Maharashtra State Board Of Technical Education, Mumbai

Learning and Assessment Scheme for Post S.S.C Diploma Courses

Programme Name : Diploma In Automation and Robotics

Programme Code : AO **With Effect From Academic Year** : 2023-24

Duration Of Programme : 6 Semester **Duration** : 16 WEEKS

Semester : Second **NCrF Entry Level : 3.0** **Scheme** : K

Sr No	Course Title	Abbrevation	Course Type	Course Code	Total IKS Hrs for Sem.	Learning Scheme					Credits	Assessment Scheme												
						Actual Contact Hrs./ Week			Self Learning (Activity/ Assignment /Micro Project)	Notional Learning Hrs /Week		Paper Duration (hrs.)	Theory				Based on LL & TL				Based on Self Learning		Total Marks
																	Practical						
						CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
													Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
(All Compulsory)																								
1	APPLIED MATHEMATICS	AMS	AEC	312301	2	3	1	-	-	4	2	3	30	70	100	40	-	-	-	-	-	-	100
2	APPLIED SCIENCE – APPLIED PHYSICS	ASC	DSC	312308	4	2	-	2	0	8	4	1.5	30	70*#	100	40	25	10	25@	10	-	-	200
	APPLIED SCIENCE – APPLIED CHEMISTY					2	-	2	0								25	10	25@	10			
3	BASIC ELECTRONICS	BEL	AEC	312314	-	4	-	4	-	8	4	3	30	70	100	40	50	20	25@	10	-	-	175
4	ELEMENTS OF ELECTRICAL ENGINEERING	EEE	SEC	312315	-	3	-	2	1	6	3	3	30	70	100	40	25	10	25@	10	25	10	175
5	PROFESSIONAL COMMUNICATION	PCO	SEC	312002	-	-	-	2	-	2	1	-	-	-	-	-	25	10	25@	10	-	-	50
6	SOCIAL AND LIFE SKILLS	SFS	VEC	312003	-	-	-	-	2	2	1	-	-	-	-	-	-	-	-	-	50	20	50
7	ELECTRONICS WORKSHOP PRACTICE	EWP	SEC	312008	-	-	-	4	2	6	3	-	-	-	-	-	25	10	25@	10	25	10	75
8	PROGRAMMING IN C	CPR	SEC	312019	-	1	-	2	1	4	2	-	-	-	-	-	25	10	25@	10	25	10	75
Total					**6**	**15**	**1**	**18**	**6**		**20**		**120**	**280**	**400**		**200**		**175**		**125**		**900**

Abbreviations : CL- Classroom Learning , TL- Tutorial Learning, LL-Laboratory Learning, FA - Formative Assessment,SA -Summative Assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

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

Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing 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 Time Table.
7. * Self learning includes micro project / assignment / other activities.

Course Category : Discipline Specific Course Core (DSC) , Discipline Specific Elective (DSE) , Value Education Course (VEC) , Intern./Apprenti./Project./Community (INP) , AbilityEnhancement Course (AEC) , Skill Enhancement Course (SEC) , GenericElective (GE)

♦ For the course Applied Science - candidate will have to appear for pre-examination of both physics & chemistry. If absent in any one section (physics / chemistry) student will be declared as absent & fail for the course and marks will not be processed or carried forward.

