

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	--

I. LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Course Type	Learning Scheme						Credits	Assessment Scheme												
			Actual Contact Hrs./Week			SL	H	NL		H	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	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 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:

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 AlCl ₃ Definition of covalency, single, double and triple covalent bonds, formation of Covalent compounds H ₂ O, CO ₂ , N ₂	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 of electrolysis for the given electrolyte. TLO 2.4 Calculate CE, ECE, the	2.1. Definition of electrolyte, electrolysis, ionization, Arrhenius theory, Difference between atom and ion 2.2. Activity series, mechanism of electrolysis of CuSO ₄ using Pt electrode and Cu electrode 2.3. Applications of electrolysis: electroplating, electro-refining, 2.4. Faraday's laws of electrolysis and numerical. 2.5. Types of conductors: metallic conductors, electrolytic Conductors (definition and	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
	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	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 babbitt 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 synthetic rubber TLO 4.7 Explain the properties and application of thermal insulators TLO 4.8 Explain the properties and application of electrical insulators	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 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.	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
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 of three groups of resistor materials. TLO 6.7 Describe the properties and applications of Resistor material	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

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 ₂ O, CO ₂ , N ₂	Write the formation of compounds NaCl, AlCl ₃ , H ₂ O, CO ₂ , N ₂	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 ionic solutions 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
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

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
	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, AlCl₃, H₂O, CO₂, N₂
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- 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			
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. 2012 818360093X

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
Sr.No	Link/Portal	Description
5	www.chemcollective.org	Collection of virtual labs, scenario-based learning activities
6	https://www.ancient-origins.net/history-famous-people/indian-sage-acharya-Kanad-001399	IKS Philosophy of atom by Acharya Kanad.

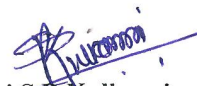
Name & Signature:


Smt. Rupali S. Patil
 Lecturer in Chemistry
 (Course Experts)

Name & Signature:


Shri. S.S. Prabhune
 (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				
						Max	Min			Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
	APPLIED MATHEMATICS	AEC	3	1	-	-	4	2		3	30	70	100	40	-	-	-	-	-	

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 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:

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

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

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

- CO1 - Apply Solve the broad-based engineering problems of integration using suitable methods.
- CO2 - Use definite integration to solve given engineering related problems.
- CO3 - Apply the concept of differential 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 by partial fractions	Unit - I Indefinite Integration 1.1 Simple Integration: Rules of integration and integration of standard functions 1.2 Integration by substitution. 1.3 Integration by parts. 1.4 Integration by partial fractions (only linear non repeated factors at 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 Definite Integration. TLO2.2 Use properties of definite integration to solve 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 given differential 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 squareroot. (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 engineering problems	Unit - V Probability Distribution 5.1 Binomial distribution. 5.2 Poisson's distribution. 5.3 Normal distribution.		CO5

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

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
1	LLO 1.1 Solve simple problems of Integration by substitution	*Integration by substitution	1	CO1
2	LLO 2.1 Solve integration using 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 meanvalue and root mean square value.	* #Mean value and root mean square value. (Only for Information Technology, Computer, Electrical and Electronics Engineering)	1	CO2
8	LLO 8.1 Solve examples on order, degree and formation of differential 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 differentialequation.	*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 lab experiment 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	Kreyszig, 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 David J. Ellenbogen Scott A. Sargent	Calculus and Its Applications	Addison-Wesley 10th Edition ISBN-13: 978-0-321-69433-1
8	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 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=CNqHuabCys4CFdOJaddHoPig	Concept of Mathematics through video lectures and notes
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 explanations of mathematical concepts
6	https://www.mathsisfun.com/	Explanations and interactive lessons covering various math topics, from basic arithmetic to advanced
7	http://tutorial.math.lamar.edu/	Comprehensive set of notes and tutorials covering a wide range of mathematics topics.
8	https://www.purplemath.com/	Purplemath is a great resource for students seeking help with 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 mathematics from universities and institutions around the globe.
12	https://ocw.mit.edu/index.htm	The Massachusetts Institute of Technology (MIT) offers free access to course materials for a wide range of mathematical courses.

Name & Signature:



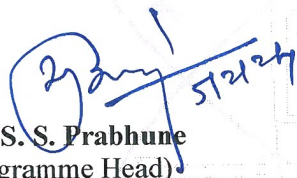
Shri. Vitthal B. Shinde
Lecturer in Mathematics



Shri. Sachin B. Yede
Lecturer in Mathematics

(Course Experts)

Name & Signature:



Shri. S. S. Prabhune
(Programme Head)

Name & Signature:



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

GOVERNMENT POLYTECHNIC, PUNE
'120 – NEP' SCHEME

PROGRAMME	DIPLOMA IN ET
PROGRAMME CODE	03
COURSE TITLE	ELEMENTS OF ELECTRICAL ENGINEERING
COURSE CODE	EE21202
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
			CL	TL	LL					Practical				FA-TH	SA-TH	Total	FA-PR		SA-PR	
						Max	Max		Max	Min	Max	Min	Max				Min	Max	Min	
EE21202	ELEMENTS OF ELECTRICAL ENGINEERING	SEC	3	1	2	0	6	3	3	30	70	100	40	25	10	25@	10			150

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.

- 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 .
- 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.
- Notional learning hours** for the semester are (CL + LL + TL + SL) hrs. * 15 Weeks
- 1 credit** is equivalent to **30 Notional hours**.
- * Self-learning hours shall not be reflected in the Timetable.
- * Self-learning includes micro-projects/assignments/other activities.

II. RATIONALE:

Technical person has to deal with the various electrical machines, equipment, and protective devices. In order to increase the technical proficiency, a technician should possess essential knowledge of electrical engineering parameters, basic concepts, and laws of electrical engineering.

III. COMPETENCY :

Use electrical equipment efficiently for different electronic engineering application.

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

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

- CO1 - Interpret the magnetic field parameters for the particular magnetic circuits.
- CO2 - Analyze A.C. circuits for single phase and polyphase supply.
- CO3 - Select the transformer and DC motor for the given application.
- CO4 - Select the fractional horse power motor for the given application.
- CO5 - Choose the protective devices for the electrical protection.

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 – I ELECTROMAGNETIC INDUCTION (CL HRS-8 ,MARKS-12)				
	TLO 1.1 Describe the terms related to Magnetic circuit. TLO 1.2 Distinguish between electric and magnetic circuit. TLO 1.3 Interpret magneto motive force in series magnetic circuit. TLO 1.4 Solve numerical on Magnetic flux, Flux density, MMF, Magnetic field strength, Permeability TLO 1.5 Describe laws related to magnetic circuit. TLO 1.6 Classify the types of induced emf.	1.1 Define and state units of Magnetic flux, Flux density, Magneto motive force, Magnetic field strength, Permeability. 1.2 Electric circuit and magnetic circuit analogy and differences. 1.3 Series magnetic circuit. 1.4 Faraday's laws of electro-magnetic induction, Lenz's law, Fleming right hand and left hand rule. 1.5 Dynamically and statically induced emf, self and mutual induced emf . 1.6 Self and mutual inductance. 1.7 Coefficient of coupling.	Presentations Chalk-Board Video Demonstrations Model Demonstration	CO1
UNIT - II A.C FUNDAMENTALS FOR SINGLE PHASE AND POLYPHASE CIRCUITS(CL HRS-11,MARKS-18)				
	TLO 2.1 Compare AC quantities with DC quantities. TLO 2.2 Describe terminology related to A.C. fundamentals. TLO 2.3 Solve numerical on instantaneous value, cycle, amplitude, time period, frequency, angular frequency, R.M.S. value, average value form factor, peak factor for sinusoidal waveform TLO 2.4 Describe different forms of representation for electrical quantity. TLO 2.5 Analyze A.C. circuits for different types of load. TLO 2.6 Solve numerical on power in 1 phase. TLO 2.7 Explain generation of three phase induced emf. TLO 2.8 Analyze three phase circuit for star and delta connection. TLO 2.9 Solve numerical on power, power factor in 3 phase balanced system.	2.1 Define A.C. and D.C. quantities, advantages of A.C. over D.C. 2.2 Single phase sinusoidal A.C. wave: instantaneous value, cycle, amplitude, time period, frequency, angular frequency, R.M.S. value, average value ,form factor, peak factor for sinusoidal waveform. 2.3 rectangular and polar forms representation of an ac quantity, phase angle, phase difference concept of lagging and leading. 2.4 A.C through pure resistance, inductance and capacitance. Its equation, phasor diagram and waveform, power. 2.5 Define polyphase system and advantages of three phase system over single phase system. 2.6 Generation of three phase induced emf and its waveform. 2.7 Phase and line currents, phase and line voltages in star connected and delta connected balanced load system. current, power, power factor in 3 phase balanced system.	Video Demonstrations Presentations Chalk-Board	CO2

