-charge)

GOVERNMENT POLYTECHNIC, PUNE

'120 – NEP' SCHEME

PROGRAMME	**DIPLOMA IN ELECTRICAL ENGINEERING**
PROGRAMME CODE	**02**
COURSE TITLE	**MINI PROJECT**
COURSE CODE	**EE31207**
PREREQUISITE COURSE CODE & TITLE	**NO**
CLASS DECLARATION COURSE	**NO**

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	
EE31207	**MINI PROJECT**	**SEC**	--	--	**02**	--	**02**	**01**	--	--	--	--	--	**50**	**20**	**50@**	**20**	--	--	**100**

Total IKS Hrs. forSemester:0Hrs.

Abbreviations: CL- Class Room 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, *#On Line Examination, @$-Internal Online Examination.

Note:

1. FA-TH represents average of two class tests of 30 marks each conducted during the Course.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing mark sin 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.*15Weeks
5. 1credit is equivalent to 30 Notional hrs.
6. *Self-learning hours shall not be reflected in the Time Table.
7. *Self-learning includes micro-project/assignment/other activities.

II. RATIONALE:

A mini project requires comparatively less time than major projects. They are comparatively simpler and have shorter duration. Mini Project helps students to explore and strengthen their understanding of fundamentals through practical application of theoretical concepts. Mini Project can help them to boost their skills and widen their horizon of thinking. It will act like a beginner's guide to undertake the major project/dissertation during the final year and will ensure preparedness of students to undertake major projects/dissertation. Students will be required to select the topic relevant to their specialization and that has value addition. The presentation should be done along with the report on the identification of the topic for the work and the methodology adopted involving scientific research, collection, and analysis of data, and determining solutions highlighting individuals' contributions

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: Illustrate how to identify needs and convert them into the problems.

CO2: Analyse the process of solving the problem in a group.

CO3: Justify the process of applying basic engineering fundamentals to attempt solutions to the problems.

CO4: Remember to utilize the self-learning and research in your projects

IV. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

NOT APPLICABLE

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 Select the relevant topic for mini project.	Select the Mini project topic	2	CO1
2	LLO 2.1 Finalize the relevant topic for mini project.	Finalized the mini project	2	CO1
3	LLO 3.1 Collection of literature through Literature survey	Literature survey of mini projects	2	CO4
4	LLO 4.1 Prepare a plan of mini project.	Develop a plan of mini projects	2	CO4
5	LLO 5.1 Prepare a of estimation and costing of mini project.	Estimation and Costing of the mini projects	2	CO2
6	LLO 6.1 Prepare a block diagram of a mini project	Draw a block diagram of mini projects	2	CO2
7	LLO 7.1 Prepare a circuit diagram of a mini project also collect and select of Raw material of a mini project	Draw the circuit diagram and selection of raw materials of mini projects	2	CO2
8	LLO 8.1 Design a circuit diagram of a mini project.	Test the circuit diagram of identified mini project	2	CO2
9	LLO 9. Illustrate of mini projects part I	Perform the Experimentation of mini projects part I	2	CO3
10	LLO 10. Illustrate of mini projects part II	Perform the Experimentation of mini projects part II	2	CO3
11	LLO 11. Evaluate the observation, Results, Conclusion of mini projects	Write observation, Results and Conclusion of mini projects	2	CO3
12	LLO 12.1 Develop the report related to mini project.	Write the report on mini projects	2	CO3
13	LLO 13.1 Prepare a report based on mini project	Finalized the mini project report.	2	CO3
14	LLO 14.1 Prepare a presentation based on mini project	Make a mini project presentation	2	CO3

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

Micro project:

Mini projects Titles (Perform any one of the following)

1) Solar panel with sun position tracking
2) RPM Display for BLDC motor with speed control
3) Home and Industrial Safety using fire and gas detection system
4) Power supply with Auto Switching
5) Clap-based fan-switching system
6) Design of windmill
7) Design a Solar system to supply a room (only lighting load)
8) Battery Charger
9) Substation Model
10) Model of Switchgear Devices
11) Water level indicator with alarm
12) Design of PM Generator
13) Transformer overload protection
14) Speed control of Induction motor using any one control method
15) EV working model
16) Electrical lab Maintenance as per the mentor instruction

(Other than the suggested mini-project topics, Students can also select one electrical engineering branch related mini project under the guidance of the mentor . A Maximum of seven students are allowed in each group)

- **Suggestion content of the mini-project reports**

- Title page (With individual name and mentor teacher)
- Certificate
- Acknowledgement
- Abstract
- Content page

Chapters

Chapter 1 :- Introduction
Chapter 2 :- Literature survey
Chapter 3:- Scope of mini projects
Chapter 4:- Methodology
Chapter 5:- Details of the design, working and processes
Chapter 6:- Results and Application
Chapter 7:- Conclusion & Future scope

- **Mini project Diary: -**

Mini project duration (Mention dates)

1) Activity planned
2) Activity Executed
3) Reason for delay if any
4) Corrective measures adopted
5) Remark and Signature of guide

- **Instruction for students: -**

1) The reports should be neatly typed on white A4 size paper. The typing should be of normal spacing and only on one side of the paper.
2) Use font Times New Roman, for the title font size 14 for normal typing font size 12.
3) A project work approval sheet by mentor in the form of a certificate, duly signed, should be included.
4) Follow all the instructions given by the mentor from time to time.

- **Submission of Mini Project report: -**

The students should submit a detailed report based on his/ her mini-project work at the time of submission. It should include relevant circuits, diagrams, graphs, Specification sheets etc. Mentor will able to talk about the content addition to relative mini projects.

VII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED

NOT APPLICABLE

VIII. SUGGESTED FOR WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE

Sr. No.	Criteria	Marks
1	Mini project proposal / Identification	10
2	Punctuality and overall performance	
3	Mini Project Diary / Daily Performance Report	
4	Execution of plan during the semester	20
5	Project report including documentation	15
6	Presentation	05
	Total	**50**

IX. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)	Summative Assessment (Assessment of Learning)
Assignment, Self-learning, and Terms work Seminar/Presentation	----------

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	--	2	2				
CO2	2	--	--	2	--	2	2				
CO3	2	--	--	2	--	2	2				
CO4	2	--	--	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
1	S.K. Bhattacharya and S. Chatterjee	Projects in Electrical, Electronics, instrumentation, and Computer Engineering.	S. Chand publication ISBN: 81-219-3090-1
2	Nikhil Shukla	Electrical and Electronics projects	V&S Publisher ISBN: 9789350578339, 9789350578339
3	Nikhil Shukla	Electrical projects for beginners	V&S Publisher ISBN: 13-9789350578322 ISBN:10- 9789350578322

XII. LEARNING WEBSITES & PORTALS

Sr.No.	Link/Portal	Description
1	https://nevonprojects.com	Provide the Electrical based projects and mention the procedure to make mini projects
2	https://elprocus.com	To get electrical project ideas on the latest topics
3	https://electricalprojectsguide.com	Various electrical projects provided and some research work for reference
4	https://eeweb.com	Provide the Electrical based mini project with explanation

Name & Signature:

Dr. S.S. Bharatkar
HOD in Electrical Engg.

Shri. Ravi B. Chauthmal
Lecturer in Electrical Engg.

(CourseExperts)

Name &Signature:-

Dr. S.S.Bharatkar
(Program Head)

Name & Signature:

Shri. S.B. Kulkarni
(CDC In Inharge)

GOVERNMENT POLYTECHNIC, PUNE

'120 – NEP' SCHEME

PROGRAMME	**DIPLOMA IN ELECTRICAL ENGINEERING**
PROGRAMME CODE	**02**
COURSE TITLE	**FUNDAMENTAL OF POWER ELECTRONICS**
COURSE CODE	**EE41201**
PREREQUISITE COURSE CODE & TITLE	**NA**
CLASS DECLARATION COURSE	**NO**

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	
EE41201	FUNDAMENTAL OF POWER ELECTRONICS	DSC	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 course..
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:

Power Electronics finds extensive applications in domestic, commercial, industrial front and electric utilities particularly in terms of efficient conversion, control and conditioning of electric power from its available input into the desired electrical output form. This course will enable the diploma students to develop the knowledge and skillsets of operating and testing different power electronic devices and their applications.

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

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

- CO1 - Test the functionality of a given power electronic device.
- CO2 - Test the switching performance of thyristors.
- CO3 - Test the performance of the given controlled converter.
- CO4 - Test the performance of the given chopper.
- CO5 - Use a suitable power electronic circuit for a given application.

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 POWER ELECTRONIC DEVICES (CL Hrs-08, MARKS-12)				
1	TLO 1.1 Illustrate the power electronic system using a block diagram. TLO 1.2 Solve simple numerical losses in the given switch. TLO 1.3 Explain the general characteristics of the given power electronic switch. TLO 1.4 Describe the construction of the given power electronic device. TLO 1.5 Explain the working principle of the given power electronic device. TLO 1.6 State the applications of the given power electronic device.	Unit - I Power Electronic Devices 1.1 Power electronic system: general block diagram, need, advantages and disadvantages 1.2 Switching in power electronic circuit: Need and its importance; Ideal switch and practical switch: concept, general characteristics, conduction losses, switching losses 1.3 SCR: Construction, working principle, Static V-I characteristics, switching characteristics, and applications 1.4 IGBT: Construction, working principle, Static V-I characteristics, switching characteristics, and applications 1.5 Power MOSFET: Construction, working principle, Static V-I characteristics, and applications 1.6 TRIAC: Construction, working principle, Static V-I characteristics, and applications	Lecture Using Chalk-Board Demonstration Video presentations	**CO1**
UNIT - II PROTECTION AND FIRING CIRCUIT OF THYRISTOR (CL HRS-11, MARKS-18)				
	TLO 2.1 Explain the need for the given protection for SCR TLO 2.2 Describe the given protection scheme of SCR TLO 2.3 Explain the given turn-on method of SCR TLO 2.4 Illustrate the given firing circuit of SCR TLO 2.5 Explain the given commutation technique of SCR	2.1 di/dt protection: need, a snubber circuit 2.2 dv/dt protection: need, snubber circuit 2.3 Overvoltage protection: need, internal & external overvoltage, voltage clamping device 2.4 Overcurrent protection: need, electronic crowbar circuit 2.5 Thermal Protection of SCR: Need, thermal resistance, and heat sink specification 2.6 Firing circuit: Features and general layout of firing scheme 2.7 SCR turn-on methods: forward voltage triggering, gate triggering, dv/dt triggering, temperature triggering, and light triggering 2.8 SCR Firing circuit: resistance firing circuit (no derivation), RC firing circuit (no derivation), pulse transformer-based triggering 2.9 SCR commutation techniques: load commutation(Class A), line commutation (Class F)	Lecture Using Chalk-Board Demonstration Video presentations	**CO2**

UNIT-III CONTROLLED CONVERTERS (CL HRS-14, MARKS-22)				
	TLO 3.1 Define the given term(s) related to the controlled converter. TLO 3.2 Illustrate the working of the given single-phase controlled rectifier. TLO 3.3 Derive equation of DC output voltage of the given controlled converter. TLO 3.4 Compare voltage source inverter and current source inverter based on the given criteria. TLO 3.5 Explain the working of the given single-phase inverter. TLO 3.6 Explain the working principle of sinusoidal pulse width modulation.	3.1 Basic terminologies: conduction angle, firing angle, output voltage, output current, voltage across switch, source current, source voltage 3.2 Single phase half wave controlled rectifier with R, RL load: Circuit diagram, working, input-output waveforms, derivation for average output voltage, equations for output currents, voltages & power, and effect of freewheeling diode 3.3 Single phase full wave controlled bridge rectifier with R, RL load: Circuit diagram, working, input-output waveforms, derivation for average output voltage, equations for output currents, voltages & power 3.4 Three-phase full wave controlled bridge rectifier: working principle with R load, input-output waveforms 3.5 Inverters: the concept of voltage source inverter and current source inverter 3.6 Single phase half wave bridge inverter with R, RL load: Circuit diagram, working, input-output waveforms 3.7 Single phase full wave bridge inverter with R, RL load: Circuit diagram, working, input-output waveforms 3.8 Pulse width modulation: importance/need, types; Sinusoidal pulse width modulation: concept, working principle and waveforms	Lecture Using Chalk-Board Demonstration Video presentations	**CO3**
UNIT - IV DC-DC CONVERTERS (CL HRS-07, MARKS-10)				
	TLO 4.1 Explain the given terminology related to chopper. TLO 4.2 Explain the control strategies of the chopper. TLO 4.3 Illustrate the working of the given chopper. TLO 4.4 Calculate the output voltage of the given chopper	4.1 Basic terminologies: duty ratio, turn-on period, turnoff period, chopping period 4.2 Control strategies of the chopper: Constant frequency system, variable frequency system 4.3 Step up chopper: circuit diagram, working, waveforms and output voltage equation 4.4 Step-down chopper: circuit diagram, working, waveforms and output voltage equation 4.5 Buck-Boost chopper: circuit diagram, working, waveforms and output voltage equation.	Lecture Using Chalk-Board Demonstration Video presentations	**CO4**

UNIT- V APPLICATIONS OF POWER ELECTRONICS (CL HRS-05, MARKS-08)				
	TLO 5.1 Explain the operation of the charge controller used in the photovoltaic (PV) system. TLO 5.2 Explain the speed control of the ceiling fan using TRIAC. TLO 5.3 Explain AC to AC converter used in Wind Power Generation. TLO 5.4 Explain the function of the converter station in HVDC	5.1 Charge Controller: Concept, types, applications in Photovoltaic (PV) system with block diagram 5.2 Speed control of ceiling fan using TRIAC: Working, Block Diagram, advantages 5.3 AC to AC converter using DC link: Concept, applications in Wind Power Generation 5.4 HVDC converter station: Concept, Circuit Diagram	Lecture Using Chalk-Board Demonstration Video presentations	**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 Identify the given power electronic device	Power Electronic Devices.	2	CO1
2	LLO 2.1 Test the performance of SCR.	Experiment to plot the V –I characteristics of forward-biased SCR for different gate currents	2	CO1
3	LLO 3.1 Test the proper functioning of the power MOSFET.	Testing of power MOSFET	2	CO1
4	LLO 4.1 Test the proper functioning of the IGBT.	Testing of IGBT	2	CO1
5	LLO 5.1 Test the proper functioning of the TRIAC	Testing of TRIAC.	2	CO1
6	LLO 6.1 Test the performance of the Snubber circuit.	Performance of Snubber circuit.	2	CO2
7	LLO 7.1 Test the effect of variation of resistance in the R triggering circuit on the firing angle of SCR.	Resistance triggering circuit of SCR.	2	CO2
8	LLO 8.1 Test the effect of variation of resistance and capacitance in RC triggering circuit on the firing angle of SCR.	RC triggering circuit of SCR	2	CO2
9	LLO 9.1 Perform the triggering of SCR using the Pulse transformer	Triggering of SCR using Pulse transformer	2	CO2
10	LLO 10.1 Perform the operation of the Class A commutation circuit	Class A (Load Commutation) commutation circuit.	2	CO2
11	LLO 11.1 Perform the operation of the Class F commutation circuit	Class F (Line Commutation)commutation circuit	2	CO2
12	LLO 12.1 Measure output voltage of single phase half wave controlled rectifier by using CRO/DSO. LLO 12.2 Use various controls of the CRO	Operation of single phase half wave controlled rectifier with resistive load	2	CO2

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles/Tutorial Titles	Number of hrs.	Relevant COs
13	LLO 13.1 Measure output voltage of single phase half wave controlled rectifier by using CRO/DSO. LLO 13.2 Use various controls of the CRO	Operation of single phase half wave controlled rectifier with RL loads without freewheeling diode.	2	CO2, CO3
14.	LLO 14.1 Measure output voltage of single phase half wave controlled rectifier by using CRO/DSO. LLO 14.2 Use various controls of the CRO	Operation of single phase half wave controlled rectifier with RL load with freewheeling diode	2	CO2, CO3
15	LLO 15.1 Measure output voltage of single phase full wave controlled rectifier by using CRO/DSO. LLO 15.2 Use various controls of the CRO	Operation of single phase full wave controlled rectifier with R load.	2	CO2, CO3
16	LLO 16.1 Measure output voltage of single-phase full wave controlled rectifier by using CRO/DSO. LLO 16.2 Use various controls of the CRO/DSO	Operation of single phase full wave controlled rectifier with RL load.	2	CO2, CO3
17	LLO 17.1 Measure the output voltage of three three-phase full wave-controlled rectifiers by using CRO/DSO. LLO 17.2 Use various controls of the CRO/DSO	Operation of three phase full wave controlled rectifier with R load	2	CO2 CO3
18	LLO 18.1 Measure the output voltage with different firing angles of the controlled rectifier available in your laboratory	Voltage control using a controlled rectifier	2	CO2, CO3
19	LLO 19.1 Measure output voltage of single phase half wave bridge inverter by using CRO/DSO. LLO 19.2 Use various controls of the CRO/DSO	Operation of single phase half wave bridge inverter with resistive load	2	CO2, CO3
20	LLO 20.1 Measure output voltage of single phase full wave bridge inverter by using CRO/DSO. LLO 20.2 Use various controls of the CRO/DSO	Operation of single phase full wave bridge inverter with resistive load	2	CO2, CO3
21	LLO 21.1 Measure output voltage of single phase half wave bridge inverter by using CRO/DSO. LLO 21.2 Use various controls of the CRO/DSO	Operation of single phase half wave bridge inverter with RL load.	2	CO2, CO3
22	LLO 22.1 Measure output voltage of single phase full wave bridge inverter by using CRO/DSO. LLO 22.2 Use various controls of the CRO/DSO	Operation of single phase full wave bridge inverter with RL load	2	CO2, CO3
23	LLO 23.1 Measure the output voltage of the chopper by varying duty cycles. LLO 23.2 Use various controls of the CRO/DSO	Operation of step-up chopper	2	CO2, CO4
24	LLO 24.1 Measure the output voltage of the chopper by varying duty cycles. LLO 24.2 Use various controls of the CRO/DSO	Operation of step-down chopper	2	CO2, CO4
25	LLO 25.1 Test the performance of the charge controller in the PV system.	Charge controller in PV system	2	CO4, CO5
26	LLO 26.1 Observe the operation of AC to AC converter (with DC link). LLO 26.2 Interpret the input and output profile of the AC to AC converter (with DC link).	Demonstration of AC to AC converter(with DC link) used in wind power plant	2	CO3, CO4, CO5
27	LLO 27.1 Control the speed of the fan using TRIAC.	Speed control of fan using TRIAC	2	CO3, CO5

Perform any 20 Practical. All CO's should be covered in the 20 Practical.

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

Micro project

i) Build a power electronic circuit to produce variable voltage for a given application using the following steps.

1) Identify the voltage range for a given application.
2) Select circuit components suitable for the identified voltage range.
3) Connect circuit components to build a power electronic circuit controlling voltage.
4) Test the circuit for the production of variable voltage.
5) Prepare a report on the circuit built and submit the same.

ii) Prepare a report on commercial or industrial applications of power electronics devices by performing the following activities.

1) Identify 3 to 5 relevant applications.
2) Visit the site and understand the role of power electronic devices in identified applications.
3) Write the specifications of major components in the applications.
4) Prepare a block diagram or process flow diagram of the applications.

iii) Prepare a report on the ratings/specifications and applications of various power electronic devices.

1) Select any 3 to 5-power electronic devices.
2) Visit manufacturers' sites or official websites of power electronic device manufacturers and note the specifications or ratings of the selected power electronic devices.
3) Compare selected power electronics devices based on collected information along with their applications.

iv) Build a circuit of charge controller for a given battery using the following steps.

1) Write the specifications of a given battery.
2) Select circuit components required for the charge controller circuit suitable for the given battery.
3) Connect circuit components to build a charge controller.
4) Test change controller for controlling power flow through the battery.
5) Prepare a report on the charge controller and submit the same.

Any other relevant micro project assigned by the subject teacher.

Assignment

- Numerical on losses in power electronic device.
- Prepare a report on the evolution of power electronic devices.
- Numerical on the output voltage of given controlled converter.
- Numerical on DC output voltage of given chopper.
- Prepare a report on testing the performance of GTO.
- Any other relevant assignment was given by the subject teacher.

VII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED

Sr. No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Multimeter: 2000 count digital display, 1000V DC/750 V AC ranges, 10 A AC/DC ranges	ALL
2	Power MOSFET: Vds-400V, ID-10A-6.3A Pd-125W	1,3,23,24
3	SCR: Irms = 16A, IH = 100mA, IL = 200mA, IGT = 90 to 35 mA,VGT = 3 to 1 V, Vrms = 1600V	1,2,6,7,8,10,11, 9,12,13,14,15,1 6,17,18
4	IGBT: Vces = 1200V, VGE = 20V, IC = 139 to 93A, PD = 650 to300W	1,4,19,20,21,22
5	Rheostat: Nichrome wire, 300ohm, 10A, 400V	12,13,14,15,16, 17,19,20,21,22
6	Variable inductive load: Single phase,250V, 2.5kW continuously variable core type	12,13,14,15,16, 17,19,20,21,22
7	CRO/Digital Oscilloscope with probes: 20MHz, dual channel, sensitivity = 1mV/div., Max Input = 400V, Power supply =230VAC.	12,13,14,15,16, 17,19,20,21,22
8	Clamp-on meter: Current = 0 to 400A, Voltage = 0 to 600V	2,3,4,5,25,27
9	AC and DC Ammeter: Range = 0 to 20A, Sensitivity = 0.5A/div	25,27
10	AC and DC Voltmeter: 0 to 300V, Sensitivity = 1V/div.	25,27
11	TRIAC: It = 4A, IGT = 10mA, Vt = 600V.	1,5

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	POWER ELECTRONIC DEVICES	CO1	8	2	6	4	12
2	II	PROTECTION AND FIRING CIRCUIT OF THYRISTOR	CO1,CO2	11	4	10	4	18
3	III	CONTROLLED CONVERTERS	CO2,CO3	14	2	14	6	22
4	IV	DC-DC CONVERTERS	CO2,CO4	7	2	4	4	10
5	V	APPLICATIONS OF POWER ELECTRONICS	CO3,CO4,CO5	5	2	4	2	8
Grand Total				**45**	**12**	**38**	**20**	**70**

IX. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)	Summative Assessment (Assessment of Learning)
Each practical will be assessed considering - - 60% weightage to process and - 40% weightage to product Continuous assessment based on process and product-related performance indicators, and laboratory experience.	End-of-semester exam based on observations and recording of the particular experiments.