Programme Name/s	**: Architecture Assistantship/ Automobile Engineering./ Artificial Intelligence/ Agricultural Engineering/ Artificial Intelligence and Machine Learning/ Automation and Robotics/ Architecture/ Cloud Computing and Big Data/ Civil Engineering/ Chemical Engineering/ Computer Technology/ Computer Engineering/ Civil & Rural Engineering/ Construction Technology/ Computer Science & Engineering/ Digital Electronics/ Data Sciences/ Electrical Engineering/ Electronics & Tele-communication Engg./ Electrical and Electronics Engineering/ Electrical Power System/ Electronics & Communication Engg./ Electronics Engineering/ Computer Hardware & Maintenance/ Instrumentation & Control/ Industrial Electronics/ Information Technology/ Computer Science & Information Technology/ Instrumentation/ Interior Design & Decoration/ Interior Design/ Civil & Environmental Engineering/ Mechanical Engineering/ Mechatronics/ Medical Electronics/ Production Engineering/ Computer Science/ Electronics & Computer Engg.**
Programme Code	**: AA/ AE/ AI/ AL/ AN/ AO/ AT/ BD/ CE/ CH/ CM/ CO/ CR/ CS/ CW/ DE/ DS/ EE/ EJ/ EK/ EP/ ET/ EX/ HA/ IC/ IE/ IF/ IH/ IS/ IX/ IZ/ LE/ ME/ MK/ MU/ PG/ SE/ TE**
Semester	**: Second**
Course Title	**: APPLIED MATHEMATICS**
Course Code	**: 312301**

I. 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.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Engineers applying Mathematics should proficiently solve complex real-world problems, enhancing decision-making, design and innovation with precision and efficiency.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - 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. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											
				Actual Contact Hrs./ Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
312301	APPLIED MATHEMATICS	AMS	AEC	3	1	-	-	4	2	3	30	70	100	40	-	-	-	-	-	-	100

Total IKS Hrs for Sem. : 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, *# On Line Examination , @$ Internal Online Examination
Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If 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 Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Solve the given simple problem(s) based on rules of integration. TLO 1.2 Evaluate the given simple integral(s) using substitution method. TLO 1.3 Integrate given simple functions using the integration by parts. TLO 1.4 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
2	TLO 2.1 Solve given examples based on Definite Integration. TLO 2.2 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
3	TLO 3.1 Find the order and degree of given differential equations. TLO 3.2 Form simple differential equation for given elementary engineering problems. TLO 3.3 Solve given differential equations using the methods of Variable separable and Exact Differential Equation(Introduce the concept of partial differential equation). TLO 3.4 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
4	TLO 4.1 Find roots of algebraic equations by using appropriate methods. TLO 4.2 Solve the system of equations in three unknowns by iterative methods. TLO 4.3 Solve problems using Bakhshali iterative method for finding approximate square root. (IKS)	**Unit - IV Numerical Methods** 4.1 Solution of algebraic equations: Bisection method, Regula falsi method and Newton –Raphson method. 4.2 Solution of simultaneous equations containing three	Video SCILAB Spreadsheet Chalk-Board Flipped Classroom Presentations

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
		Unknowns by iterative methods: Gauss Seidal and Jacobi's method. 4.3 Bakhshali iterative method for finding approximate square root. (IKS)	
5	TLO 5.1 Solve given problems based on repeated trials using Binomial distribution. TLO 5.2 Solve given problems when number of trials are large and probability is very small. TLO 5.3 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.	Video ORANGE Chalk-Board Improved Lecture Presentations

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

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Solve simple problems of Integration by substitution	1	*Integration by substitution	1	CO1
LLO 2.1 Solve integration using by parts	2	*Integration by parts	1	CO1
LLO 3.1 Solve integration by partial fractions(only linear non repeated factors at denominator of proper fraction).	3	Integration by partial fractions.	1	CO1
LLO 4.1 Solve examples on Definite Integral based on given methods.	4	Definite Integral based on given methods.	1	CO2
LLO 5.1 Solve problems on properties of definite integral.	5	*Properties of definite integral	1	CO2
LLO 6.1 Solve given problems for finding the area under the curve and volume of revolution.	6	* #Area under the curve and volume of revolution.(Only for Civil and Mechanical Engineering Group)	1	CO2
LLO 7.1 Solve examples on mean value and root mean square value.	7	* #Mean value and root mean square value. (Only for Computer, Electrical and Electronics Engineering Group)	1	CO2
LLO 8.1 Solve examples on order, degree and formation of differential equation.	8	Order, degree and formation of differential equation.	1	CO3
LLO 9.1 Solve first order first degree differential equation using variable separable method.	9	Variable separable method.	1	CO3
LLO 10.1 Solve first order first degree differential equation using exact differential equation and linear differential equation.	10	*Exact differential equation and linear differential equation.	1	CO3
LLO 11.1 Solve engineering application problems using differential equation.	11	*Applications of differential equations.(Take programme specific problems)	1	CO3
LLO 12.1 Solve problems on Bisection method and Regula falsi method.	12	*Bisection method and Regula falsi method.	1	CO4