UNIT - III TRANSFORMERS AND INDUCTION MOTORS(CL HRS-8 ,MARKS-14)

TLO 3.1 Explain construction and working principle of given type of transformer. TLO 3.2 Solve numerical on emf equation, voltage ratio, transformation ratio, losses, efficiency, regulation TLO 3.3 Select different types of transformer for the particular application. TLO 3.4 Describe construction and the working of Induction motor. TLO 3.5 Select the type of Induction motor for given application.	3.1 Transformer construction and working principle, emf equation, voltage ratio, transformation ratio, losses, efficiency, regulation. 3.2 Auto-transformer, Pulse transformer and Isolation transformer construction, working principle and applications. 3.3 construction and working of three phase induction motor. 3.4 Types of induction motor, application.	Chalk-Board Model Demonstration Video Demonstrations Presentations	CO3
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UNIT - IV FRACTIONAL HORSE POWER MOTORS(CL HRS-10 ,MARKS-14)

TLO 4.1 Explain the construction and working principle of the given type of FHP motor. TLO 4.2 Select relevant FHP motor for the respective application TLO 4.3 Describe the procedure to connect given motor for the given application.	4.1 Construction, working principle and application of capacitor start, capacitor start and run single phase AC induction motors. 4.2 Construction, working principle and application of universal motor and reversal of direction of rotation. 4.3 Construction, working principle and application of stepper motor. Only concept of speed control, stepper motor's reversal of direction of rotation 4.4 Construction, working principle, specification and application of BLDC motor.	Model Demonstration Presentations Chalk-Board	CO4
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UNIT - V ELECTRICAL PROTECTIVE DEVICES(CL HRS-8 ,MARKS-12)

TLO 5.1 Explain general safety rule of electrical system. TLO 5.2 Explain and select the different types of protective devices. TLO 5.3 Draw circuit connection diagram of protective devices. TLO 5.4 Describe earthing system and related terms.	5.1 Electrical general safety rules, Personal Protective Equipment (PPE), Selection of wires and cable as per application. 5.2 Type of fuses, operation, connection diagram and application of fuses, Miniature Circuit Breaker (MCB), Molded Case Circuit Breaker (MCCB), Earth Leakage Circuit Breaker(ELCB)operation, connection diagram and general specification 5.3 Draw circuit connection diagram of Protective devices. 5.4 Need of Earthing, methods of Earthing, types of earthing and factors affecting earthing as per Indian Electricity rule.	Model Demonstration Video Demonstrations Presentations Chalk-Board	CO5
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VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL/ TUTORIAL EXPERIENCES.

Sr. No		Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
1	LLO 1.1 Use Faraday's law of electro-magnetic induction. LLO 1.2 Classify types of induced emf.	Demonstration of Faraday's law of electro-magnetic induction for statically and dynamically induced emf.	2	CO1
2	LLO 2.1 Use Faraday's law of electro-magnetic induction. LLO 2.2 Observe mutual induced emf in transformer.	Demonstration of Mutually induced EMF by using single-phase transformers.	2	CO1
3	LLO 3.1 Use cathode ray oscilloscope. LLO 3.2 Identify different parameters on CRO.	Measure, Time period, Peak value, and calculate RMS value of sinusoidal AC waveform using CRO.	2	CO2
4	LLO 4.1 Identify phase angle and phase difference of given quantities. LLO 4.2 Identify the nature of power factor for the respective circuit	Observe the phase difference between voltage and current on CRO for resistive, inductive, and capacitive load and comment on the nature of the power factor (Lagging, Leading, Unity).	2	CO2
5	LLO 5.1 Connect star connected three phase load. LLO 5.2 verify relationship between line and phase quantities.	Connect three phase star connected balanced load and verify the relationship between line voltage and phase voltage, line current and phase current.	2	CO2
6	LLO 6.1 Connect delta connected three phase load. LLO 6.2 verify relationship between line and phase quantities.	Connect three phase delta connected balanced load and verify the relationship between line voltage and phase voltage, line current and phase current.	2	CO2
7	LLO 7.1 Calculate transformation ratio of transformer. LLO 7.2 Connect transformer to given load.	Determine the transformation ratio, current ratio of single phase transformer.	2	CO3
8	LLO 8.1 Calculate efficiency and regulation of transformer. LLO 8.2 Connect transformer to given load.	Calculate efficiency and regulation of single phase transformer	2	CO3
9.	LLO 9.1 Identify pin configuration of pulse transformer. LLO 9.2 Check electrical isolation between input and output of pulse transformer.	Demonstration of working of pulse transformer by observing input pulse and output pulse of pulse transformer on CRO.	2	CO3
10	LLO 10.1 Identify different parts 3 Φ Induction motor. LLO 10.2 Identify different types of 3 Φ Induction motor.	Identify different types of 3 Φ Induction motor by observing terminal connections and also identify different parts of 3 Φ Induction motor.	2	CO3

11	LLO 11.1 Connect 3 Φ Induction to AC supply. LLO 11.2 Select particular starter for particular motor starting.	Reverse the direction of rotation 3 Φ Induction motor.	2	CO3
12	LLO 12.1 Connect single phase induction motor to the supply. LLO 12.2 Change the direction of rotation of single phase induction.	Start single phase induction motor /universal motor/stepper motor. And reverse the direction of rotation of it.	2	CO4
13	LLO 13.1 Select fuse for particular application. LLO 13.2 Select circuit breaker for particular application.	Identify different types of fuses and circuit breakers. State their specification for suitable application.	2	CO5
14	LLO 14.1 Explain connection of Earthing for domestic's application. LLO 14.2 Test available of Earthing for given switch board.	Testing of Earthing using a test lamp and earth tester .comment on it.	2	CO5

VII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED

Sr. No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Single Phase 230/115 V, 50Hz, 1 kVA Transformer	2,7,8
2	Single Phase 0-270V, 50Hz, 10A Auto-transformer	2,7,8,11
3	Cathode Ray Oscilloscope (CRO) 20MHz, Dual channel	3,4
4	Single phase 230V, 10A Resistive Load bank	4,5,6
5	Single phase 230V, 50Hz, 2A Inductive Load bank	4
6	Single phase 230V, 50Hz, 2A Capacitive Load bank	4
7	Pulse transformer 1:1:1 4503 or 1:1 4502	9
8	Different types of 3 Φ Induction motor	10,11
9	Single phase 230V, 50Hz, 1Hp Induction motor	12
10	Single phase 230V, 50Hz, 1/4Hp Universal motor	12

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

Sr. No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Magnetic circuits	CO1	8	4	4	4	12
2	II	A.C fundamentals for single phase and polyphase circuits	CO2	11	4	6	8	18
3	III	Transformers and DC motors	CO3	8	6	4	4	14
4	IV	Fractional horse power motors	CO4	10	4	4	6	14
5	V	Electrical protective devices	CO5	8	4	4	4	12
Grand Total				45	22	22	26	70

IX. ASSESSMENT METHODOLOGIES/TOOLS**Formative assessment (Assessment for 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, laboratory experience.