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**	1	**--**	**--**	**--**
CO2	**3**	**2**	**1**	**2**	**--**	**--**	**2**	**--**	1	**--**	1
CO3	**3**	**2**	**2**	**2**	**--**	**1**	**2**	**--**	1	**--**	**--**
CO4	**3**	**2**	**2**	**2**	**--**	**1**	**2**	1	1	1	**--**
CO5	**2**	**3**	**2**	**2**	**2**	**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
1	Muhammad H. Rashid	Power Electronics Handbook	Butterworth-Heinemann Inc, ISBN:978-0128114070
2	P S. Bimbhra	Power Electronics	KHANNA PUBLISHERS, ISBN:978-8174092793
3	Muhammad H. Rashid	Power Electronics: Devices, Circuits, and Applications	Pearson Education, ISBN:978-8120345317
4	M D Singh, K B Khanchnadani	Power Electronics	McGraw Hill Education, ISBN:9780070583894

XII. LEARNING WEBSITES & PORTALS

Sr. No	Link/Portal	Description
1.	https://nptel.ac.in/courses/108102145	Course on Power Electronics by IIT Delhi
2.	https://nptel.ac.in/courses/108105066	Course on Power Electronics by IIT Kharagpur
3.*	https://nptel.ac.in/courses/108101038	Course on Power Electronics by IIT Bombay
4.	https://ocw.mit.edu/courses/6-334-power-electronics-spring-2007/	Course on Power Electronics by MIT Open courseware
5.	https://www.youtube.com/playlist?list=PL4emuJKx0B8aREwkC5BEOw2OZ48puPyOG	Videos on Power Electronics
6.	https://3dcircuits.engineering.dartmouth.edu/powani.html	Animation on Chopper and Rectifier

Name & Signature:

Smt. A. A. Patole
Lecturer in Electrical Engineering

Smt N.V.Devarkar
Lecturer in Electrical Engineering

(Course Experts)

Name & Signature:	Name & Signature:
Dr. S. S.Bharatkar (Programme Head)	**Shri. S.B. Kulkarni** (CDC In-charge)

GOVERNMENT POLYTECHNIC, PUNE

'120 – NEP' SCHEME

PROGRAMME	**DIPLOMA IN ELECTRICAL ENGINEERING**
PROGRAMME CODE	**02**
COURSE TITLE	**ELECTRICAL SAFETY**
COURSE CODE	**EE41204**
PREREQUISITE COURSE CODE & TITLE	**NA**
CLASS DECLARATION COURSE	**NO**

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	
EE41204	ELECTRICAL SAFETY	DSC	2	--	--	--	2	1	1	15	35*#	50	20	--	--	--	--	25	10	75

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 course.
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:

Most of our modern devices, instruments, and appliances at work, at home, and for leisure are electricity-powered either through electrical utilities and/or through the use of batteries. It is a fact that hundreds of preventable electrical accidents occur each year in our country, many resulting in serious injury, and even death. Countless electrical incidents (e.g. minor electrical shocks) and unsafe acts involving electrically powered devices or electrical infrastructure go unreported each year. Hence Electrical safety is not just important for electricians and electrical workers, but it is also important for all who work with electrically powered devices or who are engaged in activities that may result in electrical hazards. Hence knowledge of this course is essential which will help the students in day-to-day life while working in Industry or other related profession.

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

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

CO1- Describe the terms related to electrical safety.
CO2. Identify the type of electrical hazard, causes & effects.
CO3. Follow various safe working practices to be adopted while working as per electrical safety standards/ norms & statutory provisions.

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 BASICS OF ELECTRICAL SAFETY (CL Hrs-10, Marks-13)				
1.	**TLO1.1** Explain the importance of electrical safety. **TLO1.2** Explain the issues (statistics associated) with poor electrical safety in the workplace. **TLO1.3** Define key electrical terms which are essential to understanding	**1.1 Electrical Safety:** Introduction To Electrical Safety, Hazard, Shocks And Their Prevention. **1.2**. Introduction To Electrical Safety, Shocks And Their Prevention. The safe limit of current and voltage. **1.3.** Circuit protection devices. Overloading in an electrical circuit. Overhead lines, static electricity, Hazards from static electricity and prevention. **1.4** CEA (Central Electricity Authority), BIS, IEC, IEEE, NFPA, CEI, EI, Electricity Act, Regulations.	Chalkboard Demo video Presentation	**CO1**
UNIT - II ELECTRICAL SAFETY IN RESIDENTIAL, COMMERCIAL AND INDUSTRIAL INSTALLATIONS (CL HRS-10, MARKS-12)				
2.	**TLO2.1** Describe safety provisions in Residential, Commercial and Industrial Installations **TLO2.2** Avoiding situations leading to hazards due to electric fire. **TLO2.3** Describe the effects of fire. **TLO2.4** Describe probable places prone to hazard due to electric fire.	**2.1**.water tap giving shock –shock from the wet wall – fan firing shock –multi-storied building –Temporary installations. Dos and Don'ts for safety in the use of domestic electrical appliances. **2.2** Fire Prevention. Fire triangle. Classification of fire .stages of fire. Causes of industrial fire. **2.3** Fire precaution through building design and construction. Fire detection. Automatic fire detection and alarm system. Optical detectors, smoke detectors, ionization type of detectors, thermal detectors, flame detectors. **2.4** fire extinguisher: I)fixed firefighting system II) portable fire extinguisher, soda acid type, dry chemical powder type, carbon dioxide type, foam type.	Chalkboard Demo video Presentation	**CO2**

UNIT – III PREVENTION AND SAFETY LAW (CL HRS-10, MARKS- 10)				
3.	**TLO3.1** Interpret how to implement safety measures for protection in different stages of working conditions such as domestic, industries, & other commercial workplaces. **TLO3.2 K**now the law related to safety. **TLO3.3** State various safe working practices to be adopted while working in industry or at residence **TLO3.4** Study Various Policies and Regulations.	**3.1 Safety in the use of hand tools:** Tool accident, safe practices, correct use of the tool. Safety in portable tools: precaution and care**.** **3.2** Personal protective equipment: parts human body needs protection,(hand, foot, head. eye, face, skin body, protection against fall, hearing, noise, respiratory protection.) **3.3** Law related to safety in the workplace: The people, The machine, The working conditions, The working facilities, and The working environment. **3.4** Accident appraisal system: reporting, recording, investigation and analysis. **3.5** Norms and standard, safety policy Emergency Control Plan. Emergency management plan. Work permit system **3.6** Principle of accident prevention, safety training, the role of supervisor achieving a high standard of safety. Safety suggestion scheme, safety committee, safety competition, contest, safety drive, exhibition, poster	Chalkboard Demo video Presentation	**CO3**

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

NOT APPLICABLE

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

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

1. Prepare the report on Fire Precautions in Residential Area.
2. Prepare the Fire Safety Precautions Against Electricity.
3. Prepare the Fire Protections in Industries.
4. Prepare the report on different types of fire extinguishers.
5. Prepare the report on Electrical safety act in India.
6. Prepare the report on safety drive.
7. Prepare the report on safety policy in Industries.

VII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED

NOT APPLICABLE

VIII. SUGGESTED FOR WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE

Sr. No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	**BASICS OF ELECTRICAL SAFETY**	CO1	10	4	5	4	13
2	II	**TYPES OF HAZARDS AND THEIR EFFECTS**	CO2	10	4	4	4	12
3	III	**PREVENTION & SAFETY LAW**	CO3	10	4	2	4	10
			Grand Total	**30**	**12**	**11**	**12**	**35**

IX. ASSESSMENT METHODOLOGIES/TOOLS

NOT APPLICABLE

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**	**1**	**1**	**2**	**1**	**1**	**3**	**2**	**2**	**2**	**2**
CO2	**2**	**1**	**1**	**2**	**2**	**2**	**3**	**1**	**1**	**2**	**2**
CO3	**2**	**2**	**1**	**2**	**3**	**2**	**3**	**2**	**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
1	K.T.Kulkarni	Introduction to Industrial Safety	Pradish mudran
2	N.K.Tarafdar K.J.Tarafdar	Industrial safety Management	Dhanpat Rai & CO
3	Sunil S. Rao, R. K. Jain, H.L.Saluja	Electrical Safety, Fire Safety Engineering and Safety Management	Khanna Publication
4	D.R . Nagpal	Electrical Safety	Standard Publishers Distributors

XII. LEARNING WEBSITES & PORTALS

Sr. No	Link/Portal	Description
1.	https://www.esfi.org/	Electrical Safety, workplace safety, disaster safety
2.	https://www.nfpa.org/Public-Education/Fire-causes-and-risks/Top-fire-causes/Electrical	Fire & life safety
3.	https://www.lanl.gov/safety/electrical/docs/elec_hazard_awareness_study_guide.pdf	Hazard Awareness
4.	www.greenwgroup.co.in	Electrical Safety course
5	https://www.worksafe.qld.gov.au/laws-and-compliance/electrical-safety-laws	Electrical safety laws

Name & Signature:

Smt. N.V.Devarkar
Lecturer in Electrical Engineering

Smt. A.A.Patole
Lecturer in Electrical Engineering

(Course Experts)

Name & Signature:	Name & Signature:
Dr. S. S.Bharatkar (Programme Head)	**Shri. S.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	**INDIAN CONSTITUTION: CORE CONCEPTS AND VALUES**
COURSE CODE	**HU21203**
PREREQUISITE COURSE CODE & TITLE	**NA**
CLASS DECLARATION COURSE	**NO**

I. LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Course Type	Learning Scheme					Credits	Assessment Scheme											
			Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory Practical				Based on LL & TSL Practical				Based on SL		Total Marks
			CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
										Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
HU21203	INDIAN CONSTITUTION : CORE CONCEPTS AND VALUES	VEC	1	--	--	1	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.
2. 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 course.
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.
1. **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:

Introducing a course on the Indian Constitution can provide students with a comprehensive understanding of the country's legal framework and democratic principles. Such a course could cover the historical context of its creation, the structure and functions of the government it establishes, and the fundamental rights and duties of citizens. It could also explore the significant amendments and judicial interpretations that have shaped its evolution over time. This foundational knowledge is not only for fostering informed and engaged citizens who can contribute to the nation's democratic processes but also enriches the educational experience by fostering a sense of national identity and ethical responsibility among future engineers. Furthermore, embedding Electoral Literacy and Voter Education in diploma engineering programs strategically empowers these future professionals with an awareness of their electoral privileges and the workings of democracy.

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: Foster comprehension of the fundamental principles and goals embedded in the Indian constitution.
CO2: Elaborate on the core rights and duties conferred upon Indian citizens by the Constitution.
CO3: Comprehend the distribution of legislative, executive, and financial powers between the Union and the States.
CO4: Understand the functioning of Indian democracy, encompassing its frameworks and mechanisms at local, state, and national levels.
CO5: Cultivate the skills and perspectives required for active participation in electoral processes, the conscientious exercise of voting rights, and the promotion of informed democratic participation within society.

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 TO INDIAN CONSTITUTION(CL Hrs-03, Marks-NIL)				
1.	**TLO 1.1** Understand the historical context and events leading to the drafting of the Indian Constitution. **TLO 1.2** Comprehend the essential features and understand the significance of the Indian Constitution in shaping India's democratic governance and societal ethos. **TLO 1.3** Analyze the vision and ideals articulated in the Preamble and their relevance in contemporary Indian society.	1.1 Historical background and making of the Indian Constitution 1.2 Salient features and significance of the Indian Constitution 1.3 Preamble: Vision and Ideals of the Indian Constitution	Presentations Case Studies and Analysis Role-Playing and Simulations Project-Based Learning	**CO1**
UNIT - II FUNDAMENTAL RIGHTS, FUNDAMENTAL DUTIES AND DIRECTIVE PRINCIPLES (CL Hrs-04, Marks-NIL)				
2	**TLO2.1** Understand the introduction and structure of Fundamental Rights in Part Ill of the Indian Constitution. **TLO2.2** Understand the principles of the Right to Equality, Right to Freedom, and Right to Life.	**2.1** Fundamental Rights: Introduction & its Scheme under Part -III **2.2** Right to Equality (Article 14-18) **2.3** Right to Freedom (Article 19-22) **2.4** Right to Life (Article 21) **2.5** Fundamental Duties and their Significance under Part IV-A **2.6** Directive Principles of State Policy under Part – IV: importance and	Presentations Case Studies and Analysis Role-Playing and Simulations Project-Based Learning	**CO2**

	TLO2.3 Identify fundamental duties in general and in particular with the engineering field. **TLO2.4**: Grasp the significance and practical application of Directive Principles of State Policy outlined in Part IV of the Indian Constitution.	implementation.		
UNIT- III UNION AND STATE EXECUTIVE(CL Hrs-03, Marks-NIL)				
3	**TLO 3.1** 3.1: Gain insight into the structure and functions of the Union executives and the jurisdiction of the Supreme Court. **TLO 3.2** 3.2: Understand the organization and responsibilities of the State Executives and the functions of the State Judiciary(High Courts).	**3.1** Union Government, Union Legislature (Parliament), Lok Sabha and Rajya Sabha (with Powers and Functions), Union Executive, President of India (with Powers and Functions), Prime Minister of India (with Powers and Functions), Union Judiciary (Supreme Court), Jurisdiction of the Supreme Court. **3.2** State Government, State Legislature (Legislative Assembly/ Vidhan Sabha, Legislative Council / Vidhan Parishad), Powers and Functions of the State Legislature, State Executive, Governor Of the State (with Powers and Functions), The Chief Minister Of the State (With Powers and Functions) State Judiciary (High Courts).	Presentations Case Studies and Analysis Role-Playing and Simulations Project-Based Learning	**CO3**
UNIT-IV AMENDMENTS AND EMERGENCY PROVISIONS(CL Hrs-03, Marks-NIL)				
4	**TLO 4.1** Comprehend the meaning and significance of constitutional amendments, as well as the procedural rules detailed in Article 368 of the Indian Constitution. **TLO 4.2** Recognize the roles of various branches of government in the amendment process, **TLO 4.3** Examine the significant procedures and historical context of major constitutional amendments	**4.1 Introduction to Constitutional Amendments:** Definition and significance of constitutional amendments. Constitutional provisions governing the amendment procedure (Article 368). **4.2 Types of Amendments:** Simple majority amendments, Special majority amendments, Amendments requiring ratification by states. **4.3 Role of the Executives Amendments**: Role of Parliament: Lok Sabha and Rajya Sabha, Role of President: Assent to amendments, Role of State Legislatures: Ratification of certain amendments. **4.4 Major Constitutional**	Presentations Case Studies and Analysis Role-Playing and Simulations Project-Based Learning	**CO4**

		Amendment procedures: Major Constitutional Amendment procedures - 1st, 7th,42nd, 44th, 73rd & 74th, 76th, 86th, 52nd & 91st, 102nd		
UNIT –V ELECTORAL LITERACY (CL Hrs-02, Marks-NIL)				
5	**TLO5.** Electoral Literacy: Develop understanding and proficiency in electoral processes, voter registration, rights and responsibilities of voters, electoral reforms, and initiatives promoting electoral literacy.	**5.1 Understanding the Electoral Process :** Overview of the electoral process: registration, voting, counting, and declaration of results, Role and functions of the Election Commission of India Types of elections: Lok Sabha, Rajya Sabha, State Legislative Assembly, Local Body elections **5.2 Voter Registration and Electoral Rolls:** Importance of voter registration Eligibility criteria for voter registration Process of voter registration: online, offline, and special drives Checking and updating voter details in electoral rolls **5.3 Rights and Responsibilities of Voters:** Understanding fundamental rights related to elections Responsibilities of voters towards ensuring free and fair elections Consequences of electoral malpractices and non-participation **5.4 Electoral Reforms and Initiatives:** Overview of electoral reforms aimed at enhancing transparency, inclusivity, and integrity of elections Role of technology in improving electoral processes: Voter Verifiable Paper Audit Trail (VVPAT), Online voter registration, e-voting Initiatives by the Election Commission and civil society organizations to promote electoral literacy	Presentations Case Studies and Analysis Role-Playing and Simulations Project-Based Learning	**CO5**

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

NOT APPLICABLE

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

i) **Case Study Analysis:** Select a few landmark Supreme Court cases related to Fundamental Rights (e.g., Kesavananda Bharati v. State of Kerala, Maneka Gandhi v. Union of India) and analyze the court's interpretation and impact on these rights.

ii) Comparative Analysis: Compare the provisions of the Right to Equality under Articles 14-18 with similar provisions in the constitutions of other countries. Highlight similarities, differences, and the reasoning behind them.

iii) Public Awareness Campaign: Design a public awareness campaign to educate citizens about their Fundamental Rights and Duties. Create informative posters, social media content, and interactive workshops to engage people in discussions about constitutional rights and responsibilities.

iv) Write a reflective essay discussing the historical context and debates surrounding the inclusion of Fundamental Rights in the Indian Constitution.

v) Create a visual timeline depicting the evolution of laws related to equality in India, from independence to the present day. Include major legislative reforms and judicial decisions.

vi) Conduct a comparative analysis of the implementation of Directive Principles in different states of India, identifying successful initiatives and areas needing improvement.

vii) **Case Study Analysis:** Choose a recent constitutional or political issue that has been debated in Parliament. Analyze the roles played by the Loksabha and Rajya Sabha in addressing the issue and the impact of their decisions.

viii) Case Study Analysis: Analyze a landmark constitutional amendment in India (e.g., the 42nd Amendment) and its impact on governance, fundamental rights, and the balance of power between different branches of government.

ix) **Infographic Creation:** Create an infographic illustrating the process of amending the Indian Constitution as outlined in Article 368. Highlight key steps and requirements for different types of amendments.

x**) Timeline Project:** Create a timeline highlighting major constitutional amendments in India, such as the 1st, 7th, 42nd, 44th, 73rd & 74th, 76th, 86th, 52nd & 91st, and 102nd amendments. Include key provisions and the political context surrounding each amendment.

xi) **Debate:** Organize a debate on the topic "Should the President have the power to refuse assent to constitutional amendments?" Encourage students to research and present arguments from legal, political, and ethical perspectives.

xi**) Campaign Design:** Design a social media campaign to raise awareness about the importance of voter participation and responsible voting. Create visually engaging posters, infographics, and videos highlighting the consequences of electoral malpractices and non-participation.

xii) **Online Tutorial:** Create a step-by-step tutorial video or guide demonstrating the voter registration process, both online and offline. Include instructions for checking and updating voter details in electoral rolls.

xiii**) Survey Project:** Conduct a survey to assess the awareness and accessibility of voter registration

facilities among different demographic groups in your locality. Analyze the results and propose strategies to improve voter registration rates.

VII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED

NOT APPLICABLE

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)
Assignment, Self-learning and Terms work Seminar/Presentation	—

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
CO1	--	--	--	--	2	--	2		
CO2	--	--	--	--	3	--	2		
CO3	--	--	--	--	3	--	2		
CO4	--	--	--	--	3	--	2		
CO5	--	--	--	--	3	--	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	M. Laxmikanth	"Indian Polity"	McGraw Hill Education: ISBN-13: 978-9352603633
2	D. D. Basu	Introduction to the Constitution of India	LexisNexis: ISBN-13: 978-8180386477
3	Subhash C. Kashyap	Our Constitution: An Introduction to India's Constitution and Constitutional Law	National Book Trust, India ISBN-13: 78-8123748462
4	Arun K. Thiruvengadam	The Constitution of India: A Contextual Analysis	Oxford University Press ISBN-1 3:978-0199467078
5	Oxford University Press	The Making of India's Constitution	Oxford University Press Oxford University Press

XI. LEARNING WEBSITES & PORTALS

Sr.No.	Link/Portal	Description
1	https://prsindia.org/.	In-depth analysis of parliamentary affairs, legislative processes, and policy Issues in India.
2	https://awmin.gov.in	Official repository providing access to the full text of the Indian Constitution.
3	https://constitution.org.in	Interactive platform offering the text of the Constitution along with annotations and historical context.
4	https://indiankanoon.org	Legal search engine offering a vast database of Indian case law, including constitutional judgments.
5	https://nptel.ac.in	Offers video lectures and course materials on studies of law and the constitution.

Name & Signature: **Mr. S.B. Kulkarni** Lecturer in Mechanical Engineering **(Course Experts)**	
Name & Signature: **Dr. Sachin. S. Bharatkar** (Programme Head)	Name & Signature: **Shri. S.B. Kulkarni** (CDC In-charge)

GOVERNMENT POLYTECHNIC, PUNE

'120 – NEP' SCHEME

PROGRAMME	**DIPLOMA IN EE/ME/MT**
PROGRAMME CODE	**02/04/05**
COURSE TITLE	**FUNDAMENTALS OF PYTHON PROGRAMMING**
COURSE CODE	**ME41202**
PREREQUISITE COURSE CODE & TITLE	**NA**
CLASS DECLARATION COURSE	**NO**

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	
ME41202	FUNDAMENTALS OF PYTHON PROGRAMMING	AEC	1	-	2	1	4	2	--	--	--	--	--	25	10	25@	10	25	10	75

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 course.
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.

1. **Notional learning hours** for the semester are **(CL + LL + TL + SL) hrs. * 15 Weeks**
3. **1 credit** is equivalent to **30 Notional hours**.
4. * Self-learning hours shall not be reflected in the Timetable.

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

II. RATIONALE:

Python's reputation as a powerful programming language is well-deserved. Its high-level data structures and object-oriented approach streamline complex software development, making it accessible for beginners and efficient for seasoned programmers. The simplicity and readability of Python code, alongside its intuitive nature, contribute to its widespread use in teaching computing and problem-solving concepts. Moreover, Python's elegant syntax and dynamic typing, combined with its interpreted nature, facilitate scripting and rapid application development across diverse fields and platforms, solidifying its position as a versatile tool in the developer's toolkit.

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: Acquire fundamental Python programming skills, empowering them to create simple scripts and grasp essential concepts including variables and data types.

CO2: Develop Python programs using control flow statements.

CO3: Perform operations on various data structures in Python.

CO4: Develop functions, and modules to solve given problems using Python.

CO5: Represent data visually using a wide range of charts, plots, and graphs, including bar charts, line plots, scatter plots, and histograms.

THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr. No	Theory Learning Outcomes (TLO's) aligned to COs.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
	UNIT-I INTRODUCTION TO PYTHON			
1.	**TLO 1.1** Explain the given features of Python. **TLO 1.2** Write a Python program to perform basic input-output operations. **TLO 1.3** Write a Python program to solve a given expression. **TLO 1.4** Implement the given decision-making statements and looping statements in the Python program.	**1.1 Introduction:** Features, History and Applications of Python, Python IDE's **1.2 Python Environment Setup:** Installation and working of IDE **1.3 Python building blocks:** Indentation, Identifiers, Variable, Comments, Keywords. **1.4 Python Data Types:** Numbers, String, Tuples, Lists, Dictionary. Declaration and use of data types. **1.5 Basic input-output operations:** input(), print(). **1.6** Running Simple Python scripts to display the given text messages.	Chalk-Board, Demonstration Presentations, Hands-on	**CO1**
	UNIT-II PYTHON OPERATORS AND CONTROL FLOW STATEMENTS			
2	**TLO 2.1** Write a simple Python program for the given arithmetic expressions. **TLO 2.2** Write a Python program to manipulate tuples. **TLO 2.3** Write a Python program to manipulate sets. **TLO 2.4** Write a Python program to manipulate dictionaries.	**2.1 Operators:** Arithmetic, Relational, Assignment, Logical, Bitwise, Membership and Identity Operator. **2.2 Control flow statements:** **2.2.1** Conditional Statements (if, if ... else, nested if) **2.2.2** Looping in Python (while loop, for loop, nested loops) **2.2.3** loop manipulation using continue, pass, break, or else.	Chalk-Board Demonstration Presentations, Hands-on	**CO2**
	UNIT- III DATA STRUCTURES IN PYTHON			
	TLO 3.1 Write a Python program to use and manipulate lists for the given problem **TLO 3.2** Write a Python program to use and manipulate Tuples for the given problem **TLO 3.3** Write a Python program to use and manipulate Sets for the given problem **TLO 3.4** Write a Python	**3.1 Lists:** Defining Lists, Accessing values in lists, deleting values from lists, updating lists. Basic List Operations, Built-in List Functions. **3.2 Tuples:** Accessing values in Tuples, deleting values from Tuples and updating Tuples. Basic Tuple operations, Built-in Tuple Functions. **3.3 Sets:** Accessing values in Set, deleting values from Set and updating Sets. Basic Set operations, Built-in Set Functions. **3.4 Dictionaries:** Accessing values in Dictionary, deleting values from Dictionary	Chalk-Board Demonstration Presentations, Hands-on	**CO3**

	program to use and manipulate Dictionaries for the given Problem	and updating Dictionary. Basic Dictionary operations, Built-in Dictionary Functions.		
UNIT-IV PYTHON FUNCTIONS, MODULES				
3	**TLO 4.1** Write relevant user-defined functions for the given problem. **TLO 4.2** Write a relevant user-defined module for the given problem. **TLO 4.3** Write packages for the given problem	**4.1 Use of Python built-in functions** (e.g. type/data conversion functions, math functions etc.). **4.2 User-defined functions:** Function definition, Function call, function arguments and parameter passing, return statement, scope of variable: Global variable and Local variable. **4.3 Modules:** Writing modules, importing modules, importing objects from modules, python built-in modules, (e.g. Numeric and mathematical module, Functional programming module), Namespace and Scoping.	Chalk-Board Demonstration Presentations, Hands-on	**CO4**
UNIT–V GRAPHICS HANDLING IN PYTHON				
5	**TLO 5.1** Proficient in using Python libraries such as Matplotlib and Plotly for creating static and interactive visualizations. **TLO 5.2** Representing data visually using various types of charts, plots, and graphs, including bar charts, line plots, scatter plots, histograms, and more **TLO 5.3** Customizing and styling visualizations to enhance readability, including adjusting colours, fonts, labels, axes, legends, and annotations.	5.1 Introduction to Graphics handling in Python involves various libraries and tools for creating, manipulating, and displaying graphical content. **5,2 Matplotlib:** Matplotlib is a comprehensive library for creating static, interactive, and animated visualizations in Python. It provides a MATLAB-like interface and supports a wide range of plot types, including line plots, scatter plots, bar charts, histograms, and more. **5.3 Plotly:** Plotly is a library for creating interactive plots and dashboards in Python. It supports a wide range of plot types, including scatter plots, line plots, bar charts, 3D plots, and more. **5.4 Numpy:** NumPy is a fundamental package for scientific computing with Python. It provides support for large, multi-dimensional arrays and matrices, along with a collection of mathematical functions to operate on these arrays efficiently.	Chalk-Board Demonstration Presentations, Hands-on	**CO5**

IV. 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** Install the given Python IDE.	Install the given Python IDE.	2	CO1
2	**LLO 2.1** Write a Python program for performing basic input and output operations in a given problem.	1. Write a Python program to display a welcome message on the screen. 2. Implement the Python program to read data from the user and display data on the screen. **Practical Tasks:** i) Write a Python program to display a welcome message on the screen. ii) Write a Python program to read data from the user and then print it on the screen.	2	CO1
3	**LLO 3.1** Write a Python program to solve a given expression.	Implement a Python program using the following operators: 1. Arithmetic 2. Relational & Logical 3. Assignment 4. Bitwise 5. Membership 6. Identity **Practical Tasks ((ANY ONE)** i) Write down a Python program which will find the average (Percentage) of marks in three subjects. ii) Write down a Python program which will ask two numbers to the user, store them in two variables a and b then interchange their values. iii) Write a Python program to find Gross salary when basic is entered. Gross Salary = Basic + HRA+DA. (Given HRA=15% of basic, DA=25% of basic)	2	CO2
4	**LLO 4.1** Write a Python program for solving a given problem using various If statements. Implement a Python program to demonstrate the use of the following conditional	Implement a Python program to demonstrate the use of the following conditional statements: 1. if statement 2. if..else statement	2	CO2

	statements: 1. if statement 2. if..else statement 3. if..elif..else statement 4. nested if statement	3. if..elif..else statement 4. nested if statement **Practical Tasks: (ANY TWO)** i) Write a program to find out if any integer is input through the keyboard. whether it is an odd number or an even number. ii) Write a program to determine whether the year is a leap year or not for any year is input through the keyboard. iii) Write down a program to find the biggest of three numbers. iv) Write a program to check whether a triangle is valid or not, when the three angles of the triangle are entered through the keyboard. v) If the three sides of a triangle are entered through the keyboard, write a program to check whether the triangle is an isosceles, equilateral, scalene or right-angled triangle. vi) Percentage marks obtained by a student are input through the keyboard. The student gets a division as per the following rules: 1) Percentage above or equal to 60 - First division 2) Percentage between 50 and 59 - Second division 3) Percentage between 40 and 49 - Third division 4) Percentage less than 40 - Fail Write a program to calculate the division obtained by the student.		
5	**LLO 5.1** Write a Python program for solving given problems using a while loop. **LLO 5.2** Write a Python program for solving a given problem using a for loop.	Implement a Python program to showcase the utilization of the following looping statements: 1. while loop 2. for loop 3. nested loop **Practical Tasks: (ANY TWO)** i) Program to find the factorial value of	2	CO2

		any number entered through the keyboard. ii) Program to print all prime numbers from 1 to 100. iii) Program to print the first 25 odd numbers. iv) The program calculates and prints the sum of the digits of the number input through the keyboard. v) Program to calculate the sum of all numbers from 1 to a given number. vi) Program to calculate the sum of all the odd numbers within the given range. vii) Program to count the total number of digits in a number. viii) Program to print all the even numbers within the given range.		
6	**LLO 6.1** Use loop control statements in Python to solve a given problem.	Implement a Python program to showcase the application of loop control statements, including continue, pass, break, and else. **Practical Tasks: (ANY TWO)** i) Write a program that continuously prompts the user to enter a password until the correct password is entered. If the entered password is correct, it prints a message and exits the loop. Otherwise, it displays an error message and continues prompting for the password. (Hint: use break) ii) Write down a program to find whether a given number is prime or not. (Hint: use break and if..else) iii) Write down a program which will repeatedly accept a number and display its square root till the user enters 0. (Hint: Use break and continue)	2	CO2
7	**LLO 7.1** Write a Python program to perform operations on a list.	Implement a Python program to showcase different list operations including appending elements, inserting elements at specific positions, removing elements, reversing the list, sorting the list, finding the index and count of elements, and clearing the list.	2	CO3

		Practical Tasks:(ANY ONE) i) Write a program to perform the following operations on a list of names. a) Create a list of 5 names - 'Anil', 'Amol', 'Aditya', 'Avi', 'Alka' b) Insert the name 'Anuj' before 'Aditya' c)Append the name 'Zulu' d)Delete 'Avi' from the list -e)Replace 'Anil' with 'AnilKumar' Alka' f) Sort all the names in the list g) Print reversed sorted list ii) Write a program to perform the following operations on a list of numbers. a) Create a list of 5 odd numbers b) Create a list of 5 even numbers c) Combine the two lists d) Add prime numbers 11, 17, and 29 at the beginning of the combined list e) Report how many elements are present in the list f) Replace the last 3 numbers in the list with 100, 200, 300 g) Delete all the numbers in the list h) Delete the list iii) Suppose a list contains positive and negative numbers. Write a program to create two lists—one containing positive numbers and another containing negative numbers.		
8	**LLO 8.1** Write a Python program to perform operations on a tuple.	Implement a Python program to illustrate various operations on a tuple, such as accessing elements, slicing, concatenating, repeating, determining length, checking element existence, finding index, counting occurrences, and converting between tuple and list. **Practical Tasks:(ANY ONE)** i) Given the following tuple ('F', 'a', 'b', 'b', 'e', 'r', 'g', 'a', Is', 't', 'd')	2	CO3

		Write a Python program to carry out the following operations: a) Add an ! at the end of the tuple Convert a tuple to a string Extract (lb', 'b') from the tuple b) Find out the number of occurrences of 'e' in the tuple Check whether 'r' exists in the tuple c) Convert the tuple to a list Delete characters 'b, 'e', and 'r' from the tuple. ii) Write a Python program that simulates a grade where student names and their corresponding grades are stored in a tuple of tuples. It performs various operations like accessing elements, determining length, checking element existence, finding index, and counting occurrences. iii) Write a Python program to manage an inventory of books using a tuple of dictionaries. It performs operations like accessing elements, slicing, and converting between tuples and lists. iv) Write a Python program to manage a list of employee details using a tuple of tuples. It performs operations like repeating and concatenating.		
9	**LLO 9.1** Write a Python program to manipulate the set.	Implement a Python program to demonstrate various operations on sets, such as union, intersection, difference, symmetric difference, checking subset and superset, adding and removing elements, discarding elements, and clearing the set. **Practical Tasks:(ANY ONE)** i. Given the following two sets engineers = {'Vijay', 'Sanjay', 'Ajay', 'Sujay', 'Dinesh'} managers = {'Aditya', 'Sanjay'} Write a program to perform union, intersection and difference operations that can be carried out on any two sets. ii) Write a python program for product	2	CO3

		inventory management where, we have two sets representing available products in two different stores. We can use set operations such as Union, Intersection, Difference, Symmetric difference and Checking if one store's products are subset/superset of the other in products to manage the inventory.		
10	**LLO 10.1** Write a Python program to perform operations on the dictionary.	Implement a Python program to demonstrate various operations on dictionaries, such as accessing values, adding and modifying key-value pairs, removing key-value pairs, checking for key existence, getting keys and values, and clearing the dictionary. **Practical Tasks:(ANY ONE)** i) Write a Python program where users can register by providing a username and password. The program stores the user credentials in a dictionary. After the registration process, it performs the basic operations on dictionaries, including accessing values, adding and modifying key-value pairs, removing key-value pairs, checking for key existence, getting keys and values, and clearing the dictionary. ii) Write a Python program where the teacher can enter student grades. The program stores the student's grades in a dictionary. After the student grade process, it performs the basic operations on dictionaries operations on a nested dictionary, including accessing values and modifying key-value pairs. iii) Write a Python program where the store manager can enter the inventory of products. The program stores the inventory of products in a dictionary After the inventory of products process, how to iterate over a dictionary to perform various operations such as Accessing values and keys using a loop, adding a prefix to all string values, Removing key-value pairs based on a condition.	2	CO3

11	**LLO 11.1** Write a Python program to use built-in functions on the list.	Implement Python program to demonstrate the use of various built-in functions on a list, including len() to get the length of the list, sum() to calculate the sum of elements,•min() and •max() to find the minimum and maximum elements, •sorted() to sort the list, and •reversed() to reverse the list. **Practical Tasks:(ANY ONE)** i) Write a Python program which analyzes student grades stored in a list. It uses built-in functions like len( ) sum( ), min( ), max( ), sorted( ), and reversed( ) to perform various operations. ii) Write a Python program which manages an inventory of products stored in a list. It uses built-in functions like len( ) sum( ), min( ) , max( ) , sorted( ) , and reversed( ) for inventory analysis. iii)Write a Python program which manages a list of employee salaries. It utilizes built-in functions like len( ) sum( ), min( ), max( ), sorted( ), and reversed( ) to analyze employee salaries.	2	CO4
12	**LLO 12.1** Write functions to solve a given problem.	Write a user define function to implement the following features: 1. Function without argument 2. Function with argument 3. Function returning value **Practical Tasks:(ANY ONE)** i) Write down a program which will use a function to find the value of $y=x^2+3x+5$; when the value of x is entered through the keyboard. ii) Write down a program which will use a function to display values of squares of numbers between 1 to 25. iii) Write down a program which will accept marks in three different subjects and show the result as pass or fail. Use	2	CO4

		functions to find the average and minimum		
13	**LLO 13.1** Write a user-defined module to solve a given problem.	Implement a Python program to create and use a user-defined module for a given problem. **Practical Tasks:(ANY ONE)** i) Write a Python program to create a module that contains functions to calculate the area and perimeter of a rectangle. ii) Write a Python program to define a module named temperature_ converter that contains functions to convert temperature between Celsius and Fahrenheit scales. iii) Write a Python program to define a module named basic calculator that contains functions to perform basic arithmetic operations.	2	CO4
14	**LLO 14.1** Developing a program that employs parametric equations to compute and visualize coordinates on a specified curve.	Implement a program that employs parametric equations to compute and visualize coordinates on a specified curve. **Practical Tasks:(ANY ONE)** i) Develop a Python program to calculate and plot the coordinates of points on an ellipse using parametric equations and Matplotlib, based on inputs of semi-major axis (a) and semi-minor axis (b). ii) Develop a Python program that computes and plots the This program plots a parametric spiral using parametric equations for a spiral curve. using Matplotlib, the coordinates of points on an involute curve based on the radius of the base circle and the number of points. Adjust the radius and num_points parameters according to your requirements.	2	CO5

		iii) Develop a Python program that computes and plots an Archimedean spiral using parametric equations for a spiral curve using Matplotlib, the coordinates of points on a spiral curve based on the constant determining the distance between each turn. and values of t from 0 to 10pi Adjust the distance between each turn. and values of t from 0 to 10pi according to your requirements.		

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

SELF-LEARNING - MICRO PROJECT/ASSIGNMENT/ACTIVITIES(ANY FOUR)

1. Develop a Python program to calculate the shear force at a given distance along the simple supported beam and the bending moment at the same distance. The input parameters include the point load magnitude, beam length and the distance of the point load from the left support. Adjust these parameters according to your specific beam configuration and point load.

2. Develop a Python program that computes the frictional force acting on an object on an inclined plane. The program's function should accept parameters such as the object's mass, acceleration due to gravity, angle of the inclined plane, and coefficient of friction. It should then calculate the normal force, maximum frictional force, and weight parallel to the inclined plane. By comparing the weight with the maximum frictional force, it determines the frictional force. Finally, the program should print the calculated frictional force. Adjust the input parameters as per your specific scenario.

3. Develop an Arithmetic Calculator Python program capable of executing fundamental arithmetic operations (addition, subtraction, multiplication, division) according to user input.

4. Develop a Python program that utilizes a dictionary for storing book details, comprising titles and authors. Enable users to search for books based on either title or author.

5. Develop a Python program featuring a module specifically designed to sort a list of numbers using diverse algorithms (e.g., bubble sort, insertion sort, selection sort).

6. **Develop a Student Grade Calculator Python program:**
   - Obtain input marks for various subjects from the user and compute the total score, average score, and grade according to predefined criteria (e.g., A, B, C, D).
   - Utilize functions to segment the code for calculating the total score; average score, and grade.
   - Incorporate error handling to validate input marks and furnish suitable feedback to the user.

7. Develop a simple Contact Management System:

- Construct a user-friendly contact management system allowing users to add, delete, search, and display contacts.
- Utilize dictionaries to store contact information, including name, phone number, and email**.**

(**Note:** Faculty members can opt to choose and assign Microprojects/assignments from their specific programs instead of the aforementioned tasks.)

VI. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	a) Computer System with all necessary Peripherals and Internet connectivity. b) Any Open Office Software c) Any Browser (Any General Purpose Computer available in the Institute)	ALL

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

NOT APPLICABLE

VIII. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)	Summative Assessment (Assessment of Learning)
Lab performance, Assignment, Self-learning and Seminar/Presentation	Lab. Performance, viva voce

IX. 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
CO1	2	3	2	3	--	--	2		
CO2	2	3	2	3	--	--	2		
CO3	2	3	2	3	--	--	2		
CO4	2	3	2	3	--	--	2		
CO5	2	3	2	3	--	--	2		

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

X. SUGGESTED LEARNING MATERIALS/BOOKS

Sr.No	Author	Title	Publisher
1	Kenneth A. Lambert	Fundamentals of Python: First Programs 2E	Cengage Learning India Private Limited, ISBN:9789353502898
2	Yashavant Kanetkar, Aditya Kanetkar	Let Us Python - 6th Edition	BPB Publications, ISBN: 9789355515414
3	K. Nageswara Rao,Shaikh Akbar	Python Programming	Scitech Publications (India) Pvt. Ltd. ISBN:9789385983450
4	Mark Lutz	Learning Python	O'Reilly Publication, 5th Edition ISBN13:9781449355739
5	David Beazley	Python Essential Reference	Addison-Wesley Professional 4th Edition ISBN:9780672329784

XI. LEARNING WEBSITES & PORTALS

Sr.No	Link/Portal	Description
1	https://www.w3schools.com/python	The website provides comprehensive resources for learning Python programming language. It includes tutorials, examples, and exercises covering various Python topics such as syntax, data types, control structures, functions, and modules.
2	https://www.tutorialspoint.com/index.htm	The website offers a comprehensive guide to Python programming, covering essential topics such as syntax, data types, control structures, functions, modules, and advanced concepts like object-oriented programming and exception handling.
3	https://www.python.org/	The website serves as the official resource for the Python programming language. Users can access Python documentation, tutorials, guides, and references to learn about Python's syntax, features, and libraries. Additionally, the website provides downloads for the latest Python releases, including the Python interpreter and standard library, as well as links to community forums, events, and development resources.,
4	https://realpython.com	The website is a comprehensive platform dedicated to providing high-quality tutorials, articles, and resources for Python programmers of all levels. The website covers a wide range of topics,
5	https://www.geeksforgeeks.org/python-programming-language/	Tutorials, articles, and coding challenges focused on Python programming, suitable for beginners and advanced learners.
6	https://stackoverflow.com/	Community-driven Q&A platform where you can find answers to common Python questions, seek help with programming challenges, and learn from experienced developers.

Name & Signature:

Mr.S.B.Kulkarni
Lecturer in Mechanical Engineering

Mr. A.M.Joshi
Lecturer in Mechanical Engineering

(Course Experts)

Name & Signature:	Name & Signature:
Dr. Sachin. S. Bharatkar (Programme Head)	**Shri. S.B. Kulkarni** (CDC In-charge)

GOVERNMENT POLYTECHNIC, PUNE
'120 – NEP' SCHEME

PROGRAMME	**DIPLOMA IN ELECTRICAL ENGINEERING**
PROGRAMME CODE	**02**
COURSE TITLE	**DC MACHINES AND TRANSFORMERS**
COURSE CODE	**EE31205**
PREREQUISITE COURSE CODE & TITLE	**EE 21201 - FUNDAMENTALS OF ELECTRICAL ENGINEERING**
CLASS DECLARATION COURSE	**NO**

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	
EE31205	DC MACHINES AND TRANSFORMERS	DSC	2	0	2	2	6	3	2	15	35	50	20	25	10	25@	10	25	10	125

Total IKS Hrs for Term: 00 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 15 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 course.
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:

DC machines, including motors and generators, are essential in electrical engineering because of their reliability and versatility. They offer excellent speed control and torque, making them ideal for precise applications like robotics, conveyors, and electric vehicles. Their strong and durable design ensures long-lasting performance in various industries.

Transformers are crucial for transmitting electrical power efficiently. They increase voltage for long-distance transmission and reduce it for safe distribution. Transformers also provide electrical isolation, improving safety and reducing risks. Modern transformers are highly efficient, reliable, and designed to last, playing a key role in ensuring stable and uninterrupted power supply in industries and households.

III. COURSE-LEVELLEARNINGOUTCOMES(CO'S)

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

- **CO1**: Analyze the construction, operation, and performance of DC machines for industrial applications.
- **CO2**: Evaluate the performance characteristics and efficiency of single-phase transformers in power systems.
- **CO3**: Demonstrate the ability to evaluate and select three-phase transformers based on their advantages, limitations, and application requirements.