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 13.1 Solve problems on Newton-Raphson method.	13	Newton- Raphson method.	1	CO4
LLO 14.1 Solve problems on Jacobi's method and Gauss Seidal Method.	14	Jacobi's method and Gauss Seidal Method.	1	CO4
LLO 15.1 Use Bakhshali iterative methods for finding approximate value of square root. (IKS)	15	*Bakhshali iterative methods for finding approximate value of square root. (IKS)	1	CO4
LLO 16.1 Solve engineering problems using Binomial distribution.	16	*Binomial Distribution	1	CO5
LLO 17.1 Solve engineering problems using Poisson distribution.	17	*Poisson Distribution	1	CO5
LLO 18.1 Solve engineering problems using Normal distribution.	18	Normal Distribution	1	CO5
LLO 19.1 Solve problems on Laplace transform and properties of Laplace transform.	19	* # Laplace transform and properties of Laplace transform.(Only for Electrical and Electronics Engineering Group)	1	CO2
LLO 20.1 Solve problems on Inverse Laplace transform and properties of Inverse Laplace transform.	20	* # Inverse Laplace transform and properties of Inverse Laplace transform.(Only for Electrical and Electronics Engineering Group)	1	CO2

Note : Out of above suggestive LLOs -

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

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

Micro project

- NA

Assignment

- NA

Note :

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

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Open-source software like wolfram alpha, SageMaths, MATHS3D, GeoGebra, Graph, DPLOT, and Graphing Calculator (Graph Eq2.13), ORANGE can be used for Algebra, Calculus, Trigonometry and Statistics respectively.	All

IX. SUGGESTED 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**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Tests

Summative Assessment (Assessment of Learning)

- End Term Exam

XI. SUGGESTED COS - POS MATRIX FORM

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

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
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

APPLIED MATHEMATICS **Course Code : 312301**

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

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	http://nptel.ac.in/courses/106102064/1	Online Learning Initiatives by IITs and IISc
2	https://www.khanacademy.org/math?gclid=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
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.

Note :

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

APPLIED SCIENCE **Course Code : 312308**

Programme Name/s	**: Automobile Engineering./ Agricultural Engineering/ Automation and Robotics/ Civil Engineering/ Civil & Rural Engineering/ Construction Technology/ Electrical Engineering/ Electrical Power System/ Instrumentation & Control/ Instrumentation/ Civil & Environmental Engineering/ Mechanical Engineering/ Mechatronics/ Production Engineering**
Programme Code	**: AE/ AL/ AO/ CE/ CR/ CS/ EE/ EP/ IC/ IS/ LE/ ME/ MK/ PG**
Semester	**: Second**
Course Title	**: APPLIED SCIENCE**
Course Code	**: 312308**

I. RATIONALE

Diploma engineers have to deal with various processes, materials and machines. The comprehension of concepts and principles of Science like Elasticity, motion, Oscillation, Photoelectricity, X rays ,LASER, Nanomaterials, metals, alloys, water treatment ,fuel and combustion, cells and batteries will help the students to use relevant materials ,processes and methods for various engineering applications .

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to attain following industry/ employer expected outcome through various teaching learning experiences. Apply the principles of physics and chemistry to solve broad-based engineering problems.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Select relevant material in industries by analyzing its physical properties .
- CO2 - Apply the concept of simple harmonic motion , resonance and ultrasonic sound for various engineering applications.
- CO3 - Apply the concept of modern Physics (X-rays, LASER, Photosensors and Nanotechnology) for various engineering applications.
- CO4 - Use the relevant metallurgical processes in different engineering applications.
- CO5 - Use relevant water treatment processes to solve industrial problems.
- CO6 - Use appropriate fuel and electrolyte for engineering applications.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
312308	APPLIED SCIENCE	ASC	DSC	4	-	4	-	8	4	1.5	30	70*#	100	40	50	20	50@	20	-	-	200

Total IKS Hrs for Sem. : 4 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, *# On Line Examination , @$ Internal Online Examination

Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be

declared as "Detained" in that semester.
3. If 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 Time Table.
7. * Self learning includes micro project / assignment / other activities.