Summative Assessment (Assessment of Learning)

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
CO1	2	3	3	1	2	-	2			
CO2	2	3	2	-	2	3	2			
CO3	3	2	3	2	2	-	2			
CO4	2	2	3	3	2	2	2			
CO5	3	3	2	2	3	2	3			
Legends:- High:03, Medium:02, Low:01, No Mapping: - *PSOs are to be formulated at the institute level										

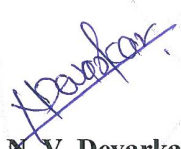
XI. SUGGESTED LEARNING MATERIALS/BOOKS

Sr. No	Author	Title	Publisher
1	Theraja B.L.	Electrical Technology Vol-I	S.Chand and Co., new Delhi, ISBN:9788121924405
2	Theraja B.L.	Electrical Technology Vol-II	S.Chand and Co., new Delhi, ISBN:9788121924375
3	V. N. Mittle and Arvind Mittal	Basic Electrical Engineering	McGraw Hill, New Delhi, ISBN:978-0070593572
4	U.A.Bakshi	Basic Electrical Engineering	Technical Publications, ISBN:9789333220392
5	DP Kothari and I J Nagrath	Basic Electrical Engineering	Mc Graw Hill, New Delhi, ISBN: 978-9353165727

XII. LEARNING WEBSITES & PORTALS

Sr. No	Link/Portal	Description
1.	https://nptel.ac.in/courses/108105112	NPTEL study materials
2.	https://www.electrical4U.com	All about electrical circuits
3.	https://instrumentationtools.com/category/electrical-animation/	Animation of basic electrical engineering quantities
4.	https://www.udemy.com/course/crash-course-electric-circuits-for-electrical-engineering/	Flip classroom learning material
5.	http://www.ece.umn.edu/users/riaz/animations/listanimations.html	Animation of electrical machines
6.	https://www.services.bis.gov.in/php/BIS_2.0/bisconnect/get_is_list_by_category_id/5	IS standard

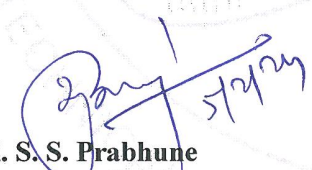
Name & Signature:


Smt. N. V. Devarkar
 Lecturer in Electrical Engineering

(Course Experts)


Smt. A. A. Patole
 Lecturer in Electrical Engineering

Name & Signature:


Shri. S. S. Prabhune
 (Programme Head)

Name & Signature:


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

GOVERNMENT POLYTECHNIC, PUNE
‘120 – NEP’ SCHEME

PROGRAMME	DIPLOMA IN ET
PROGRAMME CODE	03
COURSE TITLE	APPLIED ELECTRONICS
COURSE CODE	ET21202
PREREQUISITE COURSE CODE & TITLE	--

I. LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Course Type	Learning Scheme					Credits	Paper Duration	Assessment Scheme										Total Marks
			Actual Contact Hrs./Week			SLH	NLH			Theory				Based on LL & TSL				Based on SL		
														Practical						
			CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
						Max	Min							Max	Min	Max	Min	Max	Min	
ET21202	APPLIED ELECTRONICS	DSC	4	-	2	2	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.

- 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.
- 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.
- Notional learning hours** for the semester are (CL + LL + TL + SL) hrs. * 15 Weeks
- 1 credit** is equivalent to **30 Notional hours**.
- * Self-learning hours shall not be reflected in the Timetable.
- * Self-learning includes micro-projects/assignments/other activities.

II. RATIONALE:

Diploma engineers have to deal with the various types of electronic circuits 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. Understanding of the subject will provide skill to the students for troubleshooting and testing of some of circuits & devices.

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

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

- CO1: Select/Use wave shaping circuits.
 CO2: Use transistor as low power amplifier.
 CO3: Use BJT as tuned amplifier.
 CO4: Use BJT as high-power amplifier.
 CO5: Interpret working of feedback amplifier and oscillator.
 CO6: Use BJT as waveform generator.

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 WAVESHAPING CIRCUITS (CL Hrs-08, Marks-10)				
1.	TLO 1.1: Select clipper for obtaining the given waveform. TLO 1.2: Select clamper for obtaining the given waveform. TLO 1.3: Describe need and working principle of given RC filter.	1.1 Diode clipper: Positive, negative, biased, and combinational clipper. 1.2 Diode clamper: Positive, negative. 1.3 Applications of clipper and clamper. 1.4 Passive filters: Concept of RC high pass, low pass, band pass, band stop filter and frequency response. Circuit diagram, input/output waveforms and applications of RC integrator and RC differentiator.	Classroom Learning, Reference books, NPTEL	CO1
UNIT-II LOW POWER AMPLIFIERS (CL Hrs-12, Marks-14)				
2	TLO 2.1: Explain with circuit diagram the operation of given type of amplifier. TLO 2.2: Calculate gain and bandwidth of given low power amplifier. TLO 2.3: Compare performance parameters of given types of amplifier coupling. TLO 2.4: Explain with sketches the working principle of FET amplifier.	2.1 Introduction, Classification of amplifiers, BJT as an amplifier. Single stage CE amplifier, frequency response, voltage gain, bandwidth. 2.2 Multistage amplifier: General BJT based multistage amplifier. Types of amplifier coupling: Circuit diagram, operation, frequency response and applications of RC coupling, Transformer coupling and Direct coupling. 2.3 FET amplifier: Common Source amplifier, working principle and applications.	Classroom Learning, Reference books, NPTEL	CO2
UNIT-III TUNED AMPLIFIERS (CL Hrs-08, Marks-08)				
3	TLO 3.1: Explain with sketches working principle of given tuned circuit. TLO 3.2: Select relevant tuned amplifier for the given frequency band with justification. TLO 3.3: Compare performance of different types of tuned amplifier.	3.1 Tuned Amplifier: Introduction & necessity of tuned amplifier, Basic tuned circuit. 3.2 Circuit diagram & operating principle of single & double tuned amplifier, Stagger tuned amplifier. 3.3 Applications of all three types.	Classroom Learning, Reference books, NPTEL	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 POWER AMPLIFIERS (CL Hrs-10, Marks-12)				
4	TLO 4.1: Explain with sketches working of given type of power amplifier. TLO 4.2: Calculate the efficiency of given type of power amplifier. TLO 4.3: Compare the performance parameters of given type of power amplifier. TLO 4.4: Select the relevant power amplifier for the given applications.	4.1 Introduction, Comparison between small signal amplifier and power amplifier, Performance parameters, Operating point, load line. 4.2 Classification: Class A, Class B, Class AB & Class C with respect to operating point on load line, efficiency, 4.3 Circuit Operation, input/output waveforms, efficiency and Power equation of Single stage class A, Class B push-pull amplifier, Class C amplifier. Advantages, disadvantages, and applications of power amplifier.	Classroom Learning, Reference books, NPTEL	CO4
UNIT –V FEEDBACK AMPLIFIERS AND OSCILLATORS (CL Hrs-12, Marks-14)				
5	TLO 5.1: Explain effect of negative feedback on the given type of amplifier. TLO 5.2: Compare the performance of given type of negative feedback amplifier. TLO 5.3: Explain with sketches working of given type of oscillator. TLO 5.4: Calculate the frequency of oscillation for given type of oscillator.	5.1 Feedback Amplifiers: Concept of Feedback: series & shunt. Types of feedback: negative and positive Types of feedback connections: voltage shunt, voltage series, current series & current shunt. 5.2 Sinusoidal Oscillators: Introduction, need and condition for oscillations, Barkhausen's criteria. Comparison of oscillators and amplifiers. Types of oscillators: LC Oscillators- Working principle of Hartley Oscillator and Colpitts Oscillator, RC Oscillators- Working principle of RC phase shift oscillator and Wein bridge oscillator. Crystal oscillator- Concept, working principle and applications.	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 MULTIVIBRATORS (CL Hrs-10, Marks-12)				
6	TLO 6.1: Explain with sketches working of given type of multivibrator. TLO 6.2: Calculate the frequency of output waveform of multivibrator. TLO 6.3: Explain with sketch working of Schmitt trigger.	6.1 Transistor as a Switch. 6.2 Classification of multivibrator: Astable multivibrator: circuit diagram, working principle, waveforms & Time period. Monostable multivibrator: circuit diagram, working principle, waveforms & Time period. Bistable multivibrator: circuit diagram, working principle, waveforms, applications. 6.3 Applications of multivibrator: Schmitt trigger	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*	Observe output waveform and test the performance of positive and negative diode clipper.	Test the performance of diode clipper.	02	CO1
2	Observe output waveform and test the performance of positive and negative diode clamper.	Test the performance of diode clamper.	02	CO1
3*	Observe output waveform and test the performance of RC integrator and differentiator.	Test the performance of RC integrator and differentiator.	02	CO1
4*	Build and plot the frequency response of common emitter BJT amplifier. Determine gain and bandwidth.	Build and plot the frequency response of common emitter BJT amplifier. Determine gain and bandwidth.	02	CO2
5	Plot the frequency response of RC coupled BJT amplifier.	Plot the frequency response of RC coupled BJT amplifier.	02	CO2
6*	Simulate the frequency response of FET amplifier.	Simulate the frequency response of FET amplifier.	02	CO2
7*	Build/ Test single tuned BJT amplifier.	Build/ Test single tuned BJT amplifier.	02	CO3
8	Build/ Test double tuned BJT amplifier.	Build/ Test double tuned BJT amplifier.	02	CO3
9*	Build/ Test the performance of class-A power amplifier.	Build/ Test the performance of class-A power amplifier.	02	CO4