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 DC MACHINE (CL Hrs-06, Marks-08)			
1.	TLO 1.1 Describe working, construction and functions of each part of DC machine with sketches.(Motor and Generator) TLO 1.2 Draw circuit diagrams of various connections of Motor and Generator . TLO 1.3 Derive E.M.F equation. Of Motor and Generator TLO 1.4 State significance of back emf. TLO 1.5 Derive torque equation of DC motor TLO 1.6. Justify the need of DC motor starter and explain its working. TLO 1.7 Calculate the losses and efficiency of dc motor.	1.1 Construction & Functions of various parts , Working principle of DC machine (Motor and Generator) 1.2 Types of DC machines (Motor and Generator) based on the interconnections of Field and Armature winding. 1.3 E.M.F Equation (Motor and Generator) 1.4 Significance of back emf , 1.5 Torque- speed characteristics of DC Motor 1.6 Necessity of starter,Working of Three-point starter. 1.7 Losses in DC motor and its Efficiency	Lecture Using Chalk-Board , Video Demonstrations,Flipped Classroom, Case Study, Collaborative learning, Presentations	CO1
	UNIT-II SINGLE PHASE TRANSFORMER (CL Hrs-14, Marks-15)			
2	TLO 2.1. Describe construction, working and role of each part of single-phase transformer. TLO 2.2 Describe Why the transformer works on AC supply only and the effect if DC is applied across he transformer winding. TLO 2.3 Differentiate between different types of transformers along with sketches TLO 2.4 Derive EMF equation	2.1 Construction , Working principle function & materials used for different parts of Single-phase transformer 2.2 Performance of the transformer if DC supply is applied to the transformer. 2.3 Core Type and shell type, Dry Type and Hermetically sealed transformer,Single Phase Distribution Transformer and High voltage Distribution Trasnformer 2.4 EMF equation and transformer,		

Sr. No	Theory Learning Outcomes (TLO'S) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
	of transformer and define ratios of transformer. TLO 2.5 Justify why rating of the transformer is expressed in KVA. TLO 2.6 i) State the properties of an ideal transformer. ii) Draw and explain the phasor diagram of ideal transformer and practical transformer on no load. iii) Describe various voltage drops in the windings for transformer is on load. iv) Draw & explain the phasor diagram of transformer on load. TLO 2.7 i) State the need for conducting O.C. & S.C. test on single phase transformer ii) Determine the various parameters of equivalent circuit from OC /SC test TLO 2.8 i) Draw the equivalent circuit of a single-phase transformer. ii) Determine Parameters of equivalent circuit of single-phase transformer. TLO 2.9 i)State the various losses in transformer. ii) Derive expression for efficiency and the condition for maximum efficiency of a single-phase transformer . TLO 2.10 i) Describe construction and working of an autotransformer with sketches. ii) Distinguish between an autotransformer and two winding transformer. iii) List the advantages, limitations & applications of an	Transformer ratios. i) Numerical on emf equation & ratios. ii) Numerical on Transformer ratios 2.5 Rating of the transformer. 2.6 Properties of an ideal transformer i) Ideal Transformer on no-load with phasor diagram. ii) Practical transformer on no load with Phasor diagram. iii) Various voltage drops in the windings for practical transformer is on load. iv)Numerical on calculating winding drops and induced EMFs, voltages. v) Phasor diagram of transformer on load for different type of load. 2.7 Direct load test, OC and SC test and their necessity 2.8 i) Determine Parameters of equivalent circuit (Exact, Approximate) of single-phase transformer. ii) Numerical on approximate equivalent circuit 2.9 i)Losses in transformer. Various techniques to minimise them. ii) Efficiency , All day Efficiency iii) Expression for efficiency and the condition for maximum efficiency of a single-phase transformer. iii) Numerical on efficiency & all day efficiency 2.10 i)Construction and working of an autotransformer ii) Distinguish between autotransformer and two winding transformer. iii)Advantages, limitations& applications of an autotransformer	Lecture Using Chalk-Board , Video Demonstrations, Flipped Classroom, Case Study, Collaborative learning, Presentations	CO2

Sr. No	Theory Learning Outcomes (TLO'S) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
	autotransformer. TLO 2.11 State the IS Codes used for transformer.	2.11 IS code of Practice		
UNIT-III THREE PHASE TRANSFORMER (CL Hrs-10, Marks-12)				
3	TLO3.1Describe construction of Three Phase Transformer TLO 3.2 Compare 3 phase transformer with a bank of 3 single phase transformers. TLO 3.3 Describe the significance of windings connection of three phase transformer. TLO 3.4 State the need and condition for parallel operation of single phase and three phase transformers. TLO 3.5 Explain the parallel operation & determine the load sharing of single phase and three phase transformer.	3.1 Construction of 3 phase transformer. 3.2 Comparison between three phase transformer and bank of 3 single phase transformers. 3.3Advantages & limitations of star-star, Delta-Delta, Star-Delta, Delta-Star winding connections. Types of Connection of Three phase Transformer 3.4 Need of Parallel Operation of single-phase transformer and three phase transformer. 3.5 Condition of Parallel Operation of single-phase transformer and three phase transformer. 3.4 Parallel operation and load sharing of single phase and three phase transformer with phasor diagram. 3.5 Numericals on Parallel Operation of single-phase transformer .	Lecture Using Chalk-Board , Video Demonstrations, Flipped Classroom, Case Study, Collaborative learning, Presentations	CO3

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 Know the constructional features of D. C. machine LLO1.2Observe the shape , placement of poles of D. C. machine (salient pole structure)	Identify the constructional features of D.C. machine to know the function & material used for each part.	02	CO1
2	LLO 2.1 Obtain speed of the D.C. shunt motor below & above its rated speed. LLO 2.2 obtain smooth control of the speed	Control the speed of D.C. shunt motor	02	CO1
3	LLO 3.1 Identify and label different parts of a transformer. LLO 3.2 State the function and importance of each identified part. LLO 3.3 Demonstrate the testing of windings using a multimeter to check continuity and resistance.	Identification, Description, and Testing of Transformer Parts and Windings	02	CO2,CO3

Sr. No	**Practical / Tutorial / Laboratory Learning Outcome (LLO)**	**Laboratory Experiment / Practical Titles /Tutorial Titles**	**Number of hrs.**	**Relevant COs**
4	LLO4.1Use the auto transformer in step up & step-down modes LLO4.2 Check the functioning of Transformer	Connecting single phase autotransformer in step up & step-down modes.	02	CO2
5	LLO 5.1 Measure the primary & secondary voltages for calculating various ratios of single phase transformer. LLO 5.2 Verify the relationship between the ratios.	Calculating the voltage ratio & current ratio of single-phase transformer to verify the relation between them.	02	CO2
6	LLO 6.1 Observe variation in secondary voltage when the transformer is loaded. LLO 6.2 Verify relationship between load and efficiency LLO 6.3 Draw phasor diagram	Conducting direct loading test on single phase transformer to determine its efficiency and regulation.	02	CO2
7	LLO7.1Select proper range of meters to conduct the O.C. and S.C. test LLO7.2Measure the constant and variable losses & calculating the efficiency of the transformer	Performing O.C. and S.C. test on single phase transformer to calculate efficiency, regulation of transformer.	02	CO2
8	LLO8.1Calculate core & winding parameters of transformer	Performing O.C. and S.C. test on single phase transformer to determine parametrs of equivalent circuit of transformer.	02	CO3
9	LLO 9.1 Observe cooling methods of three phase transformer LLO 9.1 Observe constructional details of three phase transformer.	Identify the constructional features of three phase transformers to know the function & material used for each part.	02	CO3
10	LLO 10.1 Measure load shared by each transformer at different load conditions. LLO 10.2 Interpret load sharing performance of transformer from the measured values.	Perform parallel operation of two single-phase transformers and determine the apparent and real power load sharing.	02	CO2
11	LLO 11.1 Mark the terminals of the primary and secondary winding of the transformer with respect to polarity. LLO 11.2 Connect the transformer for additive and subtractive polarity.	Perform polarity test on a single-phase transformer whose polarity markings are masked.	02	CO3
12	LLO 12.1 Identify the primary and secondary winding terminals belonging to the same phase of the given three-phase transformer using phasing out test.	Perform Phasing out test on a three-phase transformer whose phase markings are masked.	02	CO3

Sr. No	Practical / Tutorial / Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
13	LLO 13.1Connect the auto-transformer in step-up and step-down modes noting the input/output readings.	Connect the autotransformer in step-up and step-down modes noting input/output readings.	02	CO3
14	LLO 14.1 Check the Functioning of CT	Check the Functioning of CT	02	CO2
15	LLO 15.1 Check the Functioning of PT	Check the Functioning of CT	02	CO2

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

Microproject: Teacher should give the topic on theory/lab contents

D.C. Motor

- **Line Following Robot**: Build a small robot that follows a line using sensors (like infrared or reflectance sensors) to detect the path. Use a DC motor to drive the wheels and another motor for steering. This project involves both hardware assembly and programming logic.
- **Mini Conveyor Belt**: Construct a miniature conveyor belt system using a DC motor and a few rollers. You can use this setup to demonstrate automated material handling concepts or create a small sorting system.
- **Automated Curtain Opener**: Design a mechanism using a DC motor to open and close curtains automatically. Use limit switches or sensors to detect when to stop the motor based on the curtain's position.
- **Solar Tracker**: Build a solar panel tracker that adjusts the panel's angle to maximize sunlight exposure throughout the day. Use a DC motor to rotate the panel horizontally or vertically based on light intensity measurements from sensors.
- **Miniature Wind Turbine**: Construct a small wind turbine using a DC motor as a generator. You can connect LEDs or a small battery to demonstrate how wind energy can be converted into electrical energy.
- **Electric Skateboard or Scooter**: Build a small electric vehicle using a DC motor for propulsion. This project involves designing a chassis, integrating motor control with a throttle mechanism, and ensuring safety features.
- **DIY Electric Toy Car**: Modify a toy car by replacing its manual propulsion system with a DC motor and batteries. This project is suitable for beginners and allows for creativity in designing the chassis and integrating the electrical components.
- **Remote-Controlled Boat**: Create a remote-controlled boat using a DC motor to drive a propeller. This project involves waterproofing electronics and ensuring the boat's stability and maneuverability in water.
- **Gripper or Robotic Arm**: Construct a simple robotic arm or gripper using DC motors to control the movement of joints or fingers. Use potentiometers or encoders for feedback to control the arm's position accurately.

Transformers

1. **Transformer Construction and Testing**: Build a small single-phase transformer using laminated iron core, copper wire, and insulation materials. Measure and verify its voltage transformation ratio and efficiency.
2. **Voltage Converter**: Design a voltage converter circuit using a single-phase transformer to step up or step down AC voltage. This project can include using diodes and capacitors for rectification and smoothing.
3. **Power Supply Unit**: Construct a simple AC to DC power supply unit using a transformer for voltage stepping and rectification circuitry (diodes and capacitors). This project can power low-voltage DC devices from a standard AC outlet.
4. **Isolation Transformer**: Build an isolation transformer to electrically isolate sensitive equipment or devices from the mains supply, enhancing safety and reducing electrical noise.
5. **Signal Transformer for Audio Applications**: Design and build a signal transformer suitable for audio applications, such as impedance matching or line isolation in audio circuits.
6. **Transformer Coupled Amplifier**: Create a transformer-coupled audio amplifier circuit. This project involves designing the amplifier stages and selecting an appropriate transformer for coupling signals between stages.
7. **Variable Autotransformer (Variac)**: Build a variable autotransformer using a single-phase transformer with multiple taps on the winding. This project allows for adjustable AC voltage output for testing and experimental purposes.
8. **Transformer-based Voltage Stabilizer**: Design a simple voltage stabilizer circuit using a single-phase transformer and a voltage regulator (such as a Zener diode or IC regulator) to maintain a stable output voltage despite fluctuations in input voltage.
9. **Wireless Power Transfer System**: Explore wireless power transfer using a single-phase transformer. Design a resonant circuit for efficient power transmission over short distances, such as for charging mobile devices wirelessly.
10. **Grid Tie Inverter**: Design a small grid tie inverter using a single-phase transformer to convert DC power (from solar panels or batteries) into AC power synchronized with the grid.
11. **Energy Loss Analysis in Transformers:** Construct a small transformer and analyze its energy losses, including core losses and copper losses. Compare efficiency under different load conditions.
12. **Temperature Monitoring System for Transformers:** Design a system to monitor the temperature of a transformer under load using temperature sensors and display it using an LCD or an LED indicator.
13. **Transformer Efficiency Improvement:** Experiment with different core materials (e.g., laminated iron, ferrite) to study their impact on transformer efficiency and performance.
14. **High-Frequency Transformer for SMPS:** Design and build a high-frequency transformer for a switched-mode power supply (SMPS) circuit and analyze its operation.
15. **Transformer-Based Inverter:** Construct an inverter circuit using a transformer to convert DC to AC for operating small appliances.
16. **Step-Down Transformer with Multiple Outputs:** Design a transformer with multiple secondary windings to provide various voltage levels for different applications.
17. **Harmonic Analysis in Transformer Load:** Use a transformer to power a nonlinear load and measure the harmonics generated in the system using an oscilloscope or harmonic analyzer.
18. **Current Transformer for Measurement Applications:** Build and test a current transformer for measuring high AC currents with a low-power measurement circuit.
19. **Transformer Load Tester:** Design a device to test the performance of transformers under different load conditions and measure voltage regulation and efficiency.
20. **Smart Transformer with IoT Integration:** Build a transformer monitoring system that uses IoT to collect and transmit data like load, voltage, current, and temperature for remote monitoring.
21. **Three-Phase Transformer Bank:** Construct a three-phase transformer bank using three single-phase transformers. Study its operation under different connection configurations (Delta-Delta, Delta-Star, Star-Star).

22. **Pulse Transformer for Switching Applications:** Design a pulse transformer for high-speed switching circuits, such as in power electronics or communication systems.
23. **Noise Reduction in Transformers:** Experiment with different shielding techniques to reduce electromagnetic noise from transformers in sensitive electronic circuits.
24. **Transformer Protection Circuit:** Develop a protection circuit for a transformer using fuses, circuit breakers, or thermal cutoffs to prevent damage under fault conditions.
25. **Custom Toroidal Transformer Design:** Wind and construct a toroidal transformer and compare its efficiency and size advantages over a laminated core transformer.
26. **Overvoltage Protection for Transformers:** Design a circuit with MOVs (Metal Oxide Varistors) and surge protectors to safeguard transformers against voltage spikes.
27. **Transformer Balancing for Audio Applications:** Create a balanced audio line using a transformer for noise reduction and signal clarity in professional audio systems.
28. **Inductive Coupling for Data Transfer:** Use a small transformer to demonstrate wireless data transfer between two circuits through inductive coupling.
29. **Transformer-Based Dimmer Circuit:** Build a dimmer circuit for light control using a transformer and phase-controlled rectifier.
30. **Transformer for Renewable Energy Systems:** Design a transformer to interface with renewable energy sources like wind or solar for efficient energy transfer to the grid or battery storage systems.

Assignment: -Numericals to be solved by students as self learning and teacher should assess the same

VII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED

Sr.No	**EquipmentNamewithBroadSpecifications**	**Relevant LLONumber**
1	Stand alone 5 kW, 220 V, D.C Shunt motor	1,2,
2	5 kW, 220 V, D.C. M-G set Shunt motor	1,2,
3	Rheostats (1A to 10 A)	All
4	D.C. Ammeter, D.C. Voltmeter, Tachometer	1,2,
5	Single phase, 2 kVA,50 Hz, Auto Transformer (0-230) V	3 to 15
6	Single phase Transformer 2.5 kVA, 50 Hz, 230/115 V	3 to 15
7	Single phase 3 kW, 230 V, Load Bank : Resistive,Capacitive,Inductive	3 to 15
8	Low Power Factor Wattmeter (0-5-10)A, 250/500 V	5,6,7,8,10
9	Multimeterof suitable range	All

VIII. SUGGESTED FOR WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE

(SpecificationTable)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	**D.C. Machine**	CO1	06	02	03	03	08
2	II	**Single Phase Transformer**	CO2	14	03	06	06	15
3	III	**Three Phase Transformer**	CO3	10	02	04	06	12
			Total	**30**	**07**	**13**	**15**	**35**

IX. ASSESSMENT METHODOLOGIES / TOOLS

Formative assessment (Assessment for Learning)	Summative Assessment (Assessment of Learning)
Two-unit tests of 15 marks will be conducted and an average of marks obtained in these two-unit tests will be considered. Each practical will be assessed for 25 marks and an average of all marks obtained will be considered.	End semester assessment of 35 marks through offline mode of examination. End semester summative assessment of 25 marks for laboratory learning.

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**	2	3	3	2	2	2
CO2	3	3	3	3	2	2	3	3	2	3	2
CO3	2	3	2	2	2	2	3	2	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	Theraja,B.L.; Theraja, A. K.	ATextBookofElectrical Technology Vol-II	S.ChandandCo.Ramnagar,NewDelh, 2012; ISBN : 9788121924405
2	Electrical Machine	S. K. Bhattarcharya	Mcgraw Hill ISBN9789332902855

3	Electrical Machine-I	J. B. Gupta	S. K. Kataria& sons, New Delhi, ISBN 9789350140550
4	Electrical Machines- I	U. A. Bakshi, M. V. Bakshi	Technical Publications, Pune ISBN 9788184317756
5	Electrical machines - Theory and Practice	M.N. Bandopadhyay	PHI publication. ISBN 812032997X, 9788120329973
6	Principles of Electrical Machines	V. K. Mehtha	S.Chand and Co., New Delhi

XII. LEARNING WEBSITES& PORTALS

Sr.No	Link/Portal	Description
1	https://nptel.ac.in/	D.C. machine, Transformer literature, video lectures
2	https://www.youtube.com/watch?v=oJtY6xn6dkQ	Video on transformer
3	https://en.wikipedia.org/wiki/Transformer	Transformer basics

Note:
Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

Name & Signature:

Smt. V.P.Karhad
Lecturer in Electrical Engineering

Smt.T.J.Bhangale
Lecturer in Electrical Engineering

(Course Experts)

Name & Signature:	Name & Signature:
Dr. S.V.Bhangale (Programme Head)	**Shri. S. B. Kulkarni** (CDC In-charge)

GOVERNMENT POLYTECHNIC, PUNE
'120-NEP' SCHEME

PROGRAMME	**DIPLOMA IN ELECTRICAL ENGINEERING**
PROGRAMME CODE	**02**
COURSE TITLE	**ELECTRICAL ESTIMATION AND CONTRACTING**
COURSE CODE	**EE41202**
PREREQUISITE COURSE CODE AND TITLE	**EE31201-ELECTRICAL MATERIALS AND DRAWING**
CLASS DECLARTION COURSE	**YES**

I. LEARNING AND 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	
EE41202	ELECTRICAL ESTIMATION & CONTRACTING	DSC	03	00	02	01	06	03	03	30	70	100	40	25	10	-	-	25	10	150

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 course.
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 thoroughly explores important aspects of wiring installations, covering planning of electrical installation and contracts, adherence to electrical by laws, understanding supply systems, implementing effective installation methods, and mastering the estimation of electrical wiring, installations, and contracting. This course provides students with holistic knowledge to pursue careers as contractors and entrepreneurs and empowers them to successfully execute a wide range of electrical wiring installation projects with confidence and proficiency.

III.COURSE LEVEL LEARNING OUTCOMES (COS)

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

CO1: Prepare tender , quotation, comparative statement,and supply order.
CO2: Design and estimate domestic and commercial electrical installations.
CO3:Design and estimate industrial installations.
CO4:Design and estimate public lighting installations
CO5:Design and estimate distribution line installations.
CO6:Design illumination schemes.

IV. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr. No.	Theory Learning Outcomes (TLO's) aligned to CO's.	Learning content mappedwith TLO's	Suggested Learning Pedagogies	Relevant COs
		SECTION - I		
		UNIT - I ESTIMATES AND CONTRACTS (CL Hrs - 6, Marks –10)		
1	TLO 1.1 Apply the principles of NEC 2023 during the preparation of the given document. TLO 1.2 State the purpose of preparation of the given type(s) of estimates. TLO 1.3 State the purpose of awarding the given type(s) of contracts. TLO 1.4 Prepare tender documents, quotations, and bills for the specified work.	1.1 National Electrical Code 2023 (NEC 2023): Importance,various types of electrical installation- Non-industrial and industrial, Standard value of voltages and their limits, Fundamental principles of electrical installations, Safety in electrical work, permit to electrical work, safety instruction and safety practices 1.2 Estimating and costing: Purpose, Qualities of a good estimator, essential elements of estimating and costing, Meaning and purpose of- rough estimate, detailed estimate, supplementary estimate, annual maintenance estimate and revised estimate, Factors to be considered while preparation of detailed estimate and economical execution of work. 1.3 Contracts: Concept, types, roles, and qualities of a good contractor 1.4 Tender and Quotation: Types of tenders, tender notice, preparation of tender document, and method of opening of tender, Government e-Market Place (GeM), features and benefits of GeM, Quotation, quotation format, comparison between tender and quotation, Comparative statement, format of comparative statement. Order format, placing of purchase order, Principles of execution of works, planning, organizing and completion of work, billing of work.	Chalk and board lectures Tutorial Assignment Demonstration	**CO1**
		UNIT - II DOMESTIC AND COMMERCIAL INSTALLATIONS (CL Hrs – 08, Marks- 12)		
2	TLO 2.1 Interpret the given electrical installation plan and electrical diagrams. TLO 2.2 Estimate materials required for the given domestic installations. TLO 2.3 Estimate materials required for the given commercial installations.	**2.1** Electrical Drawing: Electrical symbols used in electrical diagrams as per NEC 2023, , Electrical diagrams, and their Classification. Methods of representation for the wiring diagram- multiline and single line representation, Necessity and reading of Civil Engineering building drawing. Interpretation of electrical installation plan and electrical diagrams. 2.2 Design of Domestic Installations: Steps to be followed for design and estimation of domestic installations. Design consideration of electrical installation in domestic installations. Design, drawing,	Lectures using Chalk-Board Presentations Case Study Site/Industry Visit	**CO 2**

	TLO 2.4 Estimate materials required for a given type of service connection.	estimation, and costing of a domestic installation having a maximum 5 kW load. 2.3 Design of Commercial Installations: Steps to be followed for design and estimation of Electrical commercial installations. 2.4 Design electrical installation scheme of small commercial installations of classroom , small shop, dispensary etc. 2.5 Service Connection: Underground and overhead,diagram and description. Calculation of material required for underground and overhead service connection. (Simple numerical based on above points)		
UNIT - III INDUSTRIAL INSTALLATIONS (CL Hrs- 08, Marks-13)				
3	TLO 3.1 Select wiring types for industrial installations. TLO 3.2 Draw an installation plan, wiring diagrams and single-line diagrams for the given industrial installations. TLO 3.3 Describe the given design considerations of an industrial installation. TLO 3.4 Carry out estimation for the given industrial installations.	3.1 Difference between non-industrial and industrial installations, General characteristics of industrial installation, and selection of wiring system. 3.2 Wiring diagram and single line diagram for single-phase and three-phase motors, Installation plan. 3.3 Design Considerations: Calculation of Motor current, deciding the cable size, deciding the size of the Conduit, deciding the fuse rating, deciding distribution board and main switch/ MCB, and deciding the starter for Motors. 3.4 Design electrical installation scheme and preparation of estimate of the agricultural pump, flour mill and small industrial unit having a total aggregate three-phase load of less than 30 kW. (Simple numerical based on above points)	Lectures Using Chalk-Board Presentations Case Study Site/Industry Visit	**CO3**
SECTION-II				
UNIT - IV PUBLIC LIGHTING INSTALLATION (CL Hrs-08, Marks-14)				
4	TLO 4.1 Describe given terms related to public lighting installation. TLO 4.2 Select proper materials for streetlight installation. TLO 4.3 Select proper materials for High-mast lighting installation. TLO 4.4 Carry out estimation of streetlights and High-mast lighting.	4.1 Classification of outdoor installations, street lighting/ public lighting installation, terminology used according to NEC 2023 aim of public lighting installation, classification of roads, standard layout of roads. 4.2 Street light pole structures. Selection of equipment, and sources used in street light installations. Cables recommended types and sizes of cable. On-off Control of equipment of street light installation. 4.3 High-mast pole structure, selection of equipment, wiring diagram. 4.4 Design, estimation and costing of streetlights and High-mast lighting.	Lecture Using Chalk-Board Presentations Case Study Site/Industry Visit	**CO4**

UNIT - V DISTRIBUTION LINES (CL Hrs-08, Marks-11)				
5	TLO 5.1 Compare the given types of distribution lines. TLO 5.2 Describe the given material required for distribution lines. TLO 5.3 Carry out estimates for the specified distribution lines.	5.1 Block Diagram of Electrical Power system, Types of Distribution lines - Primary and Secondary, Overhead and Underground,and comparison between them. 5.2 Materials used for distribution line HT (11kV) and LT (415 V), Cables used for distribution line, factors determining the selection of LT/ HT power cables, and cable termination methods. Design, estimation and costing of HT (11kV), LT (415 V) overhead line and underground cabling. (Simple numerical based on above points)	Presentations Lecture Using Chalk-Board, Case Study Site/Industry Visit	**CO5**
UNIT – VI ILLIMINATION IN RESIDENTIAL INSTALLATION (CL Hrs-07, Marks-10)				
6	TLO6.1 Define various terms related to illumination. TLO6.2. State laws of illumination TLO6.3. Describe various factors affecting the illumination TLO6.4. Describe different types of lighting arrangements and Design consideration of good lighting scheme TLO6.5. State the use of various lamps & their illumination levels. TLO6.6. Describe the construction & working of various lamps. TLO6.7. Calculate number of luminaries. TLO6. Design the illumination scheme for small installation	6.1 Introduction,different terms used in illumination:Luminous flux, Luminous intensity, Lumen, Illumination or illuminance, Lux, Space-height ratio, utilization factor, depreciation factor, luminous efficiency 6.2 Laws of illumination-Inverse Square Law, Cosine Law, Numerical based on illumination received directly underneath, illumination received on horizontal screen and screen moved horizontally at certain distance 6.3 Factors affecting the illumination. 6.4 Different types of lighting arrangements, Design consideration of good lighting scheme. 6.5 Various types of lamps, their construction, Lumens per watt of different types of lamps, illumination levels required for different places. 6.6 Calculation of average lux level. (Numerical based on design of illumination scheme for residential unit)	Lectures Using Chalk-Board Case Study Site/Industry Visit	**CO6**

V.LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL/ TUTORIALEXPERIENCES.