♦ Candidate remaining absent in practical examination of any one part of Applied Science course i.e. Physics,Chemistry will be declare as Absent in Mark List and has to appear for examination. The marks of the part for which candidate was present will not be processed or carried forward.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Apply the concept of elasticity and plasticity to select the material for engineering applications. TLO 1.2 Establish relation between given types of moduli of elasticity. TLO 1.3 Predict the behavior of the given metallic wire. TLO 1.4 Explain the relevant Newton's laws of motion for the given moving object. TLO 1.5 Calculate the work, power, energy for the given situation.	**Unit - I Properties of matter and kinematics** 1.1 Deforming Force and Restoring Force, Elasticity, Plasticity, Rigidity. 1.2 Stress and Strain and their types, elastic limit and Hooke's law, types of moduli of elasticity. 1.3 Stress -Strain diagram, Poisson's ratio, factors affecting elasticity 1.4 Newton's laws of motion, and their applications. 1.5 Angular displacement, angular velocity, angular acceleration, three equations of angular motion,projectile motion, trajectory, range of projectile angle of projection ,time of flight 1.6 Work, power and energy: potential energy, kinetic energy, work –energy principle.	Improved lecture Video Demonstrations Model Demonstration
2	TLO 2.1 Find the parameters required to analyze the given wave motion and simple harmonic motion. TLO 2.2 Explain the concept of resonance and its applications. TLO 2.3 Describe the properties of given ultrasonic waves. TLO 2.4 Explain the given method of production of ultrasonic waves .	**Unit - II Waves and Oscillations** 2.1 Sound waves, amplitude, frequency, time - period, wave-length and velocity of wave, relation between velocity, frequency and time - period of wave. 2.2 Simple Harmonic Motion , Uniform Circular Motion as Simple Harmonic Motion, Equation of simple harmonic motion , Phase of Simple Harmonic Motion. 2.3 Resonance , Application of resonance. 2.4 Resonance concept in prehistoric times, concept of different frequencies (Mantras) used to ignite different chakras in body (IKS). 2.5 Ultrasonic waves, properties of ultrasonic waves. 2.6 Piezoelectric and Magnetostriction method to produce ultrasonic waves . 2.7 Applications of ultrasonic waves.	Improved lecture Demonstration Video Demonstrations
3	TLO 3.1 Explain properties of photon on basis Planck's hypothesis. TLO 3.2 Explain the construction and working of given photoelectric device. TLO 3.3 Explain the	**Unit - III Modern Physics (Photoelectricity , X rays, LASER and nanotechnology)** 3.1 Planck's hypothesis, properties of photons. 3.2 Photo electric effect: threshold frequency, threshold wavelength, stopping potential, Work function, characteristics of photoelectric effect, Einstein's photoelectric equation 3.3 Photoelectric cell and LDR : principle ,Working and	Improved lecture Presentations Demonstration Video Demonstrations