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
10*	Build/ Test the performance of class-B push pull power amplifier.	Build/ Test the performance of class-B push pull power amplifier.	02	CO4
11*	Build and test/simulate the performance of negative feedback of a given type of amplifier.	Build and test/simulate the performance of negative feedback of a given type of amplifier.	02	CO5
12*	Observe the waveform and measure the frequency of Hartley/Colpitt's oscillator.	Observe the waveform and measure the frequency of Hartley/Colpitt's oscillator.	02	CO5
13	Observe/simulate the waveform and measure the frequency of RC phase shift oscillator.	Observe/simulate the waveform and measure the frequency of RC phase shift oscillator.	02	CO5
14*	Observe the waveform and measure the frequency of crystal oscillator.	Observe the waveform and measure the frequency of crystal oscillator.	02	CO5
15*	Build/test switching characteristics of BJT.	Build/test switching characteristics of BJT.	02	CO6
16*	Observe the waveforms of astable multivibrator and measure its time period and frequency.	Observe the waveforms of astable multivibrator and measure its time period and frequency.	02	CO6
17	Observe the waveforms of monostable multivibrator and measure its pulse width.	Observe the waveforms of monostable multivibrator and measure its pulse width.	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 judicious 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:

- Build and test a circuit to pass only high frequency signals.
- Build and test a circuit to pass only low frequency signals.
- Construct a circuit on general purpose PCB to clamp +2V signal with input signal 5Vpp.
- Construct audio amplifier circuit using IC810 or equivalent IC.
- Build and test frequency response of single stage BJT amplifier.
- Construct power amplifier for FM receiver output.
- Construct class-B push pull amplifier and test its performance.
- Construct negative feedback amplifier and test its performance.
- Build a circuit of astable multivibrator on general purpose PCB and test its performance.

Assignment/Activity

- Make a chart to compare all types of RC filters with its frequency responses.
- Make library survey regarding different electronic circuits and voltage regulators.
- Give a seminar on any relevant topic.
- Collect information on various multivibrators using IC555 and its applications.
- Prepare power point presentation on class-A class-B, class-C operation of power amplifier.
- Undertake a market survey for different ICs and electronic circuits and make a report.

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	1,2,4,5,6,7,8,9,10,11,12,13,14,15,16,17
2	Cathode Ray Oscilloscope Dual trace 20 MHz, 1MΩ, Input Impedance	1,2,3,4,5,6,7,8,9,10,11,12,13,14,16,17
3	Function Generator 0-2MHz with Sine, square, and triangular output	1,2,3,4,5,6,7,8,9,10,11
4	Digital Multimeter: 3 1/2-digit display, 9999 counts digital	9,15

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	Wave shaping circuits	CO1	8	2	6	2	10
2	II	Low power amplifiers	CO2	12	2	8	4	14
3	III	Tuned amplifiers	CO3	8	4	4	-	8
4	IV	Power amplifiers	CO4	10	2	8	2	12
5	V	Feedback amplifiers & Oscillators	CO5	12	2	8	4	14
6	VI	Multivibrators	CO6	10	2	8	2	12
Grand Total				60	14	42	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	3	3	-	2	2	2	2	3
CO2	3	3	3	3	-	2	2	3	2	3
CO3	3	2	2	3	-	2	2	3	2	3
CO4	3	2	3	3	-	2	2	3	2	3
CO5	3	3	3	3	-	2	2	3	2	3
CO6	3	2	3	3	-	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
1	Albert Malvino	Basic Electronics.	8 th Edition, Tata McGraw Hill 2015 ISBN10:1259200116 ISBN13:9781259200113
2	Allen Mottershead	Electronics Devices and Circuits	PHI Learning Publishers ISBN: 9788120301245
3	B. L. Theraja, S Chand	Basic Electronics	Publishing, 2007, ISBN 10: 8121925568 ISBN 13: 9788121925563
4	R. S. Sedha	Applied Electronics	S. Chand & company Ltd., New Delhi, ISBN:8121927833
5	P. Ramesh Babu	Electronics Devices and Circuits	Scitech Publication Pvt. Ltd 2009 ISBN:8183711723
6	Boylestad & Nashelsky	Electronic Devices and Circuit Theory	Pearson Education India; 11 edition (2015) ISBN: 978-9332542600

XII. LEARNING WEBSITES & PORTALS

Sr.No	Link/Portal	Description
1.	https://www.electronicshub.org	Diode clippers, clampers and RC filters
2.	https://www.tutorialspoint.com/amplifiers/multi_stage_transistor_amplifier.htm	Multistage low power BJT amplifiers
3.	https://www.tutorialspoint.com/amplifiers/tuned_amplifiers.htm	Tuned amplifier using BJT
4.	https://www.tutorialspoint.com/amplifiers/power_amplifiers.htm	Types of Power amplifier
5.	https://www.tutorialspoint.com/amplifiers/amplifiers_feedback.htm	Feedback amplifiers and types
6.	https://en.wikipedia.org/wiki/Electronic_oscillator or https://www.tutorialspoint.com/sinusoidal_oscillators/sinusoidal_hartley_oscillator.htm	Oscillators and types
7.	https://learnabout-electronics.org/Oscillators/osc41.php	Multivibrators

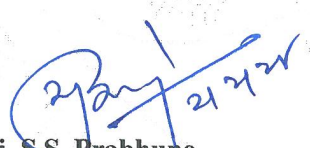
Name & Signature:


Smt. N.S. Bakde
Lecturer in E&TC

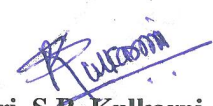
Smt. P.V. Lengare
Lecturer in E&TC

(Course Experts)

Name & Signature:


Shri. S.S. Prabhune
(Programme Head)

Name & Signature:


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

GOVERNMENT POLYTECHNIC, PUNE
‘120 – NEP’ SCHEME

PROGRAMME	DIPLOMA IN ET
PROGRAMME CODE	03
COURSE TITLE	ELECTRONICS WORKSHOP PRACTICE
COURSE CODE	ET21205
PREREQUISITE COURSE CODE & TITLE	NA

I. LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Course Type	Learning Scheme					Credits	Assessment Scheme											Total Marks
			Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TSL				Based on SL		
														Practical						
			CL	TL	LL	FA-TH	SA-TH			Total		FA-PR		SA-PR		SLA				
												Max	Min	Max	Min	Max	Min	Max	Min	
ET11201	ELECTRONICS WORKSHOP PRACTICE	DSC	2	-	2	2	6	3	--	--	--	--	50	20	50@	20	25	10	125	

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 is intended to help the students of Diploma in Engineering to get idea of various Electronic Materials and Components employed in electronic industries. It will make the students familiar with the suitability of various electronic materials and components for different applications. This course is intended to develop skills of testing components that will be needed for the project and setting up of many experiments in basic and applied technology courses.