Sr. No.	Practical/Tutorial/LaboratoryLearning Outcome (LLO)	Laboratory Experiment/Practical Titles/Tutorial Titles	Number of Hrs.	Relevant COs
1	LLO 1.1 Procure tender notices fom different News papers.	Procure tender notices fom different News papers.	01	CO1
2	LLO 2.1 Prepare a tender notice for purchasing electrical mahines and equipment.	*Prepare a tender notice for purchasing 3-phase,200KVA distribution transformer.	01	CO1
3	LLO 3.1 Prepare a quotation from the given enquiry.	Prepare a quotation from the given enquiry.	01	CO1
4	LLO 4.1 Prepare comparative statement from given qoutations LLO 4.2 Place a purchase order.	*Prepare a comparative statement from a minimum of three quotations and and place a purchase order .	01	CO1
5	LLO 5.1 Use Government eMarketplace(GeM portal) for searching of software, tools/equipment for procurement.	Study of general terms and conditions of GeM and use of GeM for Sale/Purchase of Goods/Services.	02	CO1
6	LLO 6.1 Calculate the total load for a given domestic installation. LLO 6.2 Draw the electrical installation plan from the given civil engineering drawing. LLO 6.3 Calculate the number of subcircuits and ratings of the main switch and distribution board.	*Design an electrical installation system for one BHK domestic unit and carry out an estimation.	04	CO2
7	LLO 7.1 Draw the electrical installation plan from the given civil engineering drawing using suitable drawing software.	*Domestic installation drawing using suitable software / Drawing sheet	04	CO2
8	LLO 8.1 Calculate the total load for a given commercial installation. LLO 8.2 Draw the electrical installation plan from the given civil engineering drawing. LLO 8.3 Calculate the number of subcircuits and ratings of the main switch and distribution board. LLO 8.4 Draw a single-line diagram of the distribution board for the given installation. LLO 8.5 Carry out estimation for above given commercial installation.	*Design an electrical installation system for a commercial unit and carry out an estimation.	04	CO2
9	LLO 9.1 Draw the electrical installation plan from the given civil engineering drawing using suitable drawing software. LLO 9.2 Draw a single-line diagram of the distribution board for a given installation using suitable drawing software.	*Commercial installation drawing using suitable software / Drawing sheet	04	CO2

10	LLO 10.1 Calculate the total load for a given industrial installation. LLO 10.2 Draw the electrical installation plan from the given civil engineering drawing. LLO 10.3 Calculate the size of the cable and ratings of the main switch and distribution board. LLO 10.4 Draw a single-line diagram of the distribution board for the given installation. LLO 10.5 Carry out estimation for above given industrial installation.	*Design an electrical installation system for small industrial installations and carry out an estimation.	04	CO3
11	LLO 11.1 Draw a layout diagram for street light installation from a given civil engineering drawing. LLO 11.2 Draw the details of a streetlight pole and layout as per NEC 2023. LLO 11.3 Select the size of the cable by calculating the voltage drop. LLO 11.4 Carry out the estimation for the given streetlight installation.	*Design an electrical installation system for street lighting of small premises and carry out an estimation.	04	CO4
12	LLO 12.1 Design and estimate L.T. distribution line installation work.	Design and estimate L.T. distribution line installation work ,prepare a report and draw single line diagram on drawing sheet	04	CO5
13	LLO 13.1 Draw a single-line diagram of the distribution board for the given installation. LLO 13.2 Carry out estimation for given domestic installation.	Carry out an estimation and draw a single-line diagram of the distribution board for the given installation on drawing sheet	04	CO5
14	LLO 14.1 Draw a layout diagram for a low-tension (LT) line from given data.	*Draw diagrams of Overhead & Underground service connections on a drawing sheet	04	CO5
15	LLO 15.1 Design an illumination scheme for a class room	Design an illumination scheme for a class room	02	CO6

Note: Out of the above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- A minimum of 80% of the above list of lab experiments are to be performed.Judicial mix of LLOs is to be performed to achieve desired outcomes.
- A2 size drawing sheet should be used for drawing work.

VI. SUGGESTED MICRO-PROJECTS / ASSIGNMENTS/ ACTIVITIES FOR SPECIFIC LEARNING/ SKILLS DEVELOPMENT (SELF LEARNING)

Micro project:

- Carry out a market survey of electrical materials for comparison of quality and cost.
- Collect an electrical engineering drawing of the existing electrical installation. Interpret it. Prepare a report on it.
- Collect industrial installation plan and prepare estimation for the same using suitable software.
- Collect the existing installation plan of distribution lines and prepare an estimation for the same.

- Collect the existing installation plan of the street lighting scheme and prepare an estimation for the same.
- Collect the existing installation plan of the High-mast lighting scheme and prepare an estimation for the same.
- Collect the existing installation plan of the low-tension (LT) line and prepare an estimation for the same.
- Collect the existing installation plan of the high-tension (HT) line and prepare an estimation for the same.
- Collect any tender document related to electrical installation and fill all related documents.
- Collect a list of vendors and specifications of electrical goods from the GeM portal.

Assignment:

1) Problems / Estimation & Costing of Domestic, Commercial & Industrial Electrical Installation
2) Problems / Estimation & Costing of Overhead and Underground Distribution Line

Note : The above is just a suggestive list of microprojects and assignments; faculty must prepare their bank of microprojects, assignments, and activities similarly.

- The faculty must allocate a judicial mix of tasks, considering the weaknesses and/or strengths of the student in acquiring the desired skills.
- If a micro project is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- If the course does not have an associated SLA component, the above suggestive listings apply to Tutorials and may be considered for FA-PR evaluations.

VII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	All In One Computer with following specifications. Processor - 13th Gen Intel® Core™ i5-13500T, OS-Windows 11 Pro, Graphics - Intel® Graphics, Memory - 8 GB: 1 x 8 GB, DDR4, Storage - 256 GB, M.2 2230, PCIe NVMe, SSD, Class 35, Display - 60.5-cm. display Full HD (1920X1080)	1,8,9,10
2	Laserjet multifunction printer	1,8,9,10
3	Any proprietary or open-source drawing Software such as SmartDraw, EPLAN Electric P8 , Electrical AutoCAD	8,9,10

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
SECTION - I								
1	**I**	**ESTIMATES AND CONTRACTS**	**CO1**	**06**	**2**	**4**	**4**	**10**
2	**II**	**DOMESTIC AND COMMERCIAL INSTALLATIONS**	**CO2**	**08**	**2**	**4**	**6**	**12**
3	**III**	**INDUSTRIAL INSTALLATIONS**	**CO3**	**08**	**3**	**4**	**6**	**13**
SECTION -I TOTAL				**22**	**7**	**12**	**16**	**35**
SECTION - II								
4	**IV**	**PUBLIC LIGHTING INSTALLATION**	**CO4**	**08**	**4**	**4**	**6**	**14**
5	**V**	**DISTRIBUTION LINES**	**CO5**	**08**	**2**	**3**	**6**	**11**
6	**VI**	**ILLUMINATION IN RESIDENTIAL INSTALLATION**	**CO6**	**07**	**_**	**4**	**6**	**10**
SECTION -I I TOTAL				**23**	**6**	**11**	**18**	**35**
GRAND TOTAL				**45**	**13**	**23**	**34**	**70**

IX. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)	Summative Assessment (Assessment of Learning)
• Two-unit tests of 30 marks will be conducted and an average of marks obtained in these two-unit tests will be considered. • Each practical will be assessed for 25 marks and an average of all marks obtained will be considered.	End semester assessment of 70 marks through offline mode of examination.

X. SUGGESTED COS- POs –PSOs 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	3	3	--	3	3	3	3	3	3	3
CO2	3	3	3	2	3	3	2	3	3	3	2
CO3	3	3	3	2	3	3	2	3	3	3	3
CO4	3	--	--	1	1	3	3	3	1	3	3
CO5	3	--	3	--	2	2	3	2	2	3	2
CO6	3	2	2	1	--	2	2	2	1	3	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
1	K.B.Raina, S.K.Bhattacharya	Electrical Design Estimating and Costing	New Age International Publisher, First, Reprint 2010, ISBN:13: 978-8122443585
2	Surjit Singh, Ravi Deep Singh	Electrical Estimating and Costing	Dhanpat Rai and Sons, 2014 New Delhi, ISBN:1234567150995
3	J.B. Gupta	A Course in Electrical Installation Estimating and Costing	S.K. Kataria and Sons; New Delhi Reprint Edition, 2013, ISBN: 13: 978-9350142790
4	BIS	SP-30:2023, National Electrical Code, 2023	Bureau of Indian Standards
5	BIS	IS: 732-1989, Code of Practice for Electrical Wiring Installation	Bureau of Indian Standards
6	GeM	Step by step procedure of GeM purchase	GeM portal :https://gem.gov.in

XII. LEARNING WEBSITES & PORTALS

Sr. No.	Link/Portal	Description
1	https://www.electricaltechnology.org/2013/09/electrical-wiri ng.htm	Basics of Electrical Wiring System
2	https://www.electrical4u.com/types-of-electrical-insulator-o overhead-insulator/	Distribution line materials
3	https://www.electrical4u.com/lamps-types-and-performance-com parison/	Different types of lamps.
4	https://youtu.be/yhzhloBF_eo?si=Esgl05OzWNCOQaiD	High mast light wiring
5	https://www.youtube.com/watch?v=IoMXX6xct1g	Streetlight wiring
6	https://standardsbis.bsbedge.com/	SP:30 NEC 2023
7	https://gem.gov.in/	GeM portal for procurement.

Name & Signature:

Shri. Jabir Gulab Momin
Lecturer in Electrical Engineering

Mrs.Vaishali Prasad Karhad
Lecturer in Electrical Engineering

(Course Experts)

Name & Signature:	Name & Signature:
Dr. S. V. Bhangale (Programme Head)	**Shri.S.B.Kulkarni** (CDC In-charge)

GOVERNMENT POLYTECHNIC, PUNE

'120 – NEP' SCHEME

PROGRAMME	**DIPLOMA IN ELECTRICAL ENGINEERING**
PROGRAMME CODE	**02**
COURSE TITLE	**DISTRIBUTION AND UTILIZATION OF ELECTRICAL ENERGY**
COURSE CODE	**EE41203**
PREREQUISITE COURSE CODE & TITLE	**EE31202 - ELECTRIC CIRCUIT & NETWORK**
CLASS DECLARATION COURSE	**YES**

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	
EE41203	DISTRIBUTION AND UTILIZATION OF ELECTRICAL ENERGY	DSC	3	--	2	1	6	3	3	30	70	100	40	25	10	-	-	25	10	150

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 course.
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 Electrical Engineers who work as technicians in the field of distribution of Electrical Power. They must know about the components used in distribution systems. This course will explain the construction, operation, and analytical performance to find values of derived parameters such as efficiency & regulations of distribution lines. Also possess knowledge and skills of operation and use of electrical drives, electrical furnaces, and traction systems. Essential theoretical and practical knowledge will be achieved by taking this course. Contents of course are designed essentially keeping in mind the job profile of an electrical engineer handling electrical utilities.

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

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

CO1 – Calculate various parameters for a particular distribution system.

CO2 – Identify and apply the components of substation.

CO3 - Select the type of electric furnaces and welding system according to applications.

CO4 - Apply a suitable electric drive for a particular application.

CO5 – Maintain different electric traction system.

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
	SECTION I			
	UNIT – I REQUIREMNTS OF DISTRIBUTION SYSTEM (CL Hrs – 09, Marks-14)			
1	**TLO 1.1.** State the need for the distribution system. **TLO 1.2**. Describe with sketches the various connection schemes of the distribution system. **TLO 1.3** Solve simple numerical problems on voltage drop calculation of feeder fed at one end **TLO1.4** Solve simple numerical on Kelvin's Law. **TLO 1.5.** State the causes of low power factor and disadvantages of low power factor **TLO 1.6** State the advantages of improved power factor and explain the methods to improve it and simple numerical based on it. **TLO 1.7** Define the Tariff and state its necessity.	**1.1** Necessity of distribution system, Primary and secondary distribution. **1.2** Types of distribution systems. **1.3** i) AC distribution and its requirements, connection schemes of distribution system: Ring, Radial etc. ii) Voltage drops calculations for feeder fed at one end. **1.4** Selection of conductor size for distributor, Kelvin's Law **1.5** i) Causes of low power factor. Effect of harmonics on pf. ii) Disadvantages of low power factor **1.6** Advantages of improved power factor and Methods of improving power factor, by use of i) Static condenser, ii) Synchronous condensers, iii) Automatic p.f. Improvement, iv) Phase advancers (Numerical) **1.7** Tariff- Definition, necessity, and different types of tariffs as per M.S.E.D.C.L.	Chalk-Board, Demonstrations, Industry Visit	CO1
	UNIT- II COMPONENTS OF DISTRIBUTION LINE AND SUBSTATION (CL Hrs –08, Marks-12)			
2	**TLO 2.1** State the need for electrical substations. **TLO 2.2** Classify sub-stations based on service requirements and construction. **TLO 2.3**. Compare Indoor and Outdoor sub-stations. **TLO 2.4** State the need and function of sub-station equipment. **TLO 2.5** Explain different bus-bar arrangements. **TLO 2.6** Draw a single-line diagram of a typical transformer sub-station.	**2.1** Necessity of Electric substation. **2.2** Classification of Sub-Stations: according to service requirement, according to constructional features. **2.3** Comparison between indoor and outdoor substations. **2.4** Equipment in transformer sub-stations: Busbars, Insulators, Types of Insulators, Line support: Types of line structure, Method of erection. Isolators, Circuit breakers, Power transformers, Instrument transformers, Metering and indicating instruments, Carrier current equipment, and Batteries. **2.5** Bus bar arrangement: Single bus-bar system, Duplicate bus-bar system. **2.6** Single line diagram of typical transformer sub-station.	Chalk-Board, Demonstrations, Industry Visit	CO2

	UNIT –III ELECTRIC WELDING (CL 5 HRS, MARKS 09)			
3	**TLO 3.1** Describe the working principle, construction, advantages disadvantages and application of different types of welding. **TLO 3.2** Describe the various types of new modern welding techniques.	**Electric Welding**: 3.1 Methods of Electric Welding – Electric arc welding, Resistance welding. i) **Resistance Welding** – Principle, types of Resistance welding, Advantages, Disadvantages and applications. ii) **Arc welding-** Working principle, Characteristics of arc, Factors on which arc length depends, Methods of arc stabilization, Types of electrodes, Advantages of coated electrodes. Different types of Arc welding 3.2 New techniques in welding: Ultrasonic welding, Laser welding, under water welding, IGBT controlled welding. Applications of above types of welding.	Chalk-Board, Demonstrations,	CO3
	SECTION II			
	UNIT – IV ELECTRIC HEATING (CL Hrs – 08, MARKS-12)			
4	**TLO 4.1** Explain the construction, working principle and classification of the specified electrical heating system. **TLO 4.2** Recommend the Relevant heating system for the given application with proper justification. **TLO 4.3** Design the heating element of the given type of furnace from the specified data. And solve simple numerical for estimation of the size of the induction furnace.	**Electric Heating** 4.1 Concept of electrical heating, Advantages and Classification of electric heating, Modes of heat transfer. 4.2 i) **Resistance Heating**: Construction and operation of Direct Resistance Heating, Indirect Resistance Heating, Resistance Ovens, Requirements of Heating Element Material, Causes of Failure of Heating Elements, ii) **Arc Heating** - Direct Arc Furnace, Indirect Arc Furnace. Applications of Arc Heating. iii) **Induction Heating** – Core Type Induction Furnace, Coreless Induction Furnace, Applications of Induction Heating, iv) **Dielectric Heating**: Principle of Dielectric Heating, Advantages and Limitations of Dielectric Heating, Applications of Dielectric Heating. 4.3 Methods of Temperature Control, Applications of Resistance Heating, Design of Heating Element. (Simple Numerical problems on heating elements)	Chalk-Board, Demonstrations, Industry Visit	CO3

	UNIT–V ELECTRIC DRIVE AND ELEVATOR (CL Hrs – 08, MARKS-12)			
5	**TLO 5.1** Differentiate the salient features between the given types of electric Drives. **TLO 5.2** Recommend the relevant motor for the given application with justification. **TLO 5.3** Select the relevant enclosure for the given atmospheric condition with justification. **TLO 5.4** Select the power transmission drive of the electric motor for the given application with justification. **TLO 5.5** Estimate the relevant size and rating of the electric motor for the specified load cycles. **TLO 5.6** Select the relevant elevator machine and electric motor for the Specified application with justification. **TLO 5.7** Describe the procedure to maintain the given electric drive and elevator.	**Electric drives**: **5.1** Concept, factors governing the selection of Electric drives (motor). **5.2** Types of electrical drives: Individual and Group drive, Applications. **5.3** Mechanical features of drives: Types and applications Various types of enclosures. **5.4** Transmission of Mechanical Power: Direct and Indirect drive (Belt, Rope, Chain, Gear), Vertical drives and their applications. i) Bearing: Types and applications. **5.5** Size and Rating of motor: (Simple numerical on this topic) i) Load Cycles: Concept with graphical representation. ii) Load Equalization: Concept, and methods and Condition of load equalization. **Elevators** **5.6** Elevators: Function, Application, types, safety and Precautions. **5.7** Factors on which the shape and size of the car depend.	Chalk-Board, Demonstrations, Industry Visit	CO4
	UNIT - VI ELECTRIC TRACTION (CL Hrs –07, MARKS-11)			
6	**TLO 6.1** Recommend Relevant traction system for the given application with justification. **TLO 6.2** Select the relevant traction services with justification. **TLO 6.3** Differentiate the salient features between the given types of track electrification systems. **TLO 6.4** Differentiate between the given types of traction services based on the given criteria.	**6.1** Introduction of electric traction system, Requirements of ideal traction system **6.2** System of Track Electrification: DC; Single phase 25kV AC, Composite system. **6.3** Traction Mechanics: Block diagram of AC electric locomotive and function of each part, Nomenclature of Locomotives. **6.4** Traction services: Urban, suburban, main line service (Main features and comparison between the three of them). i)Concept and function of Catenary wire, contact wire and Dropper, Different types of catenary and their speed limits, Definition and Need of Neutral Section, Current Collecting system: Diamond type pantograph and Faiveley type pantograph (Construction and Working)	Chalk-Board, Demonstrations, Industry Visit	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.** Identify different distribution systems.	Write a report on different distribution system	02	CO1
2	**LLO 2.** Identify different insulators.	Write a report on different types of insulators required for the distribution system.	02	CO1
3	**LLO 3** identify different line supports and insulators.	Collect different samples of line support and line insulators required for the distribution system.	02	CO2
4	**LLO 4.** observe different types of distribution systems. Observe the different safety equipment used in the substation	Visit 33KV/11KV and 11KV/400V distribution substations and write a report.	02	CO2
5	**LLO 5.** Prepare a report on the Substation.	Prepare a report on different types of substations.	02	CO2
6	**LLO 6**.1 identify differently Components required for various Heating furnaces.	Identify different components required for various types of heating furnace	02	CO3
7	**LLO7.** Observe the construction and working of various heating furnaces.	Observe the construction and working of various heating furnaces by watching video programs	02	CO3
8	**LLO 8.** Identify the accessories and safety devices required for various Heating furnaces.	Identify different accessories and safety devices required for various types of Heating furnaces	02	CO3
9	**LLO 9.** Prepare a report on the specifications of various electrical welding machines	Prepare a report of specifications of various electrical welding machines available in the college workshop.	02	CO3
10	**LLO 10.** Observe various electrical drives and prepare a technical report.	Visit a small manufacturing unit to observe various electrical drives and prepare a technical report.	02	CO4
11	**LLO 11.** Identify different manufacturing companies of elevators for comparison	Prepare a comparative chart of two different manufacturing companies in India of the elevator with technical data.	02	CO4
12	**LLO 12.** Identify different types of switchgear used in Traction substation.	Visit a traction substation draw a single-line diagram of the substation and write a report.	02	CO5
13.	**LLO 13**. To observe the rising and lowering of pantograph & different parts of EMU during visit.	Visit a railway electric loco shed to study the power circuit of an electric locomotive.	02	CO5
14	Micro project planning and execution as written in the suggested micro project list	Micro project Report Writing.	02	ALL

Perform any 12 practical. All COs should be covered in the performed practical.

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

Assignment

- Prepare a power point presentation related to different distribution system.
- Prepare a power point presentation on method of improving power factor in distribution system.
- Prepare a Power Point presentation related to heating furnaces.
- Prepare a PowerPoint presentation related to welding equipment and accessories.
- Collect the Bombay Lift Act and understand the rules to inspect electrical components.
- Select any one electric drive. Explain its suitability for any one industrial application through power point Presentation. (Electrical and Mechanical Characteristics).
- Seminar on various electric drives.
- Prepare a chart of elevators.
- Prepare a chart of the components of elevators.
- Seminar on the latest electric traction trends in India.

Micro project:

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

- Draw schematic diagrams of different distribution system
- Prepare a PowerPoint presentation related to various types of heating Furnaces.
- Prepare a PowerPoint presentation related to various types of welding Methods, Equipment and accessories.
- Prepare a report on a market survey of various drives (specification, Manufacturer, Application and cost.
- Prepare a report on a market survey of various elevators (specification, manufacturer, application and cost)
- Prepare a PowerPoint presentation and the report related to electric traction systems in India and a comparison between them.