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: Identify the relevant material for the electronic applications.

CO2: Suggest relevant electronic components for the given application.

CO3: Identify the Surface Mount Devices for specific applications.

CO4: Use specific components for roof top solar energy systems.

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 ELECTRONIC MATERIALS (CL Hrs-06, Marks-NIL)				
1.	TLO 1.1 Explain the effect of the given factor on the resistivity of electrical material. TLO 1.2 Describe the properties of the given Photo emissive material. TLO 1.3 Explain the phenomenon of dielectric material. TLO 1.4 Select the dielectric material for the given application. TLO 1.5 Classify the magnetic material on the basis of given magnetic properties.	1.1 Factors affecting the resistivity of material like temperature, area of cross-section, length (or distance) of the element. 1.2 Photo emissive materials: Properties, impurities used to emit different colors, applications 1.3 Dielectric Materials: Types, Properties, frequency dependence of electronic polarisability, frequency dependence of permittivity 1.4 Magnetic Materials: Properties, classification: Permanent magnetic dipole, diamagnetism, paramagnetism, ferromagnetism.	Chalk-Board Video Demonstrations Hands-on	CO1
UNIT - II ELECTRONIC COMPONENTS (CL Hrs-12, Marks-NIL)				
2.	TLO 2.1 Select the passive Component for the given application. TLO 2.2 Suggest the relevant combination of materials for the LED of the given color TLO 2.3 Describe the given type of IC and its package. TLO 2.4 Differentiate between the given types of ICs. TLO 2.5 Identify different types of switches and relays. TLO 2.6 Test different types of switches and relays. TLO 2.7 Identify different types of cables and connectors. TLO 2.8 Test different types of cables and connectors. TLO 2.9 Identify different types of transformers.	2.1 Passive Components: Concepts and Specifications and applications Voltage Dependent Resistor (VDR), Temperature Dependent Resistor (TDR), Light Dependent Resistor (LDR). 2.2 Construction, working principle and applications of OLED 2.3 Integrated Circuit: Introduction to Monolithic IC, thick & thin film IC, Hybrid IC, Linear IC, Digital IC and IC packages (SIP, TO5, Flat, DIP), Pin , Device Identification, Temperature ranges. 2.4 Types, specifications, applications & testing of Switches & Relays 2.5 Types, specifications, applications & testing of Cable & connectors 2.6 Types, specifications, applications & testing of Transformers	Chalk-Board Hands-on Model Demonstration Video Demonstrations	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 SURFACE MOUNT DEVICES (CL Hrs-08, Marks-NIL)				
3	TLO 3.1 Explain SMT and SMD. TLO 3.2 Describe the steps involved in the assembly technique in the SMT. TLO 3.3 Differentiate between the given type of the soldering/ de-soldering in SMT. TLO 3.4 Identify the need of SMT with respect to its advantages. TLO 3.5 Classify the SMD packages with respect to the given type of components.	3.1 Introduction to Surface Mount Technology (SMT) and Surface mount Devices(SMD). 3.2 Assembly and rework techniques: Contact and noncontact types of soldering and de-soldering Advantages and Disadvantages of SMT SMD packages : Two terminal package for passive and active components, Three or four terminal packages, five or six terminal packages, More than six terminal packages; Examples of each Automatic component insertion technique	Chalk-Board Model Demonstration Video Demonstrations Hands-o	CO3
UNIT –IV SOLAR SYSTEM COMPONENTS (CL Hrs-04, Marks-NIL)				
4	TLO 4.1 State the basic principle of Photovoltaic Cell for the given application. TLO 4.2 Illustrate construction of solar panel. TLO 4.3 List the different types of solar batteries for the given specifications TLO 4.4 Use of battery bank for solar power system . TLO 4.5 Choose the suitable battery for a solar energy system.	4.1 Photovoltaic materials 4.2 Solar Cell: Working Principle and Construction 4.3 Materials used in a Solar Panel 4.4 Batteries used in solar panel, its ratings and selection factors 4.5 Specifications of battery like battery Capacity ,power ratings, depth of discharge(DOD),round trip efficiency, warranty and life span	Chalk-Board Model Demonstration Video Demonstrations Hands-on	CO4

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 resistivity for a given length of wire keeping area constant	Determination of resistivity.	02	CO1
2	Use photo electric cell to study I-V characteristics .	Determination of photoelectric cell characteristics	02	CO1
3*	Plot the charging and discharging curve of two different capacitors each having different dielectric material	Charging and discharging curve of two different capacitors	02	CO1
4*	Test the performance of Light Dependent Resistor (LDR) as a dark sensor	LDR as a Dark Sensor	02	CO2
5*	Test the identified analog IC's, digital IC's.	Testing of different IC	02	CO2
6*	Test the identified switches and relays.	Test various switches and relays.	02	CO2
7	Identify various cable and connectors used in the given circuit	Identify various cable and connectors by physical Observation	02	CO2
8*	Test identified cable and connectors used in the given circuit	Test various cable and connectors.	02	CO2
9	Identify transformer used in the given circuit	Identify various transformers.	02	CO2
10	Test transformer used in the given circuit	Test various transformers.	02	CO2
11*	Determine SMD component value (Resistor, Capacitor and Inductor) using their nomenclature.	Determination of SMD component value	02	CO3
12	Soldering of Surface Mounted Devices (SMD).	Soldering of SMD	02	CO3
13	Identify given SMD according to package type	Identification of given SMD	02	CO3
14*	Plot V-I Characteristics of the solar cell.	Characteristics of the solar cell.	02	CO4
15	Use a Solar Panel (Small panel approx. - 4.5 V output) to drive any small load	Use of Solar Panel to drive any small load	02	CO4
16	Measure voltage and current by connecting three batteries first in series and then parallel each having rating of 6V,2A	Voltage and current measurement using series and parallel connection of batteries	02	CO4

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
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 judicious 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:

- Record values of different parameters (Direction, tilt angle, distance between pedestal, connection of solar panel) during installation of a solar panel by watching animation video
- Collect different samples of photoemissive material and prepare chart of their applications.
- Collect different samples of dielectric material and prepare chart of their applications.
- Collect different samples of magnetic material and prepare chart of their applications.
- Collect capacitors of different values and make a chart for the specification and application of the same.
- Prepare a chart on different types of switches and relays.
- Prepare a chart on different types of cables and connectors.
- Prepare a chart on different types of transformers.
- Describe the solar panel installation process for residential purpose

Assignment

- Collect information on electronic materials and prepare charts of the same.
- Collect information on electronic components and prepare charts of the same.
- Make a chart of different types of ICs.
- Make a chart of different types of SMD packages.

VII. LABORATORY EQUIPMENT/ INSTRUMENTS/ TOOLS/ SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Voltmeter - 0-10V, Ammeter 0-1A, Battery 0-12V, metal wire- 40cm,50cm,60cm,70cm,80cm,90cm or as available, Resistance Box: 4 decade ranges from 1 ohm to 1K,accuracy 0.1 % - 1 %	1
2	Variable power supply 0-12V,500mA Microammeter 0-100μA Voltmeter/Multimeter 0 to 10V Photoelectric cell setup	2
3	Resistor, Capacitor, Voltmeter/Multimeter, Ammeter/Multimeter, Power Supply, Stop watch, Switch	3
4	LDR ,LED, 1K ohm Resistor ,50K ohm Resistor ,BC547– BJT ,9V battery ,Breadboard	4
5	IC tester, TTL IC's, CMOS IC's	5
6	Multimeter, switches and relays	6
7	Different types of cables and connectors	7
8	Multimeter, cables and connectors	8
9	Different types of transformers	9
10	Multimeter, transformer	10
11	Different values of SMD resistor, SMD capacitor and SMD Inductor	11
12	Soldering iron with soldering station(use 15,18 W iron), 63/27 flux cord solder wire, surface mounted components, magnifying glass	12
13	SMD of different packages like transistor SOT23 pack, transistor SOT89 Pack, IC SO8 Pack, IC SO14 pack	13
14	A solar panel, a voltmeter, a micro-ammeter, a variable resistor and a 100 W lamp.	14
15	Solar panel (output 4.5V) cell and any load that it can drive	15
16	Solar Cells Potentiometer Voltage Meter Current Meter	16