VII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED

Sr. No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Visit to 33 KV /11KV and 11 KV /400V Distribution substation	1,2,3,4,5
2	Video programme / Internet information on various types of heating furnaces.	6,7
3	Video programme / Internet information on various types of welding systems	8,9
4	Market survey / Internet information of various drives elevator as per application	10,11
5	Visit to Khadaki Traction substation to understand the layout equipment and protective measures used in the traction substation.	12,13

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
SEC - I								
1	I	REQUIREMNTS OF DISTRIBUTION SYSTEM	CO1	09	4	6	4	14
2	II	COMPONENTS OF DISTRIBUTION LINE AND SUBSTATION	CO2	08	4	6	2	12
3	III	ELECTRIC WELDING	CO3	05	4	4	1	09
SEC - II								
4	IV	ELECTRIC HEATING	CO3	08	4	6	1	12
5	V	ELECTRIC DRIVES AND ELEVATORS	CO4	08	4	6	2	12
6	VI	ELECTRIC TRACTION	CO5	07	2	6	4	11
Grand Total				45	22	34	14	70

IX. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)	Summative Assessment (Assessment of Learning)
Two unit tests of 30 marks will be conducted and an average of two unit tests considered. For formative assessment of laboratory learning 25 marks. Each practical will be assessed considering the appropriate % weightage to process and product and other instructions of assessment.	End semester assessment of 70 marks through offline mode of examination.

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	1	2	--	2	--	--
CO2	2	2	--	1	2	1	2	2	--	--	2
CO3	3	2	2	2	2	2	3	2	--	--	2
CO4	2	--	1	1	2	2	3	2	2	--	-
CO5	2	--	--	2	3	--	3	--	--	--	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	J. B. Gupta	Transmission & Distribution of Electrical Power	S. K. Kataria & Sons ISBN: 9788185749570
2	C.L.Wadhwa	Electrical Power Systems	New Age International Pvt Ltd ISBN: 9788122428391
3	S. N. Singh	Electric Power Generation: Transmission & Distribution	Prentice Hall of India Pvt Ltd ISBN: 9788120335608
4	H.Pratab	Art and Science of Utilization of Electrical Energy	Dhanpat Rai & Sons, New Delhi, ISBN:9788177001440
5	J.B. Gupta	Utilization of Electric Power and Electric Traction	S.K. Kataria & Sons, New Delhi, ISBN:978- 9350142585
6	G.K. Dubey	Fundamentals of Electric Drive	Narosa Publishing House, New Delhi, ISBN: 8173190410, 9788173190414
7	H.Pratab	Modern Electric Traction	Dhanpat Rai & Sons, New Delhi, ISBN:1234567147206

XII. LEARNING WEBSITES & PORTALS

Sr. No	Link/Portal	Description
1.	www.education4u.in	Videos on Distribution System.
2.	https://www.youtube.com/watch?v=tyuOgA1lX2Y https://www.youtube.com/watch?v=k78GHf-aT7M	Video on Insulators
3.	https://www.youtube.com/watch?v=BDMFsYnTdVI	Videos on Electric Locomotive with full description
4.	www.nptel.iitm.ac.in	All Topics of Utilization of Electrical Energy
5.	www.khanacademy.com	All Topics of Utilization of Electrical Energy
6.	https://www.youtube.com/watch?v=fakGLu03jYg	Videos on Electric Traction

Note:
Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

Name & Signature:

Mrs. Madhuri Hemant Bilgi
Lecturer in Electrical Engineering

Smt. Nilambari Vasant Devarkar
Lecturer in Electrical Engineering

(Course Experts)

Name & Signature:

Dr. S.V.Bhangale
(Programme Head)

Name & Signature:

Shri.S.B.Kulkarni
(CDC In-charge)

GOVERNMENT POLYTECHNIC, PUNE

'120 – NEP' SCHEME

PROGRAMME	**DIPLOMA IN ELECTRICAL ENGINEERING**
PROGRAMME CODE	**02**
COURSE TITLE	**DIGITAL ELECTRONICS AND MICROCONTROLLER APPLICATION**
COURSE CODE	**EE51201**
PREREQUISITE COURSE CODE & TITLE	**NA**
CLASS DECLARATION COURSE	**NO**

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	
EE51201	DIGITAL ELECTRONICS AND MICROCONTROLLER APPLICATION	SEC	2	0	2	2	6	3	2 Hrs.	15	35	50	20	25	10	25@	10	25	10	125

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 15 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 course.
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:

In today's digital world, all the equipment like computers, mobiles, music systems, ATMs, automation and control circuits and systems are built on digital circuits. Electrical Engineering Diploma pass out plays a key role in control panel operations based on microcontroller systems. This course builds the knowledge of digital electronics required to use microcontroller-based systems

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

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

CO1 - Apply knowledge of number system and logic circuits in working of digital system.
CO2 - Access various registers in the 8051 microcontroller.
CO3 - Develop and execute programs in assembly language for microcontroller and interface 8051 microcontrollers for various 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 DIGITAL CIRCUITS (CL Hrs- 08, Marks- 10)				
1.	TLO 1.1 Recognize and convert the given number into the specified number system. TLO 1.2 Perform the binary and BCD arithmetic operation on the given numbers. TLO 1.3 Develop the basic gates using the given NAND/NOR gate as a universal gate. TLO 1.4 Draw MUX/DEMUX tree for the given number of input and output lines. TLO 1.5 Describe the building process of the specified type of flip-flop.	1.1 Number System: Decimal, Binary, octal, hexadecimal, BCD. Conversion of one number system into another. 1.2 Binary Arithmetic: - Addition, Subtraction (1's and 2's complement) Multiplication, Division. BCD addition. 1.3 Logic Gates: Symbol, switch circuit, logical expression, truth table of basic logic gates (AND, OR, NOT), Universal gates (NAND and NOR) and Special purpose gates (EX-OR, EX-NOR). 1.4 Multiplexer and Demultiplexer: working, truth table and applications. 1.5 SR Flip Flops: SR-flip flop, clocked SR flip flop with preset and clear, drawbacks of SR flip flop. JK Flip Flops: Clocked JK Flip flop with preset and clear, D and T type flip flop.	Chalk-Board, Video Demonstrations, Model Demonstration, PowerPoint Presentations, Charts	CO1
UNIT - II 8051 MICROCONTROLLER ARCHITECTURE (CL Hrs- 10, Marks- 10)				
2	TLO 2.1 State salient features of 8051 microcontroller TLO 2.2 Compare the given types of architecture TLO 2.3 Draw pin diagram and architectural block diagram of 8051. Describe the given types of registers of 8051. TLO 2.4 Justify the use of the given type of memory in 8051.	2.1 8051 Microcontroller: Introduction, block diagram and features. Types of buses, address bus, data bus and control bus. 2.2 Harvard and Von-Neumann architecture. 2.3 8051 Microcontroller Architecture: - Pin configuration, Register banks, bit and byte addressable area. Registers: PC, DPTR, A&B, PSW and other Special function registers (SFR), I/O ports, Timers (pins and associated SFRs). Stack and stack pointer 2.4 Memory organization (RAM, ROM).	Chalk-Board, Video Demonstrations, Model Demonstration, PowerPoint Presentations, Charts	CO2

UNIT - III 8051 INSTRUCTION SET, PROGRAMMING , INTERFACING AND APPLICATION (CL Hrs- 12, Marks- 15)				
3	TLO 3.1 Identify the addressing mode of the given instruction with examples. TLO 3.2 Describe the function of the given instruction with suitable examples. TLO 3.3 Justify the use of the given assembler directives with examples. TLO 3.4 Explain the instruction syntax for 8051 assembly language program TLO 3.5 Develop assembly language programs to perform simple operations TLO 3.6 Describe with sketches the procedure to interface the given external memory. TLO 3.7 Describe with sketch the interfacing of the given external I/O devices.	3.1 Addressing Modes: Immediate, register, direct, indirect, indexed, relative, absolute, bit inherent, bit direct. 3.2 Instruction Set (with appropriate example): Data transfer, Logical, Arithmetic, Branching, Stack operation. 3.3 Assembler Directives: ORG, DB, EQU, END, CODE, DATA . 3.4 Assembly language programming process with instruction syntax. 3.5 Develop assembly language programs for the following commonly used applications: i) Addition and subtraction of two 8-bit unsigned numbers. ii) Multiplication and division on two 8-bit unsigned numbers. iii) Average of 8-bit numbers. iv) Data transfer from one location to another. v) Incrementing and decrementing the contents of registers and RAM. Programming for the same. 3.6 Memory interfacing - Program and Data memory 3.7 Draw an interfacing diagram and develop a flowchart to interface following with 8051 i) LED ii) LCD iii) Relay iv) Stepper Motor	Chalk-Board, Video Demonstrations, Model Demonstration, PowerPoint Presentations, Charts	CO3

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 Build AND, OR, NOT gates to verify its truth table.	* Verification of truth table of AND, OR, NOT gates using ICs.	2	CO1
2	LLO 2.1 Test the function of the RS flip flop.	Testing the function of RS flip flop using NAND Gate.	2	CO1
3	LLO 3.1 Test the function of the JK flip flop.	Testing the function of JK flip flop using 7476.	2	CO1

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
4	LLO 4.1 Develop and execute an assembly language program (ALP) to perform the addition of 8-bit data.	* Assembly language program (ALP) to perform addition of 8-bit data using a) various addressing modes, b) through stack	2	CO2 , CO3
5	LLO 5.1 Develop and execute an assembly language program (ALP) to perform subtraction of 8-bit data.	* Assembly language program (ALP) to perform subtraction of 8-bit data using a) addressing modes, b) through stack	2	CO2 , CO3
6	LLO 6.1 Develop and execute an assembly language program (ALP) to perform multiplication and division of 8-bit data.	*Assembly language program (ALP) to perform multiplication and division of 8-bit data, take the input data from data memory and display the output data on port 2	2	CO2 , CO3
7	LLO 7.1 Develop and execute an assembly language program to transfer data using internal data memory.	* Assembly language program to transfer data from source to destination location of internal data memory.	2	CO2 , CO3
8	LLO 8.1 Develop and execute an assembly language program to transfer data using external data memory.	Assembly language program to transfer data from source to destination location of external data memory.	2	CO2 , CO3
9	LLO 9.1 Develop and execute an assembly language program to exchange data of memory locations.	* Assembly language program to exchange data from source to destination memory location.	2	CO2 , CO3
10	LLO 10.1 Develop and execute an assembly language program for masking a particular bit of a given register. LLO 10.2 Develop and execute an assembly language program to SET a particular bit of a given register.	* Assembly language program to MASK and SET particular bit of given register using 1) bit addressable instructions and 2) Logical instructions.	2	CO2 , CO3
11	LLO 11.1 Develop and execute an assembly language program to get a rolling display on a given I/O port.	* Assembly language program to get a rolling display on port 2.	2	CO2 , CO3
12	LLO 12.1 Interface LED with 8051. LLO 12.2 Interface SWITCH with 8051.	* Interfacing of LED and switch with 8051 to turn ON / OFF the LED.	4	CO3
13	LLO 13.1 Interface RELAY with 8051.	* Interfacing of RELAY with 8051 to turn ON / OFF the LED.	2	CO3
14	LLO 14.1 Interface 7-segment display with 8051.	Interfacing of stepper motor with 8051 microcontrollers and writing ALP to rotate stepper motor in a clockwise and anti-clockwise direction at given angles.	2	CO3

Note: Out of the above suggestive LLOs -

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

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

Micro project

- Build a circuit of ALU using IC 74181.
- Build a water level controller to indicate overflow & under the level of water in a tank.
- Prepare a chart of various features using data sheets of the 8051 microcontroller and its derivatives.
- Build a circuit to turn the buzzer ON after 10 seconds

Suggested Student Activity –

- Prepare a chart of various logic gates & their truth table.
- Prepare Power Point presentation on digital circuit microcontroller applications.
- Give a seminar on a relevant topic.
- Undertake a market survey of different microcontroller ICs and collect information regarding- the number of pins, number of bits, clock frequency of operation etc.

Note: A suggestive list of micro-projects and assignments is given here. Similar activities could be added by the course teacher. By considering allotted self-learning hours the course teacher has to allocate a judicial mix of tasks may be a combination of assignments and/or micro projects. The micro project is expected to be completed as a group activity. Course teachers can assign specific learning or any other skill development task. According to task assignments, the course teacher can set rubrics for continuous (formative) type assessment. SLA marks shall be awarded as per continuous assessment records.

VII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Digital Multimeter: 3 and ½ digits with R, V, I measurements, diode and BJT testing.	1,2,3
2	DIGITAL IC tester: Provision for testing a wide range of Digital ICs such as 74 Series, and 40/45 Series of CMOS ICs.	1,2,3
3	Bread Board Development System: Bread Board system with DC power output 5V, +/-12V and 0-5V variable, digital voltmeter, ammeter, LED indicators 8 no, logic input switches 8 no, 7 segment display 2 no, clock generator, Manual pulser, Breadboard with about 1,600 points, Potentiometer, relay etc.	1,2,3
4	Trainer kits for digital ICs: The trainer kit shall consist of digital ICs for logic gates, flop-flop, shift registers, and counters along with toggle switches for inputs bi-colour LED at outputs, and built-in power supply.	1,2,3
5	Regulated power supply: Floating DC Supply Voltages Dual DC: 2 x 0 -30V; 0-2 A Automatic Overload (Current Protection) Constant Voltage and Constant Current Operation Digital Display for Voltage and Current Adjustable Current Limiter Excellent Line and Load Regulation	1,2,3
6	Latest Desktop PC compatible with microcontroller IDE simulation software / KEIL software.	4,5,7,8,9,10,11,12,13,14
7	Microcontroller kit: -single board systems with 8K RAM, ROM memory with battery back up,16X4,16 X2, LCD, PC keyboard interfacing facility, Hex keypad facility, single user cross c- compiler, RS-232, USB, interfacing facility with built-in power supply.	12,13,14
10	Stepper Motor, 50/100 RPM with driver circuitry	14

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	Digital Circuits	CO1	08	2	6	2	10
2	II	8051 Microcontroller Architecture	CO2	10	2	4	4	10
3	III	8051 Instruction Set, Programming , Interfacing And Application	CO3	12	3	6	6	15
			Grand Total	30	7	16	12	35

IX.ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)	Summative Assessment (Assessment of Learning)
Two-unit tests of 15 marks will be conducted and an average of marks obtained in these two-unit tests will be considered. Each practical will be assessed for 25 marks and an average of all marks obtained will be considered.	End semester assessment of 35 marks through offline mode of examination. End semester summative assessment of 25 marks for laboratory learning.

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	1	1	2	2	1	1	--	2	2	--
CO2	3	1	2	1	2	1	1	2	2	2	3
CO3	3	3	3	2	3	2	2	2	3	2	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 with ISBN Number
1	R.P. Jain	Modern Digital Electronics	McGraw-Hill Publishing, New Delhi, 2009; ISBN: 9780070669116
2	V.K.Puri	Digital Electronics	McGraw Hill Education (1 July 2017); ISBN-13: 978-0074633175
3	Salivahanan S.; Arivazhagan S.	Digital Circuits and Design	Oxford University Press India; 5th edition ; ISBN13- 978-0199488681
4	Malvino, A.P.; Leach, D.P.; Saha G.	Digital Principles and Applications	McGraw Hill Education, New Delhi, 2014, ISBN: 9789339203405
5	V. Udayashankara M. S. Mallikarjuna Swamy	8051 Microcontroller: Hardware, Software and Application.	McGraw Hill Education; 1st edition; ISBN-13 : 978-0070086814
6	Kenneth Ayala	8051 Microcontroller Architecture Programming and Application	Cengage Learning India; 3rd edition ; ISBN-13 : 978-8131502006
7	Mazidi, Mohmad Ali; Mazidi, Janice Gelispe; Mckinlay Roline D.	The 8051 Microcontroller and Embedded system	Pearson Education India; 2nd edition; ISBN-13 : 978-0199681273
8	Ajay Deshmukh	Microcontroller Theory and Application	Mc Graw Hill., New Delhi,2011, ISBN- 9780070585959

XII. LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.keil.com/download/	Simulation software
2	https://archive.nptel.ac.in/courses/108/105/108105102/	NPTEL course on-Microprocessors and Microcontrollers
3	https://nptel.ac.in/courses/117104072	NPTEL Course-Microcontrollers and Applications, IIT Kanpur by Dr. S.P. Das
4	https://play.google.com/store/apps/details?id=com.coderbro.t utorial.a8051microcontroller&hl=en_IE	Android App for Microcontroller 8051

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

Name & Signature;

Shri. Sunil Padmakar Date
Lecturer in Electrical Engineering

Smt. Sujala Parimal Phadnaik
Lecturer in Electrical Engineering

(Course Experts)

Name & Signature:

Dr. S. V. Bhangale
(Programme Head)

Name & Signature:

Shri. S. B. Kulkarni
(CDC In-charge)

GOVERNMENT POLYTECHNIC, PUNE
'120 – NEP' SCHEME

PROGRAMME	**DIPLOMA IN ELECTRICAL ENGINEERING**
PROGRAMME CODE	**02**
COURSE TITLE	**INSTRUMENTATION AND CONTROL**
COURSE CODE	**EE31206**
PREREQUISITE COURSE CODE & TITLE	**NA**
CLASS DECLARATION COURSE	**NO**

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	
EE31206	INSTRUMENTATION AND CONTROL	DSC	2	--	2	2	6	3	1	15	35*#	50	20	25	10	25@	10	25	10	125

Total IKS Hrs for Term: -- 00 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 15 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 course.
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:

In industry, engineering diploma holders are expected to handle basic instruments for the measurement of various process parameters such as temperature, pressure, flow and level in different types of industries and electrical utilization systems. The technologists should be able to select proper instruments or meters for the measurement of physical and electrical parameters and also maintain these instruments and meters for proper functioning in different applications. This course has been therefore designed to develop this competency and related outcomes.

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 - Know the basics of the instrumentation system, classification and selection of the relevant transducers in the measurement of displacement, temperature, pressure, flow and level.
CO2 – know the construction of signal conditioning and data acquisition circuits in the instrumentation system
CO3 - Identify and describe the basic components of the control system and its application.

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 TRANSDUCER & APPLICATIONS (CL Hrs- 13, Marks-15)				
1.	TLO1.1. Describe the function of each block of the instrumentation system. TLO1.2. Define sensor, and transducer and classify it. TLO1.3. Know the construction and working of the linear and angular potentiometer, construction and working of bounded and unbounded strain gauge, Define gauge factor TLO 1.4 Know the construction and working of LDR and its application TLO 1.5 Understand the construction & working of LVDT/ RVDT, their characteristics, advantages and disadvantages. TLO 1.6 Understand the construction and working of the active transducer with its application. TLO 1.7 Write the selection criteria of the transducer. TLO 1.8 State different temperature scales and understand the construction, working principle and characteristics of thermister, thermocouple & RTD TLO 1.9 Define the Seebeck	1.1 Introduction- generalized block diagram of Instrumentation system. Function of each block of the Instrumentation system. 1.2 Sensors: basic definition, classification- thermal, optical, magnetic and electric sensors 1.3 Transducer: Need, Classification 1.4 Electrical Passive Transducers: a. Resistive type - linear and angular potentiometer, strain gauges, LDR. b. Inductive type - Linear variable differential transformer (LVDT), Rotational variable differential transformer (RVDT). c. Capacitive transducer 1.5 Piezoelectric transducer, Photovoltaic cell. 1.6 Selection criteria of transducer. 1.7 Measurement of Temperature Temp. and its Units.RTD (PT-100), Thermistor, Thermocouple –Seebeck effect and Peltier effect. Construction and working principle, common thermocouples and their parameters. Pyrometer – Radiation method. Typical specifications of Thermistor, RTD and Thermocouple. 1.8 Measurement of Level units, level measurement methods.	Lecture Using Chalk-Board Presentations Video Demonstrations Flipped Classroom Collaborative learning Case Study	CO1

Sr. No	Theory Learning Outcomes (TLO's) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
	effect and Peltier effect. TLO 1.10 Understand working of the pyrometer. TLO 1.11 Know different methods of measurement of level. TLO 1.12 State different types of pressures TLO 1.13 Classify pressure measuring devices and understand the measurement of pressure by various types of sensors. TLO 1.14 State mass flow rate and volumetric flow rate TLO 1.15 Know the construction and working principles of different types of flow meters.	Indirect methods: Capacitive type, Ultrasonic type, 1.9 Measurement of Pressure Pressure - units, Types- Absolute, Gauge, Atmospheric & Vacuum. Pressure measuring devices - (i) Manometer (ii) Bourdon tube Specification of pressure transducer 1.10 Measurement of Flow Flow - units, mass flow rate, volumetric flow rate, Type- (i) Venture tube (ii) Rotameter (iii) Ultrasonic flow meter 1.11 Specification of Various Flow Meters		
UNIT-II SIGNAL CONDITIONING AND DATA ACQUISITION CIRCUITS (CL Hrs- 13, Marks- 15)				
2	TLO 2.1 State the importance of signal conditioning circuits in the instrumentation system. TLO 2.2 Know the basics of op-amp and its parameters TLO 2.3 Understand the construction and working of different circuits using op-amp in the instrumentation system. TLO 2.4 Know the necessity of a data acquisition system in the instrumentation system. TLO 2.5 Understand different circuits of DAS in the instrumentation system. TLO 2.6 Know the terms Mux, De-Mux, TDM, FDM, Modulation, and demodulation, TLO 2.7 Know the working of different displays.	2.1 Signal Conditioning: Definition, the importance of signal Conditioning, 2.2 Operational Amplifier and its parameters. Op-Amp IC's (741) pin diagram and pin function. Virtual ground concept. 2.3 Op-amp basic Circuits- inverting, non-inverting amplifier, adder, subtractor, integrator, differentiator. 2.4 Application of Op-amp- instrumentation amplifier, comparator, zero crossing detector, filters- low pass, high pass, band pass and band stop filter. 2.5 Necessity of data processing in instrumentation, data acquisition system (DAS), classification of DAS, 2.6 Signal converter-ADC – successive approximation and DAC – R-2R network type. 2.7 Basic definition of Multiplexer & de –multiplexer, TDM & FDM, modulation &demodulation 2.8 Display, analog and digital, 7 segments and 14 segments display.	Lecture Using Chalk-Board Presentations Video Demonstrations Flipped Classroom Collaborative learning Case Study	CO2

Sr. No	Theory Learning Outcomes (TLO's) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
UNIT –III BASIC CONCEPT OF CONTROL SYSTEM (CL Hrs- 4, Marks- 5)				
3	TLO 3.1 State the basic concept of the control system and its components and application. TLO 3.2 Know different control actions. TLO 3.3 State different applications of the control system.	3.1 Control system, types of control system – close loop and open loop control system 3.2 Automatic controller, basic function. Control actions- two positions, proportional (P), integral (I), proportional plus integral (PI), proportional plus derivative (PD), proportional plus integral plus derivative (PID) using Op-amp. 3.3 Application of control system.	Lecture Using Chalk-Board Presentations Video Demonstrations Flipped Classroom Collaborative learning Case Study	CO3

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 Use a potentiometer to measure the linear displacement. LLO 1.2 Plot the nature of out-put voltage against displacement.	Use a potentiometer to measure the linear displacement and plot characteristics	2	CO1
2	LLO 2.1 Use a potentiometer to measure the angular displacement. LLO 2.2 Plot the nature of out-put voltage against displacement.	Use a potentiometer to measure the angular displacement and plot characteristics	2	CO1
3	LLO 3.1 Use LVDT to measure linear displacement. LLO 3.2 Plot relation between linear displacement and output voltage.	Use LVDT to measure linear displacement and plot the relation between linear displacement and output voltage.	2	CO1
4	LLO 4.1 Use RTD- PT-100 to measure the temperature of the water. LLO 4.2 Plot characteristics of resistance versus temperature.	Use RTD- PT-100 to measure the temperature of the water and plot characteristics of resistance versus temperature	2	CO1
5	LLO 5.1 Use a 4hermistor to measure the temperature of the water. LLO 5.2 plot characteristics of resistance versus temperature.	Use a 4hermistor to measure the temperature of the water and plot characteristics of resistance versus temperature	2	CO1
	LLO 6.1 Use a thermocouple to measure the temperature of water.	Use a thermocouple to measure the temperature of water and plot characteristics	2	CO1

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant Cos
6	LLO 6.2 Plot characteristics of output voltage versus temperature	of output voltage versus temperature		
7	LLO 7.1 Use a strain gauge to measure applied pressure or weight. LLO 7.2 Plot characteristics of output voltage versus weight.	Use a strain gauge to measure applied pressure or weight and plot characteristics of output voltage versus weight.	2	CO1
8	LLO 8.1 Study measurement of flow by using rotameter/ venture tube/ orifice. LLO 8.2 Calculate the amount of flow	Study measurement of flow by using rotameter/ venture tube/ orifice	2	CO1
9	LLO 9.1 Perform Inverter / Non-inverter using Op-Amp. LLO 9.2 Perform Adder/Subtractor using Op-Amp.	Perform Inverter / Non- inverter and Adder – Subtractor using Op-Amp	2	CO2
10	LLO 10.1 Perform Instrumentation amplifier using three Op-Amps	Perform Instrumentation amplifier using three Op-Amps	2	CO2
11	LLO 11.1 Test the performance of Portable DAC.	Test the performance of Portable DAC.	2	CO2
12	LLO 12.1 Study 7 segment display system.	Study digital and analog display system	2	CO2
13	LLO 13.1 Test the performance of the portable PID controller. LLO 13.2 Study different control actions.	To Study the performance of portable PID controller	2	CO3
14	LLO 14.1 Prepare a report on given topic	Report writing on a given assignment selected in a group	2	

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

Micro project:

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty. Students should prepare slides/ charts/ prototype models for this

a) RTD/Thermistor/Thermocouple basics for indication of temperature
b) Use a level transducer to indicate and control the level of the water tank.
c) Use float type level sensor for indication of the level of water tank
d) Use a strain gauge for weight measurement in a simple platform.
e) Sketch LVDT / RVDT.
f) Do various circuits using Op-Amp.