**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)
1. Self – Learning 2. Term Work	1. End Term Exam 2. Micro-Project

X. SUGGESTED COS- POS MATRIX FORM

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

Legends:- High:03, Medium:02, Low:01, NoMapping: -

*PSOs are to be formulated at the institute level

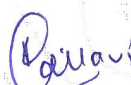
XI. SUGGESTED LEARNING MATERIALS / BOOKS

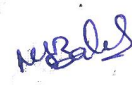
Sr.No	Author	Title	Publisher
1	Milton Kaufman , Arthur H. Seidman , Perry J Sheneman	Handbook for Electronics Engineering Technicians Hardcover	McGraw-Hill ,SBN-13 978-0070334083
2	Charles A. Harper	Electronic Assembly Fabrication: Chips, Circuit Boards, Packages, and Components (ELECTRONICS)	McGraw-Hill Professional ,SBN-13 978-0071378826
3	Rathore	Fundamentals Of Renewable Energy Sources	Himanshu Publications: eISBN no.9781003245643
4	Walter ,Bosshart	Printed Circuit Boards	Tata McGraw Hill ISBN-13 978-0074515495
5	Grover & Jamwal	Electronic Components and Materials	Dhanpat Rai & Sons, ISBN-13 5551234023845
6	Dhir S M	Electronic Components and Materials	Tata McGraw Hill ISBN: 9780074630822
7	Madhuri Joshi	Electronic Components and Materials	Shroff Publishers & Distributors private ltd.ISBN-13: 978-8173669002

XII. LEARNING WEBSITES & PORTALS

Sr.No	Link/Portal	Description
1	https://www.electronics-tutorials.ws/resistor/res_1.html	Resistors
2	https://www.greenmatch.co.uk/blog/2014/12/how-are-solar-panels-made	Solar panels
3	https://www.britannica.com/technology/integrated-circuit/Fabricating-ICs	IC fabrication
4	https://resources.pcb.cadence.com/blog/2023-ic-fabrication-process-flow-chart	IC fabrication process
5	https://en.wikipedia.org/wiki/Electronic_component	Different electronic components
6	https://www.seeedstudio.com/blog/2017/12/28/difference-between-smt-and-smd/	SMT and SMD
7	https://www.literoflightusa.org/how-are-solar-panels-made/	Solar cell and solar panel
8	https://www.google.com/search?q=practicle+on+solar+cell+experiment&sca_esv=573057508&rlz=1C1YTUH_enI	Solar cell characteristics
9	https://www.google.com/search?q=installation+process+of+solar+panels+animation&sca_esv=573067372&rlz	Installation of solar panel
10	https://renewablelab.niu.edu/experiments/seriesParallelSolarCells	Solar cell in series and parallel
11	https://www.electronicshobby.com/blog/category/soldering	Soldering methods
12	https://www.electronicshobby.com/blog/electronic-components	For electronic Components, SMT,PCB
13	https://www.electronicshobby.com/types-of-integrated-circuits-classification-of-ics-by-structure/	For Integrated Circuits

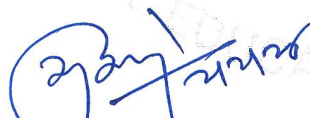
Name & Signature:


Smt. P.V. Lengare
 Lecturer in E&TC


Smt. N.S. Bakde
 Lecturer in E&TC

(Course Experts)

Name & Signature:


Shri. S.S. Prabhune
 (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	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												Total Marks		
			Actual Contact Hrs./Week			SL	H	NL		H	Paper Duration	Theory				Based on LL & TSL				Based on SL				
			CL	TL	LL							Practical												
												FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA				
														Max	Max	Max	Min	Max	Min	Max	Min		Max	Min
HU11202	PROFESSIONAL COMMUNICATION SKILLS	SEC	-	-	2	-	2	1		-	-	-	-	25	10	25@	10	-	-	50				

Total IKS Hrs for Sem. : 0 Hrs

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

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

Note :

- 1.FA-TH represents the average of two class tests of 30 marks each conducted during the semester.
- 2.If the candidate does not secure minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that course.
- 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:

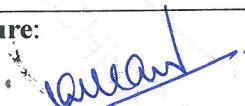
Course Outcomes (COs)	Programme Outcomes(POs)							Programme Specific Outcomes *(PSOs)		
	PO-1 Basic and Discipline-Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	-	-	-	-	-	-	1	-	-	-
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		Name & Signature:  Dr. S.P. Palve Lecturer in English
(Course Experts)		
Name & Signature:  Shri. S.S. Prabhune (Programme Head)	Name & Signature:  Shri. S.B. Kulkarni (CDC In-charge)	

GOVERNMENT POLYTECHNIC, PUNE
'120 – NEP' SCHEME

PROGRAMME	DIPLOMA IN ET
PROGRAMME CODE	03
COURSE TITLE	PROGRAMMING IN 'C' LANGUAGE
COURSE CODE	CM21203
PREREQUISITE COURSE CODE & TITLE	NA

I. LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Course Type	Learning Scheme						Credits	Assessment Scheme												Total Marks
			Actual Contact Hrs./Week			SLH	NLH	Paper Duration		Theory				Based on LL & TSL				Based on SL				
			CL	TL	LL					Practical												
										FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA				
												Max	Min	Max	Min	Max	Min	Max	Min			
CM21203	PROGRAMMING IN 'C' LANGUAGE	SEC	3	0	2	1	6	3	2	15	35*#	50	20	--	--	50@	20	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:

Programming language C is a versatile language used in many Micro controller based application. This course deals with concepts of programming to enhance programming skills of diploma students. By engaging with C programming, students acquire logical reasoning, problem-solving techniques, and analytical thinking which will enable the students to solve engineering 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

Apply the concepts of Programming to solve engineering (discipline) related problem

CO1- Interpret the basic code of C

CO2 - Implement decision making in C programming.

CO3 - Use arrays and strings in C Programming.

CO4 - Use functions in 'C' programs for modular programming approach

CO5 - Use pointers to increase efficiency of programs and Implement basic concept of structure in "C"

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 Overview of C programming(Hrs-08, Marks-12)				
1.	TLO 1.1 Describe the given data type. TLO 1.2 Construct algorithm, flowchart for the given problem TLO 1.3 Use pre-increment and post-increment operators in the given situation. TLO 1.4 Use bitwise operators in the given situation.	1.1. Structure of C : Assembler , Compiler, Linker, Interpreter 1.2 character set: Keywords. Identifiers, different types of constants (Integer, character, string, and real) variables, scope of variables, concept of ASCII. 1.3 Data types: Integer, signed ,unsigned, float 1.4 Operators and Expression: Arithmetic, Logical, Assignment, Relational, Increment and Decrement, conditional, bitwise, operators, Evaluation of expression 1.5 Algorithm and Flowchart: Formatted input output statement, input output function	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 Decision and loop control (CL Hrs-10, Marks-10)				
2	TLO 2.1: Write a 'C' program using the given decision making structure for two-way branching TLO 2.2: Write a 'C' program using the given decision making structure for multi-way branching TLO 2.3: Write a 'C' program using loop statements to solve the given iterative problem. TLO 2.4: Use related statements to alter the program flow in the given	2.1 Decision making: if statement (if. if-else. nested if-else), switch-case statement 2.2 Repetition in 'C' (loop control statement) while, do-while and for loop. break and continue statement, nested loop	Improved Lecture Tutorial Assignment Demonstration Simulation	CO2