Asignment: -

Course teachers can assign various tasks in groups and will assess the same**.**

Other than the classroom and laboratory learning, the following are the suggested student-related activities which can be undertaken to accelerate the attainment of the various outcomes in this course. Students should conduct the following activities in groups and prepare reports of about 5 pages for each activity, also collect/record physical evidence for their portfolio which will be useful for their placement interviews.

a. Prepare journals based on practicals performed in the laboratory.
b. Study the specification of sensor and transducers
c. Collect information on transducers and prepare charts of the same.
d. Prepare posters to illustrate the use of transducers and control systems.

VII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	DC Regulated Dual power supply (0-30V,0-2A) or equivalent	1,2,7,9,10,11
2	Digital Multimeter- 31 /2 digit, 0-800 volts,0-10A, or suitable	All
3	Instrumentation kits (LVDT)	3
4	Instrumentation kits (temp)	4,5,6
5	Instrumentation kits (Load cell)	7
6	Instrumentation kits (op-amp)	8,9
7	Instrumentation kits (Flow)	10
8	Instrumentation kits (op-amp)	11
9	7 segment display	12
10	Basic analog PLC trainer	13

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**	**TRANSDUCER & APPLICATIONS**	**CO1**	**13**	**5**	**5**	**5**	**15**
2	**II**	**SIGNAL CONDITIONING AND DATA ACQUISITION CIRCUITS**	**CO2**	**13**	**3**	**5**	**7**	**15**
3	**III**	**BASIC CONCEPT OF CONTROL SYSTEM**	**CO3**	**04**	**2**	**2**	**1**	**05**
			Grand Total	**30**	**10**	**12**	**13**	**35**

IX. SSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)	Summative Assessment (Assessment of Learning)
Two-unit tests of 15 marks will be conducted and an average of marks obtained in these two-unit tests will be considered. Each practical will be assessed for 25 marks and an average of all marks obtained will be considered.	End semester assessment of 35 marks through online mode of examination. End semester summative assessment of 25 marks for laboratory learning.

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	3	2	3	2	1	3	2	1	1
CO2	3	2	2	3	2	2	2	2	3	1
CO3	2	2	2	2	1	1	1	1	1	1

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

XI. SUGGESTED LEARNING MATERIALS/BOOKS

Sr.No	Title	Author	Publisher with ISBN Number
1	Industrial Instrumentation and Control	S. K. Singh, Tata, McGraw-Hill Publishing Company Limited, New Delhi.	ISBN O-07-048290-X
2	Introduction to Instrumentation and Control	A.K. Ghosh, Prentice-Hall of India Private Limited, New Delhi	ISBN-81-203-1626-6
3	Electrical and Electronic Measurements and Instrumentation	A K Sawhney, Nineteenth edition, Dhanpat Rai & Sons, New Delhi, 2005	ISBN-13-9788177000160 :
4	Electronic Instrumentation	H. S. Kalsi, McGraw Hill, New Delhi, 2010	ISBN-13-9780070702066
5	Modern Electronic Instrumentation and Measurement Techniques	A. D. Helfrick, W. D. Cooper, Pearson Education India, Ist Edition, New Delhi, 2005	ISBN-13-978-9332556065

LEARNING WEBSITES & PORTALS

Sr.No	Link/Portal	Description
1	www.nptel.com	Instrumentation Engineering
2	www.instrumentioncontrolbox.com	Instrumentation and control
3	www.myklassroom.com/Engineering	Electronics & Instrumentation Engineering
4	www.en.wikibooks.org/wiki	Electronics/Measuring _Instruments
5	www.capabilitydevelopment.org	Capability development
6	www.tatasteelelearning.com	
Note: Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students		

Name & Signature: **Shri. Sunil Padmakar Date** Lecturer in Electrical Engineering	**Smt. Sujala Parimal Phadnaik** Lecturer in Electrical Engineering
(Course Experts)	
Name & Signature: **Dr. S. V. Bhangale** (Programme Head)	Name & Signature: **Shri. S. B. Kulkarni** (CDC In-charge)

GOVERNMENT POLYTECHNIC, PUNE
'120-NEP' SCHEME

PROGRAMME	**DIPLOMA IN ELECTRICAL ENGINEERING**
PROGRAMME CODE	**02**
COURSE TITLE	**ELECTRIC VEHICLE TECHNOLOGY**
COURSE CODE	**EE51202**
PREREQUISITE COURSE CODE & TITLE	**NA**
CLASS DECLARATION COURSE	**YES**

I. LEARNING AND ASSESSMENT SCHEME:

Course Code	Course Title	Course Type	Learning Scheme					Credits	Assessment Scheme										
			Actual Contact Hrs./Week						Paper Duration(hrs.)	Theory				Based on LL & TL				Based on Self Learning	Total Marks
														Practical					
			CL	TL	LL	SLH	NLH			FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA	
										Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
EE51202	ELECTRIC VEHICLE TECHNOLOGY	DSC	03	00	02	01	06	03	03	30	70	100	40	25	10	--	--	25	10	150

Total IKS Hrs. for Semester: 0 Hrs.

Abbreviations: CL-Class Room 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 average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course, then the candidate shallbedeclared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course, then the candidate shall bedeclared 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 project/assignments / other activities.

II. RATIONALE:

The present movement for sustainable energy has positioned electric vehicle (EV) technology as a crucial field for electrical engineers. This course is designed to provide students with the essential knowledge and skills to understand, test, and work with EV systems. Through a blend of theoretical instruction and hands-on laboratory experiments, students will develop a skill and knowledge of EV technology, equipping them for careers in the rapidly expanding electric vehicle industry.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

CO1 - Identify components and subsystems used in electric vehicles. CO2 -
Select electrical drives for EV applications.
CO3 - Check the performance of batteries and energy storage systems used for EV applications.
CO4 - Apply the concept of converters and charging systems in EVs.
CO5 - Implement Indian and state EV policies for EV applications.

IV. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr. No.	Theory Learning Outcomes(TLO's) aligned to CO's.	Learning content mappedwith TLO's	Suggested Learning Pedagogies	Relevant Cos
		SECTION - I		
		UNIT 1: Introduction of Electric Vehicles (CL Hrs.- 10 , Marks – 15)		
1	TLO 1.1 Compare electric vehicles and internal combustion engine vehicles on the given points. TLO 1.2 Describe the configuration of given types of EV systems. TLO 1.3 Compare given EVs based on given points. TLO 1.4 Describe the function of a given EV subsystem.	1.1 History system of electric vehicles (EV), need of EV, Electric vehicles and internal combustion engine vehicles: Comparison based on environmental impact, power source, maintenance, gear change, noise level, vibrations level, capital cost, and running cost. 1.2 Electric vehicle architecture, Classification of EV: Battery Electric Vehicle (BEV), Hybrid Electric Vehicle (HEV), Plug-in Hybrid Electric Vehicle (PHEV), Fuel Cell Electric Vehicle (FCEV). 1.3 Comparison of different electric vehicle types based on Driving Components, Energy Source used, Features, Problems and models available in the market. 1.4 EV Block diagram subsystems: energy source, propulsion, and auxiliary subsystem.	Lecture Using Chalk-Board, Presentations, Visit, Hands-on, Video Demonstrations	CO1
		UNIT 2: Electric Vehicle Drives (CL Hrs. – 12 , Marks--20)		
	TLO 2.1 Classify Electric Vehicles. TLO 2.2 Interpret the characteristics of the electric motor(s) used in EV. TLO 2.3 Distinguish between given EV motors based on given points. TLO 2.4 Select given electrical drives for EV applications.	2.1 Types of electric drives used in EV: DC Motor drives, AC Motor drives. 2.2 Brushed DC Motor, Brushless DC Motor (BLDC), Permanent Magnet Synchronous Motor (PMSM), Induction Motor (IM), Synchronous Reluctance Motor (SynRM), PM Assisted Synchronous Reluctance Motor, Axial Flux Ironless Permanent Magnet Motor: Salient features, characteristics, advantages, limitations, and usage of different motor types in EV models. 2.3 Comparison of EV motors based on power-weight ratio, torque-speed characteristic, cost of controllers required and cost of motors. 2.4 Position of motor in EV, Rating of motors, Connections (Mechanical and Electrical), and Selection criteria of various types of EV motors.	Lecture Using Chalk-Board , Presentations, Visit, Hands-on, Video Demonstrations	CO 2
		SECTION - II		
		UNIT-3 Energy Storage Systems (Batteries) (CL Hrs.- 8 , Marks- 14)		
3.	TLO 3.1 Describe given terms related to battery parameter. TLO 3.2 Describe the procedure for selection of battery for the given EV. TLO 3.3 Calculate EV battery capacity based on mileage and load. TLO 3.4 Describe the	3.1 Energy storage technology: EV Batteries, Supercapacitors, flywheel energy storage. Battery Parameters: Cell and Battery Voltages, Charge (or Amphour) Capacity, Energy Stored, Specific Energy, Energy Density, Specific Power, Amphour (or Charge) Efficiency, Energy Efficiency, Charging -discharge	Lecture Using Chalk-Board, Presentations, Visit, Hands-on, Video Demonstrations	CO 3

	process of given Battery Management System (BMS). TLO 3.5 Compare given type of fuel cells based on given points.	Rates, Battery Structure, Battery Temperature, Heating and Cooling Needs, Battery Life and Number of Deep Cycles. 3.2 Batteries: Lead-acid, NiMH (Nickel-Metal Hydride), Li-Ion (Lithium-Ion), Ni-Zn (Nickel-Zinc), Ni-Cd (Nickel-Cadmium), Aluminium–Ion batteries (Al–Ion batteries), Aluminium–air batteries (Al–air batteries)- their basic construction components, lifetime (cycles), efficiency, advantages, and disadvantages. Comparison of various batteries. Factors affecting the operation of battery, and selection of battery. Series and Parallel connection of Batteries, Calculation of battery capacity. 3.3 Battery Management Systems (BMS): Need of BMS, Block diagram of BMS, the function of each block, Battery Condition Monitoring, "3R" (Reduce, Reuse, Recycle) process for the battery. Fuel Cell: Difference between fuel cell and batteries, Fuel Cell Terminology: Anode, Cathode, Electrolyte, Catalyst, Reformer, Direct Fuel Cell, Working principle of fuel cell. Types of Fuel Cells used in EVs: Alkaline Fuel Cell (AFC), Polymer Electrolyte Membrane Fuel Cell (PEMFC), Phosphoric Acid Fuel Cell (PAFC), Molten Carbonate Fuel Cell (MCFC), Solid Oxide Fuel cell (SOFC), Their comparison based on Electrolyte type, Cell voltage, Operating temperature, System output (kW), Efficiency (%) and Applications.		
UNIT-4 Converters and EV Chargers (CL Hrs. - 8, Marks- 11)				
4	TLO 4.1 Describe the configuration and functions of the given type of converter. TLO 4.2 Describe given type of EV charging method(s). TLO 4.3 Distinguish between given charging systems. TLO 4.4 Describe given type of charging station. TLO 4.5 Calculate charging time based on given data.	4.1 Introduction to power electronics components used in EV, Block diagram of typical EV: Functions of DC-to-DC Converter, DC to AC Converter, AC to DC Converter (Rectifier) and filters. 4.2 Battery Charging methods: Home charging, Trickle charging, Household AC charging, public charging (DC Fast charging). 4.3 Battery Charging System: Classification-Wireless, Onboard and Off-board charging, V1G (Uni-directional smart charging), V2B/V2H (Vehicle-to-Building/ Vehicle-to-Home), V2X (Vehicle-to-Everything), V2G (Vehicle-to-Grid, Bi-directional smart charging). Charging Stations: Types of charging station, Public charging station: Selection and sizing, components and, single line diagram. Calculation of charging time and concept of battery swapping. Precautions were observed while charging.	Lecture Using Chalk-Board, Presentations, Visit, Hands-on, Video Demonstrations	CO 4

UNIT-5 Electric Vehicle (EV) Policies (CL Hrs- 7, Marks- 10)				
5	TLO 5.1 State the given points related to NEMMP. TLO 5.2 Compare incentive policies for the given types of electric vehicle.	5.1 Goal of EV30@30 campaign. Goals of electric vehicles initiative in India. National Electric Mobility Mission Plan 2020 (NEMMP): Objectives, Steps taken by the Indian Government for faster adoption of electric vehicles, Barriers to adoption of electric mobility, E-mobility strategy, NEMMP 2020 Implementation structure. 5.2 Maharashtra Electric Vehicle Policy, 2021: Objectives, Basic demand incentives for electric vehicles, Vehicle segment-wise scrappage incentives, Incentives for charging infrastructure.	Lecture Using Chalk-Board , Presentations, Visit, Hands-on, Video Demonstrations	CO 5

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

.Sr. No.	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment/Practical Titles/Tutorial Titles	No. of Hrs.	RelevantCOs
1	LLO 1.1 Identify components of various types of electric vehicles.	*Identification of electric vehicle components.	2	CO1
2	LLO 2.1 Identify various subsystems of electric vehicles.	*Identification of subsystems of electric vehicles.	2	CO1
3	LLO 3.1 Identify the terminals of the Permanent Magnet Synchronous Motor. LLO 3.2 Identify the terminals of the Three-phase Squirrel cage Induction Motor. LLO 3.3 Identify the terminals of the Synchronous Reluctance Motor. LLO 3.4 Identify the terminals of the Brushless DC motor.	*Identification of terminals of motors used in EVs.	2	CO2
4	LLO 4.1 Determine and compare the characteristics of given EV motors.	Comparison of characteristics of EV motors.	2	CO2
5	LLO 5.1 Measure the open circuit voltage of a given battery using multimeter. LLO 5.2 Identify the charged, discharged and dead battery conditions. LLO 5.3 Determine Amp-hour (Ah) capacity of the battery.	*Testing of EV batteries.	2	CO3
6	LLO 6.1 Perform Active Lithium-Ion Cell balancing using a Plastic Platform Scale.	Battery Cell balancing.	2	CO3
7	LLO 7.1 Estimate capacity of battery pack for specified capacity of EV.	*Estimation of battery for EV.	2	CO3
8	LLO 8.1 Charge an EV battery using various methods, and record charging times and efficiency.	*Charging of EV battery.	2	CO4
9	LLO 9.1 Develop a charging station layout. LLO 9.2 Select the		2	

	appropriate components of the charging station. LLO 9.3 Draw a single-line diagram of a charging station. LLO 9.4 Simulate the charging process of a charging station using any open-source software.	Development of a public charging station.		CO4
10	LLO 10.1 Calculate the charging time for different battery capacities using given formulas.	*Calculation of charging time of battery.	2	CO4
11	LLO 11.1 Prepare a report on Indian EV policy.	Report on Indian EV policy.	2	CO5
12	LLO 12.1 Prepare a report on Maharashtra EV Policy, 2021.	*Report on Maharashtra EV Policy, 2021.	2	CO5

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) are mandatory.
- Minimum 80% of above list of lab experiment are to be performed. Judicial mix of LLOs are to be performed to achieve desired outcomes.

Perform Any 10 Practical. All COs should be covered in the Perform practical.

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

Micro project

Prepare a report on the performance analysis of DC-DC converters and inverters in an EV setup.
Build and test simple DC-DC converters and inverters.
Develop an EV system model and simulate using any open-source software. Test sensors and systems for autonomous EVs and submit a report on it.
Perform sub-system simulations of an electric vehicle using any open-source software.

Assignment

Prepare a report on the comparative study of various two-wheeler EVs available in the market. Prepare a report on the setting of the Fast DC charging station.
Prepare a report on EV battery swapping technology.
Prepare a report on the comparative study of various four-wheeler EVs available in the market.
Prepare a report on the Internet of Things (IoT)/ Virtual Reality (VR)/ Augmented Reality (AR) related to EV.
Prepare a report on driverless EV cars available in the market.

Note : Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.

The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
If a microproject is assigned, it is expected to be completed as a group activity.
SLA marks shall be awarded as per the continuous assessment record.
For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional . Faculty may encourage students to perform these tasks for enhanced learning experiences.
If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Electric Vehicle two-wheeler: Top Speed-23 KM/H, Minimum Range-80 KM/C, Full Charge-4 to 5 HRS, Minimum Motor Power-250 Watts, Wheel Size-12 Inch, Minimum Battery Capacity/Rating-50V / 30Ah.	1,2,3,4
2	3½ Digit Digital Multimeter.	1,2,3,4
3	Brushless DC motor: 1 kW, 3000 rpm, at 3 Nm load torque/ whichever is available.	2
4	Three-phase AC Induction Motor: Max Motor Power: 41hp at 4500rpm, Max Motor Torque: 91Nm at 3000rpm/ whichever is available.	2
5	Permanent Magnet Synchronous Motor: Minimum power and torque/ whichever is available.	2
6	Synchronous Reluctance Motor: Minimum power and torque/ whichever is available.	2
7	Plastic Platform Scale Active Lithium Cell Balancing, Size: A3, Capacity: 80Ah.	3
8	Lithium-Ion E-Bike Battery, 20 Ah, Capacity (Ah).	3,4
9	Nickel-Metal Hydride E-Bike Battery, 20 Ah, Capacity (Ah).	3,4

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
SECTION - I								
1	**I**	**Basics of Electric Vehicles**	CO1	10	2	8	5	15
2	**II**	**Electric Vehicle Drives**	CO2	12	4	6	10	20
SECTION - II								
3	**III**	**Batteries and Energy Storage Systems**	CO3	8	2	4	8	14
4	**IV**	**Converters and EV Chargers**	CO4	8	2	4	5	11
5	**V**	**Electric Vehicle (EV) Policies**	CO5	7	2	4	4	10
Grand Total				**45**	**12**	**26**	**32**	**70**

IX. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment of learning)	Summative Assessment (Assessment of learning)
Two unit tests of 30 marks will be conducted and an average of two unit tests considered. For formative assessment of laboratory learning 25 marks. Each practical will be assessed considering the appropriate % weightage to process and product and other instructions of assessment.	End semester assessment of 70 marks through offline mode of examination.

X. SUGGESTED COS- POs –PSOs 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	3	2	3	2	2	2	2	2	1
CO2	3	2	3	2	3	1	2	2	2	3	2
CO3	3	2	2	2	2	2	2	2	1	2	1
CO4	3	2	1	2	2	2	2	1	2	2	1
CO5	3	1	2	2	2	1	2	1	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 with ISBN Number
1	Mehrdad Ehsani, Yimin Gao, Stefano Longo, and Kambiz Ebrahimi.	Modern Electric, Hybrid Electric, and Fuel Cell Vehicles.	CRC Press, 2019, ISBN 13: 978-0367137465.
2	James Larminie, John Lowry.	Electric Vehicle Technology Explained.	Wiley-Blackwell, 2012, ISBN 13: 978-1119942733
3	Dr. Nitesh Tiwari, Dr. Shekhar Yadav.	Electric Vehicle (Green and Sustainable Transportation).	S.K. Kataria & Sons, 2023, ISBN 13: 987-81-963589-0-7.
4	Ali Emadi, Mehrdad Ehsani, John M. Miller.	Vehicular Electric Power Systems: Land, Sea, Air, and Space Vehicles.	CRC Press, 2003, ISBN 13: 978-0824747510.
5	Sunil R. Pawar.	Electrical Vehicle Technology: The Future Towards Eco-Friendly Technology.	Notion Press Publication, 2021, ISBN 10:1685545610.

XII. LEARNING WEBSITES & PORTALS

Sr. No	Link / Portal	Description
1	https://youtu.be/2IgZSDDFW-Y?si=Z1tfZO24ljBppzVA	Identification of terminals of BLDC motor.
2	https://www.niti.gov.in/sites/default/files/2023-02/EV_Handbook_Final_14Oct.pdf	Handbook of electric vehicle charging infrastructure implementation.
3	https://heavyindustries.gov.in/sites/default/files/2023-07/N EMMP-2020.pdf	National Electric Mobility Mission Plan 2020.
4	https://www.cleanenergyministerial.org/initiatives-campaigns/electric-vehicles-initiative/	Goal of EV30@30 campaign.
5	https://maitri.mahaonline.gov.in/PDF/EV%20Policy%20GR%202021.pdf	Maharashtra Electric Vehicle Policy, 2021.
6	https://www.mdpi.com/1996-1073/10/8/1217	Electric vehicle review paper.

7	https://archive.nptel.ac.in/courses/108/103/108103009/	NPTEL electric vehicle course literature.
8	https://onlinecourses.nptel.ac.in/noc22_ee53/preview	NPTEL electric vehicle course videos.
9	https://www.mdpi.com/1996-1073/15/3/1241	DC-AC converters for electric vehicle review paper.
10	https://www.niti.gov.in/sites/default/files/2022-05/Battery_swapping_report_09052022.pdf	Battery swapping.

Note :

- Teachers are requested to check the creative commons license status/financial implications of the suggested online educational resources before use by the students

Name & Signature:

Dr. Sanjay V. Bhangale
Head Electrical Department

Mr. Ravi B. Chauthmal
Lecturer in Electrical

(Course Experts)

Name & Signature	Name & Signature:
(Dr. Sanjay V. Bhangale) (Program Head)	**Shri. S.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	**SOCIAL AND LIFE SKILLS**
COURSE CODE	**HU21204**
PREREQUISITE COURSE CODE & TITLE	**NA**
CLASS DECLARATION COURSE	**NO**

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	
	SOCIAL AND LIFE SKILLS	**VEC**	**1**	**--**	**2**	**1**	**4**	**2**	**--**	**--**	**--**	**--**	**--**	**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 course.
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.
1. **Notional learning hours** for the semester are **(CL + LL + TL + SL) hrs. * 15 Weeks**
3. **1 credit** is equivalent to **30 Notional hours**.
4. * Self-learning hours shall not be reflected in the Timetable.

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

II. RATIONALE:

The introduction of a social and life skills course for diploma engineers is indeed a significant step forward in shaping well-rounded professionals. By integrating soft skills training with technical education, this curriculum addresses the growing need for engineers who are not only experts in their field but also adept in interpersonal communication, collaboration, and leadership. Such skills are crucial for success in the modern workforce, where the ability to navigate complex social dynamics can be just as important as technical know-how. Moreover, the emphasis on ethical decision-making prepares engineers to approach their work with integrity and responsibility. As these professionals progress in their careers, the benefits of this comprehensive education will manifest in their ability to innovate, lead, and contribute positively to their communities and the broader society. This forward-thinking approach ensures that the engineers of tomorrow are equipped not just with the tools to excel in their careers, but also with the vision to drive societal progress.

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: Achieve shared goals through effective teamwork in executing sustainable community development projects.

CO2: Improve cooperation and understanding through refined communication skills.

CO3: Encourage ethical choices and compassionate behaviour by nurturing moral values.

CO4: Foster ethical judgment, honesty, and societal accountability to shape principled and conscientious professionals.

CO5: Equip students with practical financial literacy skills for efficient financial management.

IV. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT:

Sr. No	TheoryLearning Outcomes (TLO's) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
UNIT-I ENGAGEMENTS WITHIN UNNAT MAHARASHTRA ABHIYAN (UMA) (CL Hrs-03, Marks-NIL)				
1.	**TLO1.1:** Recognize the importance of addressing societal needs and involving relevant stakeholders in problem-solving efforts. **TLO1.2:** Integrate academia, society, and technology to devise comprehensive solutions for complex societal issues. **TLO1.3:**Enhance communication and negotiation skills to effectively engage stakeholders, ensuring diverse perspectives and productive collaboration in problem-solving. **TLO1.4:** Utilize critical data sources such as economic surveys, and environmental data to guide decision-making and solution development in problem-solving endeavours. **TLO1.5:** Identify key stakeholders and delineate their roles and interests in addressing societal challenges. **TLO1.6:** Identify essential attributes for measurement in the problem-solving process. **TLO1.7:** Explore diverse tools and templates for data	**1.1 Identifying Regional Societal Challenges:** Recognizing Community Needs Requiring Engineering Solutions. **1.2Integrating Multidisciplinary Approaches:** Linking Academia, Society, and Technology **1.3 Involving Diverse Stakeholders:** Engaging Various Actors in the Problem-Solving Process **1.4Accessing Secondary Data Sources:** Utilizing Resources like Census and Economic Surveys **1.5Mapping Problems and Stakeholders:** Understanding Activities' Relevance to System Components and Key Stakeholders **1.6Defining Measurement Metrics:** Identifying Essential Attributes for Evaluation **1.7 Employing Data Collection Tools:** Exploring Surveys and Measurement Equipment **1.8Establishing Measurement Standards:** Developing Survey Forms and Piloting Processes **1.9Conducting Field Surveys:** Quantifying Local Systems such as Agriculture and Transportation **1.10Analyzing Data and Creating Reports:** Summarizing Data and	Considering the unit design, it's vital to consider the following factors during the implementation of the unit: i) Organize students into smaller groups of 5-6 members to carry out fieldwork within the larger cohort. ii) Allocate multiple student groups evenly among all faculty members involved in the course. iii) A team of course faculty will visit local governing bodies like Municipal Corporations, Villages, Panchayats, Zilla Parishads, and Panchayat Samitis to assess small-scale technological or engineering needs within their jurisdiction. iv) The team of course instructors will conduct initial field visits to explore various scenarios and options	**CO1**

	collection, including surveys and measurement equipment. **TLO1.8:** Establish a structured framework for measuring identified attributes, including the development of survey forms and piloting the measurement process. **TLO1.9:** Gain practical experience in conducting fieldwork to gather primary data, such as agricultural output, rainfall, and transportation networks. **TLO1.10:** Develop proficiency in data analysis to draw meaningful conclusions, informing decision-making and solution development processes.	Reflections in Reports, Utilizing Various Formats like Tables and Graphs	for student-led fieldwork to assess and quantify different parameters and characteristics. **a) Session I** will introduce the development approach, fieldwork methodology, and the utilization of case studies as instructional tools. **b) Sessions II** - VII will cover topics such as societal dynamics, stakeholder engagement, value creation, establishing metrics, basic analysis, and preliminary reporting. **c) Session VIII** will wrap up the program with feedback collection and assessment. **d) Field Work:** **1. Pilot Visit** - Testing the survey instrument **2. Survey Visit 1** - Gathering data/information Survey. **3**. **Visit 2-** Further data collection. **4.SummaryVisit-** Concluding activities post-analysis.	
UNIT - II NATIONAL SERVICE SCHEME (NSS) (CL Hrs-03, Marks- NIL)				
2	**TLO2.1:** Enhance communication and leadership abilities to effectively interact with local leaders. **TLO2.2:** Develop proficiency in conducting socio-economic surveys using appropriate data collection techniques and analysis methods to understand community needs. **TLO2.3:** Identify suitable villages and devise activity plans based on community	2.1 Engaging with Village/Area 2.2 Conducting initial socio-economic surveys in nearby villages. 2.3 Selecting villages for adoption and initiating project activities. 2.4 Conducting thorough socio-economic surveys in the adopted village or area. 2.5 Identifying key issues and challenges within the community. 2.6 Raising awareness about advancements in agriculture, watershed management, wasteland reclamation, renewable energy, affordable housing, sanitation,	Considering the unit design, it's vital to consider the following factors during the implementation of the unit: i) Organize students into smaller groups of 5-6 members to carry out fieldwork within the larger cohort. ii) Allocate multiple student groups evenly among all faculty members involved in the course.	**CO2**

	needs and available resources. **TLO2.4:** Analyze survey findings to discern socio-economic patterns, obstacles, and potential avenues for progress. **TLO2.5:**Prioritize community issues according to their significance and impact on community welfare. **TLO2.6:** Communicate information on agriculture, watershed management, renewable energy, housing, sanitation, nutrition, and hygiene effectively. **TLO2.7:** Cultivate networking and advocacy skills to foster collaboration among government agencies, development organizations, and the community.	nutrition, and personal hygiene. Also, informing about skill enhancement programs, income generation opportunities, government initiatives, legal aid, consumer rights, and related topics. 2.7 Facilitating collaboration between the government and development agencies to implement various schemes in the adopted village or slum.	iii) Before selecting a village or slum for NSS activities, it's advisable for teachers to conduct an initial visit. iv)The selected area should have a dense population. iv)Community members should exhibit a willingness to improve their living conditions and actively engage in projects initiated by the NSS for their benefit. vi) NSS units should avoid areas with a history of political conflicts. vii) The chosen area should be conveniently accessible for NSS volunteers to conduct regular visits to the slums.	
UNIT - III UNIVERSAL HUMAN VALUES (CL Hrs-03, Marks- NIL)				
3	**TL03.1:** Apply love and compassion to promote harmony and well-being. **TL03.2:** Demonstrate honesty and transparency to build trust and authenticity. **TL03.3:** Utilize non-violent approaches to resolve conflicts and enhance empathy. **TL03.4:** Align actions with moral principles to promote justice and fairness. **TL03.5:** Employ peace-building strategies for harmony and reconciliation. **TL03.6:** Engage in acts of service to cultivate empathy and social responsibility. **TL03.7:** Prioritize others' needs to foster altruism and generosity.	**4.1 Exploring Love and Compassion (Prem and Karuna):** Learning about and embodying the principles of love and compassion in daily life. **4.2 Embracing Truth (Satya):** Understanding the significance of truthfulness and integrating it into one's actions and interactions. **4.3 Embracing Non-Violence (Ahimsa):** Understanding the importance of non-violence and applying it in personal and societal contexts. **4.4 Upholding Righteousness (Dharma):** Exploring the concept of righteousness and practising it through ethical conduct and moral values. **4.5 Cultivating Peace (Shanti):** Reflecting on the essence of peace and cultivating	Proposed Learning Approaches for: i) Lecture Delivery ii) Demonstrations iii) Case Studies iv)Role-playing exercises v)Observational Learning vi)Portfolio Development vii) Simulations viii) Inspirational Talks from Industry Professionals ix) On-site Visits to sites or Industries	**CO3**

	TL03.8: Exhibit behaviours that uphold gender equality and respect for diversity to create an inclusive	inner tranquillity while promoting harmony in relationships and communities. **4.6 Embracing Service (Seva):** Understanding the value of selfless service and actively engaging in acts of kindness and support for others. **4.7 Embracing Renunciation (Sacrifice) Tyaga**: Understanding the concept of renunciation and willingly **letting go of self-interest for the greater good. and attitudes.** **4.8 Promoting Gender Equality and Sensitivity:** Recognizing the importance of gender equality and fostering an environment of inclusivity and respect for all genders through actions and attitudes.		
UNIT - IV VALUE EDUCATION (UNNATI FOUNDATION) (CL Hrs-03, Marks- NIL)				
4	**TLO4.1:** Display comprehension of one's own identity, values, and beliefs. **TLO4.2**: Recognize and express personal strengths and weaknesses effectively. **TLO4.3:**Demonstrate adeptness in active listening by providing feedback and demonstrating empathy. **TLO4.4:**Acquire strategies for handling conflicts constructively and respectfully. **TLO4.5:** Assess and reflect on moral values and principles that influence personal actions and choices. **TLO4.6:** Analyze and assess the moral values and principles guiding individual actions and decisions.	**4.1. Self-awareness and Personal Development** Self-understanding, Identification of strengths and weaknesses, Setting goals and devising plans, Building self-esteem and confidence **4.2.Interpersonal Skills and Effective Communication** Engaging in active listening, Resolving conflicts, Cultivating healthy relationships **4.3. Ethics and Morality** Grasping ethical concepts, Upholding moral values and principles, Making ethical decisions, Demonstrating integrity and honesty **4.4. Social Values and Responsibility** Being punctual and initiating conversation, Managing emotions effectively, Introducing oneself and others, Maintaining a positive attitude Valuing family bonds, Creating favourable impressions,	i)Video Demonstrations ii)Flipped Learning Environment iii) Case Studies iv)Role-playing Activities v)Group-based Learning vi)Team-based Learning vii)Utilization of Chalkboard	**CO4**

		Communicating effectively, Emphasizing cleanliness, hygiene, and organization, Expressing preferences, Fostering confidence Enhancing listening skills, Demonstrating appropriate greetings, Promoting gender equality and sensitivity, Exercising responsibility, Integrating visual and verbal learning, Establishing and pursuing goals, Observing social media etiquette, Efficiently managing time and daily routines		
UNIT - V FINANCIAL LITERACY(CL Hrs-03, Marks- NIL)				
5	**TLO5.1:**Comprehending Savings and Investment Practices. **TLO5.2:**Cultivating Proficiency in Financial Planning. **TLO 5.3:**Developing Competence in Transaction Handling. **TLO5.4:**Achieving Proficiency in Income, Spending, and Budget Management. **TLO 5.5:**Attaining Understanding of Inflation Concepts. **TLO 5.6:** Fostering Competence in Loan Administration. **TLO5.7: A**cknowledging the Significance of Insurance.	**5.1. Fundamentals of Finances:** Grasping concepts of income, expenses, and savings, Employing budgeting techniques, Understanding assets and liabilities, and Recognizing the significance of emergency funds. **5.2. Banking Essentials** Initiating and managing bank accounts, Familiarizing oneself with various account types (savings, checking, etc.), Comprehending interest rates, and Safely utilizing ATMs. **5.3. Management of Credit and Debt** Interpreting credit scores and reports, Identifying different credit types (credit cards, loans, etc.), Responsible debt management, and Preventing involvement in predatory lending. **5.4. Foundations of Investment** Understanding investment types (stocks, bonds, mutual funds, etc.), Assessing risk and return, Implementing diversification strategies, and Formulating investment approaches. **5.5. Financial Planning and Goal Establishment** Establishing financial objectives, Crafting a personalized financial blueprint, Continuously monitoring and adjusting financial goals, and Engaging in long-term financial	i) Video Demonstrations ii) Presentations iii) Case Studies iv) Chalkboard Utilization v) Collaborative Learning	**CO5**

		strategizing. **5.6. Consumer Rights and Duties** Familiarizing oneself with consumer entitlements, Safeguarding against financial scams and fraudulent activities Exercising responsible borrowing and spending practices, Upholding financial privacy and security measures. **5.7. Essentials of Insurance** Exploring different insurance categories (health, life, auto, home, etc.), Understanding insurance policy specifics, Recognizing the importance of insurance coverage, and Navigating the insurance claims process. **5.8. Economic Literacy** Grasping fundamental economic principles, Understanding the concepts of inflation and deflation, Analyzing market trends, and Interpreting economic indicators.		

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	**LLOI.I.1:** Communicating and interacting with residents or children with compassion and empathy, demonstrating an understanding of their needs and emotions.	1.1 Encouraging empathy and kindness through volunteer work at: i) a nearby nursing home ii)a care centre for children from disadvantaged families or similar types of facilities.	2	CO3
2	**LLO 2.1** Enhance goal-setting abilities by engaging in collaborative planning, analyzing obstacles, and reflecting on personal aspirations to align them with broader academic or career goals.	2.1 Pathway to Success: Goal-Setting Exercise	2	CO4
3	**LLO3.1:** Develop effective communication skills by demonstrating compassion, empathy, and understanding towards residents or children, while acknowledging and addressing their needs and emotions.	3.1 Exploring Your Inner World: Self-Reflection Activity	2	CO4
4	**LLO4.1:** Laboratory Learning Outcome: Cultivate structured self-reflection skills to assess personal strengths and weaknesses.	4.1 Strengths and Weaknesses Identification and Analysis Exercise	2	CO4

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment/ Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
5	**LLO 5.1:** Display proficiency in time management through the creation and adherence to structured timelines for task coordination.	5.1 Time Management Simulation for Coordinating Industrial Visits	2	CO4
6	**LLO 6.1**: Demonstrate competency in social media etiquette through engaging in activities and adhering to established norms and guidelines.	6.1 Activity on Social Media Etiquette	2	CO4
7	**LLO 7.1:** Develop skills in mapping and analyzing family income and expenses through structured exercises.	7.1. Exercise on Mapping and Analyzing Family Income and Expenses	2	CO5
8	**LLO 8.1**: Apply their knowledge of interest rate calculation to real-world financial situations, improving decision-making skills.	8.1 Exploring Simple and Compound Interest: A Hands-On Exercise on Interest Rate Calculation and Its Impact on Savings and Loans.	2	CO5
9	**LLO9.1:** Enhance comprehension of interest rates and their impact on financial dealings, encompassing savings accounts, Fixed Deposits (FDs), and loans.	9.1 Interest Rate Comparison Exercise: Analyzing Rates for Savings, Fixed Deposits, and Loans.	2	CO5
10	**LLO10.1:** Mastering and implementing safety protocols for ensuring secure ATM transactions.	10.1 Safety Precautions for ATM Usage: Exploring Tips for Secure Transactions	2	CO5

Note: Out of the above suggestive LLOs –

1. A judicial mix of LLOs is to be performed to achieve the desired outcomes

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

SELF-LEARNING - MICRO PROJECT/ASSIGNMENT/ACTIVITIES (ANY ONE)

The following list provides examples of activities that can be pursued under the program. Each group has the flexibility to choose from these options or undertake any other activity deemed suitable based on local requirements. The group focuses on the holistic development of the selected area, whether it is a village or a slum.

a) Community clean-up drives

Group tasks for community clean-up drives are,

1. Site Survey and Planning: Identify areas needing attention and plan tasks.
2. Logistics Management: Coordinate supply distribution to volunteers.
3. Volunteer Coordination: Welcome, register, and assign tasks to volunteers.
4. Trash Collection and Segregation: Collect and sort waste into categories.
5. Street Sweeping and Cleaning: Sweep and clean streets, sidewalks, and public areas.
6. Beautification and Landscaping: Enhance aesthetics by planting and trimming.
7. Safety and First Aid: Ensure volunteer safety and manage emergencies.
8. Documentation and Reporting: Capture progress through photos and reports.
9. Community Engagement: Educate and raise awareness among residents.
10. Post-Clean-up Evaluation: Review success and plan future initiatives.

b) Tree plantation initiatives

Group tasks for Tree plantation initiatives,

1. Community Awareness: Workshops to educate on tree benefits.
2. Community Participation: Engage locals in all planting
3. Team Building: Group activities to strengthen community bonds.
4. Leadership Development: Empower individuals to lead initiatives.
5. Communication Workshops: Enhance effective messaging.
6. Problem-solving Discussions: Address planting challenges.
7. Environmental Responsibility: Foster care for green spaces.
8. Cultural Integration: Incorporate local traditions into initiatives.
9. Sustainability Education: Teach sustainable planting practices.
10. Monitoring and Evaluation: Assess impact and plan improvements.

c) Environmental conservation awareness

Group tasks for Environmental conservation awareness

1. Educational Workshops: Teach about conservation methods.
2. Art Competitions: Promote environmental themes through art.
3. Street Plays: Perform interactive skits in public spaces.
4. Awareness Walks: Organize marches with environmental messages.
5. Tree Plantation: Plant trees to enhance green spaces.
6. Clean-up Campaigns: Remove litter from local areas.
7. Guest Lectures: Invite experts to discuss environmental issues.
8. Film Screenings: Show documentaries on conservation topics.
9. Social Media Campaigns: Spread awareness through online platforms.
10. Community Workshops: Educate on waste management and sustainability.

d) Health and sanitation programs

1. Health Education Sessions: Conduct informative sessions on hygiene, disease prevention, and nutrition.
2. Sanitation Infrastructure Evaluation: Assess the effectiveness of existing sanitation facilities and propose improvements.
3. Community Clean-up Events: Organize collective efforts to clean and maintain public spaces for better health outcomes.
4. Distribution of Hygiene Kits: Provide essential hygiene items such as soap, toothpaste, and sanitary products to community members.
5. Vaccination Drives: Coordinate vaccination campaigns to protect against prevalent diseases and promote community health.
6. Water Quality Testing: Conduct regular testing of water sources to ensure safe drinking water for residents.
8. Personal Hygiene Workshops: Offer workshops focusing on personal grooming, handwashing techniques, and menstrual hygiene.
9. First Aid Training: Provide basic first aid training to community members to equip them with life-saving skills.
10. Community Health Surveys: Conduct surveys to assess health needs and gather feedback for future program planning.

VII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED

Sr. No.	Equipment Name with Broad Specifications	Relevant LLO Number
1	Basic engineering measurement instruments, GPS data collection devices, and open-sour GIS software like Google Earth and QGIS, along with the Microsoft Office suite.	ALL

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)
Formative assessment (Assessment for Learning) Report and presentation of fieldwork activities, Self- Learning (Assignment)	--

X. SUGGESTED COS- POS MATRIX FORM

NOT APPLICABLE

XI. SUGGESTED LEARNING MATERIALS/BOOKS

Sr.No	Author	Title	Publisher
1	Mark Stafford Smith and Pamela Matson	Sustainable Development: Principles, Frameworks, and Case Studies	Oxford University Press, ISBN: 9780199588952
2	Katar Singh	Rural Development: Principles, Policies and Management	SAGE Publications Pvt. Ltd, ISBN:978-9351502867.
3	Anand Kumar, Asim Kumar Mandal, and R. Venkata Rao	Maharashtra: Governance and Development"	Routledge India, ISBN: 978-0367709133
4	Dalai Lama and Howard C. Cutler	The Art of Happiness	Riverhead Books, and the ISBN: 978-1594488894.
5	Stephen R. Covey	The 7 Habits of Highly Effective People	Simon & Schuster, ISBN : 978-1982137274.
6	Local college students, UMA staff	Sample Case Studies on the UMA website	IITB-UMA team

XI. LEARNING WEBSITES & PORTALS

Sr.No.	Link/Portal	Description
1	https://www.ugc.gov.in/pdfnews/4371304_LifeSKill_JeevanKaushal_2023.pdf	UHV: UGC Course on life skills. Unit 4 i.e. Course 4 is to be referred
2	https://nss.gov.in/	The National Service Scheme (NSS) website provides information about the NSS program in India. It includes details about the objectives, history, and structure of NSS. Additionally, the website offers resources for NSS volunteers and coordinators, such as program guidelines, training materials, and reports.
3	https://gr.maharashtra.gov.in/Site/Upload/Government%20Resolutions/English/201601131501523808.pdf	Government Resolution of Government of Maharashtra regarding Unnat Maharashtra Abhiyan
4	https://gr.maharashtra.gov.in/Site/Upload/Government%20Resolutions/English/201606151454073708.pdf	Government Resolution of Government of Maharashtra regarding Unnat Maharashtra Abhiyan Guidelines
5	https://www.humanvaluesfoundation.com/.	The Human Values Foundation website offers educators resources for teaching human values and social-emotional learning to children and youth. It provides curriculum-based programs, lesson plans, and activities to foster character development, resilience, and positive behaviour. Additionally, the website shares insights into the foundation's mission, values, and the global impact of its programs in schools.

Name & Signature: **Mr. S.B.Kulkarni** Lecturer in Mechanical Engineering **(Course Experts)**	
Name & Signature: **Dr. S.V. Bhangale** (Programme Head)	Name & Signature: **Shri. S.B. Kulkarni** (CDC In-charge)