UNIT-III Array and Strings (CL Hrs-10, Marks-10)				
3	TLO 3.1 Write steps to access element of the given array TLO 3.2 Write steps to perform operation on given array TLO 3.3 Write steps to initialize and declare given string in array	3.1 Introduction to Array and its types 3.2 Declaration , initialization of array 3.3 Processing elements of an array, adding, deleting, sorting, searching, 3.4 Introduction to String: Initialization,declaring and display of string 3.5String handling functions- strcat(), strcmp(), strcpy(), strlen(), strlwr(),strupr()	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 Functions (CL Hrs-07, Marks-08)				
4	TLO 4.1: Use inbuilt function for the given program. TLO 4.2: Develop relevant user defined function for given program. TLO 4.3: Create programs based on categories of user defined functions TLO4.4: Write recursion function for the given problem.	4.1Function: Concept and need of Function. 4.2Libraryfunction: Math function,string handling function. 4.3User defined function types :Elements of user defined functions, Calling a user defined function, Categories of user defined functions- No argument- No return value, Argument- No return value, No argument- Return value, Argument- Return value. 4.4 Recursive function (only concept)	Improved Lecture Tutorial Assignment Demonstration Simulation	CO4
UNIT –V Pointers and structures(CL Hrs-10, Marks-10)				
5	TLO 5.1: Use pointer for address access to manipulate the given data. TLO 5.2: Use pointer to access memory location to solve the given problem. TLO 5.3 Create a structure for given data. TLO 5.4:Develop a program to access elements of structure	5.1 Pointer concept 5.2 Address and indirection operators 5.3 Declaration and Initialization of pointer variables. 5.4 Accessing a variable through its pointer 5.5 Introduction and features and syntax of structure. 5.6 Declaring and Initialization of structure 5.7 Initialization, Accessing structure members using pointer	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: Apply rules to draw flowchart for given program	(*)Write algorithm and draw flow chart for following programs : A) Addition/Subtraction of Two numbers B) Exchange value of Two variables	2	CO1
2	LLO 2.1: Implement basic input output statement of C language.	(*)Write the Program to display the message "Hello GPP", name, address, date of birth and email id using printf() function.	2	CO1
3	LLO 3.1: Apply Logical operators on given data	(*)Write a program to demonstrate use of Logical operators	2	CO1
4	LLO 4.1: Apply Arithmetic operators on given data.	Write a program to demonstrate use of Arithmetic operators	2	CO1
5	LLO 5.1: Apply relevant operator on given data	Write a program to check whether entered year is leap or not	2	CO1
6	LLO 6.1: Apply conditional operator on given data.	Write a program to demonstrate use of Conditional operator	2	CO1
7	LLO 7.1: Implement if,if-else nested if-else statements for solving given task	(*)Write a program to demonstrate use of if, if-else nested if-else statements.	2	CO2
8	LLO 8.1: Apply switch-case statement for Implementing menu driven program.	(*)Write a program to demonstrate the use of switch, case statements.	2	CO2
9	LLO9.1:USE loop to implement iteration	(*)Write a program to demonstrate the use of for loop.	2	CO2
10	LLO 10.1: Implement post tested loop using do-while loop	Write a program to demonstrate the use of while, do while	2	CO2
11	LLO 11.1: Implement array for given data	(*)Write a program to declare, modify and print elements of a given data array.	2	CO3
12	LLO 12.1: Use array to copy data	Write a program to copy one array into second array for given data elements.	2	CO3
13	LLO 13.1: Create a C program for implementing pointers	Write a program to sort numbers in ascending and descending in a given array.	2	CO3
14	LLO 14.1: Perform string operations using standard library functions	(*)Write a program to accept a string from user and handling functions.	2	CO4
15	LLO 15.1: Implement function to add two numbers	Write the program to add two numbers using function	2	CO4

16	LLO 16.1: Implement inbuilt math functions to perform mathematical operations.	Write a program to implement following math functions i) mod() ii) sqrt() iii)pow() iv)exp()	2	CO4
17	LLO 16.1:Implement address and pointer operation for given data	Write a program to use address operator (&) and pointer operator(*)for given data.	2	CO5
18	LLO 17.1:create c program to access elements of array using pointer	Write a program to access the array elements using pointer	2	CO5
19	LLO 18.1:create a c program to implement pointers	Write a program to exchange given values of two variables using pointer.	2	CO5
20	LLO 20.1:.Use structures to implement multiple data types	(*)Create structure DATA using „C" having members day, month, year and assign initial values to that structure	2	CO5

Minimum 12 for 2 LL Hrs./Week or 24 for 4 LL hrs./Week are to be Performed.

'*' Marked Practicals (LLOs) Are mandatory

Judicial mix of LLOs are to be performed to complete minimum requirement of 12 / 24 as applicable

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 activity chart consisting of individual contribution in the project work and give a seminar presentation of it before submission.. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

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

- 1 Simple Calculator: Each group will prepare a menu driven program to perform four mathematical operation.
- 2 Bus Reservation System: Each batch will prepare a menu driven program to following operations
i) Book a Ticket ii) List the information of all the tickets booked
- 3 Employee Record System: Each group will prepare a menu driven program to perform following Operations.
i). Add Record ii).List Record
- 4 String Manipulation Project: Each group will prepare a menu driven program to perform following operations. (Any two)
i) Sub Strings ii) Reverse String iii) String Integer iii)Sort a string
5. Matrix operations: Each group will prepare a menu driven program to perform following operation. (Any two)
i). Matrix addition ii) Matrix Multiplication iii) Matrix Transpose iv)Sum of Diagonal of Matrix.

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

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

7. Digital Clock Using "C"

Assignment

1. Each of the following expressions involves the use of a library function. Identify the purpose of each expression.

- `abs(i - 2 * j)`
- `fabs(x + y)`
- `isprint(c)`
- `isdigit(c)`

2. A 'C' program contains the following declarations and initial assignments:

`int i = 8, j = 5, k;`

`float x = 0.005, y = -0.01, z;`

`char a, b, c = 'c', d = 'd';`

Determine the value of each of the following assignment expressions. Use the values originally assigned to the variables for each expression.

- `k = (i + j) * y - x`
- `z = (x + y) * x * 2`
- `K = (x + y)`
- `K = c`
- `i += 2`

3. A number is called an Armstrong number if the sum of the cubes of the digits of the number is equal to the number. For example $153 = 1^3 + 5^3 + 3^3$. Write a C program that asks the user to enter a number and returns if it is Armstrong or not (use function)

4. Write a C program that calculates the HCF and LCM of two numbers

5. Write a C program to input n numbers in an array, calculate the sum of all even numbers and all odd numbers in the array and print the larger sum

6. Write a program to find area of i) square ii) triangle

7. Write a C program to accept 10 values in an integer array. Display the number of odd, even, and negative numbers.

8. Write a C program to check whether a given string is palindrome or not.
9. Input date, month and year from the user, and using switch case, display in worded format. e.g. input: d=16, m=7, y=1992 output: 16th July, 1992
10. Write a C program, which will print two digit numbers whose sum of both digit is multiple of seven. e.g. 16,25,34.....

VII .LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Hardware: Personal computer	All
2	Operating system: Windows XP/Windows 7	All
3	Software: Turbo C	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	Overview of C Programming	CO1	8	2	6	4	12
2	II	Decision and loop control	CO2	10	2	4	4	10
3	III	Array and String	CO3	10	2	4	4	10
4	IV	Functions	CO4	07	2	2	4	8
5	V	Pointers and structures	CO5	10	2	4	4	10
Grand Total				45	10	20	20	50

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

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	3	-					
CO2	3	2	3	3	-					
CO3	2	2	3	3	-					
CO4	2	2	3	3	-					
CO5	2	2	3	3	-					
Legends:- High:03, Medium:02, Low:01, No Mapping: - *PSOs are to be formulated at the institute level										

XI.SUGGESTED LEARNING MATERIALS/BOOKS

Sr.No	Author	Title	Publisher
1.	Balguruswamy	Programming in C	Tata McGraw Hill, ISBN :978-1-25
2.	Kanetkar	Let us "C"	Edition 2017, BPB Publications 2016 ISBN : 9788183331630
3.	Denis Ritche	C programming Language	Pearson Publication ISBN:10.0131103628
4.	Gottfried	Schaum's outlines programming with C	McGraw Hill Professional ISBN-13.978-0070240353

XII. LEARNING WEBSITES & PORTALS

Sr.No	Link/Portal	Description
1.	Turbo C editor	Used to edit C programs
2.	www.sourcecodeworld.com	C programming basics
3.	www.tutorialspoint.com	Basics of C programming
4.	www.cprogramming.com	It covers both "C" in depth with beginner friendly tutorial and advanced
5.	http://www.c4learn.com/c-programs/	It provides easy to learn material

Name & Signature:

[Signature]
Smt. V.G. Mahendra
 Lecturer in Electronics
 (Course Experts)

Name & Signature:

[Signature]
Shri. S. S. Prabhune
 (Programme Head)

Name & Signature:

[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	01/02/04/05/06/07/08
COURSE TITLE	YOUTH LEADERSHIP FOR CLIMATE ACTION
COURSE CODE	HU21202
PREREQUISITE COURSE CODE AND 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	
			CL	TL	LL					Practical				Based on SL							
										FA-TH	SA-TH	Total	FA-PR		SA-PR		SLA				
													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 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.
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 & 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.	1.2.1 Global impacts and uncertainties 1.2.2 Effects on India and its various biogeographic regions 1.2.3 Impacts on livelihoods and economy: Agriculture and Horticulture 1.2.4 Impacts 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
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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
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	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
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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
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	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 week Analyze as per the following: a) What makes up the maximum part of the waste? b) How much of what was thrown out could have been reused or recycled? c) Could the amount of garbage be reduced? List the ways to reduce waste at home. Calculate: a) Waste generated over a week (in grams) divided by 7 = waste (gms)/ day, b) Waste (gms)/ day divided by the number of persons in your house = Waste (gms)/ day/capita Using your survey results, you can calculate the approximate waste generated by the entire population of a block of flats, township, village, town, city, etc.
4	Energy Management and Climate Action	Preparation of Survey report on energy-efficient appliances.	To prepare a Survey report on energy-efficient appliances, their availability and use. 1. Availability of Energy-Efficient Appliances: 2. Use of Energy-Efficient Appliances 3. Government Policies and Incentives 4. Technological Advancements 5. Environmental Impact and Consumer Trends
5	Biodiversity Conservation and Climate Action	Preparation of a Survey report on Biodiversity resources in your landscape	To prepare a Survey report on Biodiversity resources in your landscape based on any one point among the list given below. 1. List of trees, plants, and shrubs in the village/ town outskirts, their classification, occurrence, and usage study. 2. Draw a biocultural map of the landscape of the village/ town, the diversity of trees (mother trees) and those who maintain it 3. A village called Tree: Understand a tree as an ecosystem and the biodiversity associated with the tree. 4. Ranmeva special study 5. Dietary diversity across three generations, a 'change over time' study.

Table 2: Group Activity

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

Sr. No.	Unit Name	Community Project Name	Activity Details
5.	Biodiversity Conservation and Climate Action	Preparation of report on Bio-Cultural Diversity Conservation	Prepare a report on Bio-Cultural Diversity Conservation. The report should include : a) Introduction i) What is biodiversity? ii) What is its importance in our life? iii) Connections of human beings with their nonliving surrounding and with living forms. b) Biodiversity resources in your landscape -: List of trees, plants, and shrubs in the village/ town outskirts, their classification, occurrence, and usage study. c) Understand a tree as an ecosystem and the biodiversity associated with the tree.
Note: (1) Individual activities: The student should complete any Three activities among the list given in Table No. 01. above. (Total Marks: 30 i.e. 10 Marks for each activity) (2) Group activity: Students should complete any One Community Project among the list given in Table No. 02 above. (Total Marks: 20)			

VII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED

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

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

(Specification Table)

NOT APPLICABLE

IX.ASSESSMENT METHODOLOGIES/TOOLS

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

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

- i) **One Certificate on combined completion of Units 1 and 2 and**
- ii) **One Certificate each on completion of Units nos. 3,4, and 5.**

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

X. SUGGESTED COs- POs MATRIX FORM

NOT APPLICABLE

XI.SUGGESTED LEARNING MATERIALS/BOOKS

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

XII. LEARNING WEBSITES & PORTALS

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

XIII. ROLE OF STUDENT AND FACULTY:**(a) ROLE OF STUDENT.**

1. i) **Course Registration:** Students should register for this course by adopting the normal procedure for registration as applicable for other courses, as per the schedule declared in the academic calendar through his/her MIS login.
- ii) **Online Registration:** Online registration for this **Self-paced course “YOUTH LEADERSHIP FOR CLIMATE ACTION”** in online mode by using the URL as under.

“ URL for online registration: <https://www.mahayouthnet.in/>

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



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

2. Students should complete the **Module No. 01 and 02** of this course in online mode and complete the online assignments as available in the online module. Upon completion of these activities, the student will receive a certificate of completion for Units No. 1 and 2. (Will be generated Online from The portal)
3. Students should take up online **Module Nos. 03, 04 and 05 (which are available as “Elective Modules” in the same online module, No separate registration is needed for these modules)** and complete all unit-wise assignments as available in the online module. Upon completion of these activities, students will receive a separate certificate of completion for each unit i.e. **Units 03,04 and 05) i.e. three certificates.** (Will be generated Online from The portal)
4. Student must submit all 4 certificates (first certificate upon completing units nos. 1 and 2 and individual certificates upon completing units nos 3,4 and 5. A Total 4 certificates are needed to be submitted to the concerned faculty assigned for this course by the Concerned Head of the Department)
5. **Most Important Note regarding the award of 1 credit for this course: student must complete any 3 individual activities among the list of activities mentioned in table no 1 above AND must complete any 1 group activity AND submit all 4 certificates (generated in online mode upon completion of all 5 units in online study mode). Upon satisfying these conditions, the student will be awarded 1 credit for this course (SLA).**
6. **Detention/ Fail:** If a candidate does not secure minimum passing marks in SLA (Self Learning Assessment) of any course, then the candidate shall be declared as a '**fail**' and will have to repeat and resubmit SLA work.

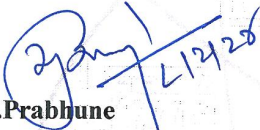
(b) ROLE OF FACULTY:

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

ii) **Online Registration for the course:** Faculty should confirm that the student has registered for the course in online mode by scanning the QR code OR through the link provided by the portal for registering for the **Self-paced course “YOUTH LEADERSHIP FOR CLIMATE ACTION”** in online mode. Faculty should collect screenshots from the students and maintain a record of such screenshots for the concerned semester/term.
2. **Regarding submissions to be accepted:** The faculty should ensure that the student has completed all 5 modules as mentioned above. The faculty should get the 4 certificates (per student) submitted as submission against completion of the online self-paced course **“YOUTH LEADERSHIP FOR CLIMATE ACTION”** during the term/semester for which, the student have registered. Also, the Faculty should accept the submissions from each student regarding the completion of the group activities as well as individual activities as mentioned above. This activity of submission must be completed before the last date of submission for other courses. ie before the provisional detention schedule as per the academic calendar for that term.

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

- i) Upon submission of online generated all 4 certificates (upon completion of online modules from the portal), the student should be considered eligible for the award of 1 credit along with satisfying the following conditions. (Faculty must not assess the individual activities and group activities if the student fails to submit all 4 certificates as proof of completion of the online course)
- ii) Upon accepting the submission concerning individual activities and group activities, the assessment of these activities should be done by the faculty as per the assessment norms mentioned above in “VI” titled “**SUGGESTED MICROPROJECT/ASSIGNMENT/ACTIVITIES FOR SPECIFIC LEARNING/SKILLS DEVELOPMENT (SELF-LEARNING)**”
- iii) Faculty should preserve the record of student-wise allotted marks in the rubrics provided for SLA assessment.
- iv) FACULTY should fill UP the marks of the student in the MIS mark sheet, only if the student has completed the online course (submitted all 4 certificates) and assessment of the group activities along with individual activities has been completed within the term schedule.
- v) In case the student fails to complete “ iv” above, the faculty should fill up the marks obtained by the student for the part-submission and fill up those marks in the MIS mark sheet.

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