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
	method to produce X-Rays with its properties and engineering applications. TLO 3.4 Differentiate between LASER and ordinary light. TLO 3.5 Explain the given terms related to LASER. TLO 3.6 Describe the properties of nanomaterials and its various applications.	applications 3.4 Production of X-rays by modern Coolidge tube, properties and engineering applications. 3.5 Laser: properties, absorption, spontaneous and stimulated emission, 3.6 Population inversion, active medium, optical pumping, three energy level system, He-Ne Laser. 3.7 Engineering applications of Laser. 3.8 Nanotechnology : Properties of nanomaterials (optical, magnetic and dielectric properties) , applications of nanomaterials, Metallic Bhasma (Ancient Ayurveda, IKS).	
4	TLO 4.1 Describe the extraction process of the ore. TLO 4.2 Explain Mechanical properties of metals. TLO 4.3 State purposes of making alloys. TLO 4.4 Describe methods of preparation of alloys. TLO 4.5 State Composition ,properties and applications of ferrous and nonferrous alloys.	**Unit - IV Metals and Alloys** 4.1 Ancient Indian Metallurgy (IKS) 4.2 Metals: Occurrence of metals in free and combined state. Basic concepts : Mineral, ore, gangue, flux and slag, metallurgy. 4.3 Metallurgy:Extraction processes of metal from ore Concentration : Gravity separation, electromagnetic separation, froth floatation, calcination and roasting, Reduction : Smelting, aluminothermic process, Refining,poling , electrorefining. 4.4 Mechanical properties of metals :Hardness, ductility, malleability, tensile strength, toughness, machinability, weldability, forging, soldering, brazing, castability. 4.5 Alloys: Purposes of making alloys with examples. 4.6 Preparation methods of alloys : Fusion, compression. 4.7 Classification of alloys :Ferrous and non-ferrous alloys Ferrous alloys: Composition ,properties and applications of low carbon, medium carbon, high carbon steels. Non-ferrous alloy:Composition ,properties and applications of Brass, Bronze, Duralumin, Tinman Solder, Woods metal.	Chalk-Board Demonstration Case Study Video Demonstrations
5	TLO 5.1 Explain types of hardness of water. TLO 5.2 List salts causing temporary and permanent hardness to water. TLO 5.3 Describe boiler corrosion and caustic embrittlement. TLO 5.4 Explain the given type of water softening process. TLO 5.5 Describe the Wastewater treatment and potable water treatment. TLO 5.6 Solve numerical based on pH and pOH.	**Unit - V Water Treatment** 5.1 Hard and soft water, causes of hardness, types of hardness 5.2 Hard water in boilers and prevention: Boiler corrosion, caustic embrittlement, priming and foaming, scales and sludges,and methods of prevention of boiler corrosion. 5.3 Methods of water softening: lime soda process (hot lime soda and cold lime soda process), zeolite process, ion exchange process. 5.4 Potable water treatment: Sedimentation, coagulation, filtration and sterilization . 5.5 Wastewater treatment: Sewage treatment, BOD and COD of sewage water. 5.6 pH and pOH: Concept of pH, pOH, pH Scale, Numerical.	Chalk-Board Demonstration Case Study Video Demonstrations
6	TLO 6.1 Describe the properties of the given type of fuel. TLO 6.2 Describe Proximate analysis and Ultimate analysis of coal	**Unit - VI Fuels and Combustion** 6.1 Fuel: Calorific value and ignition temperature, classification. 6.2 Solid fuels: Coal, Classification and composition , Proximate analysis, Ultimate analysis, Calorific value of coal by Bomb calorimeter.	Chalk-Board Demonstration Case Study Video Demonstrations

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
	samples. TLO 6.3 Calculate the calorific value of the given solid fuel using Bomb calorimeter. TLO 6.4 Describe fractional distillation of crude petroleum. TLO 6.5 Explain properties of liquid fuels. TLO 6.6 Describe composition, properties of given gaseous fuel with their applications. TLO 6.7 Describe production of green hydrogen by electrolysis. TLO 6.8 Describe construction and working of given cells and batteries.	6.3 Liquid fuels: Fractional distillation of crude petroleum, boiling range, composition, propertie Knocking, cracking, octane number and cetane number. 6.4 Gaseous fuels: Biogas, LPG, and CNG. Combustion equation of gaseous fuels, mass and volume of air required for complete combustion. 6.5 Green hydrogen: Producing green hydrogen by electrolysis from renewable sources , Advantages and disadvantages of green hydrogen. 6.6 Electrical conductance in metals and electrolytes, specific conductance, equivalent conductance, cell constant 6.7 Cells and batteries :Construction ,working and applications of dry cell, lead acid storage cell H2 - O2 fuel cell, Ni-Cd battery and Lithium ion battery	

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

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Use Searle's method to determine the Young's modulus of given wire	1	* Determination of Young's modulus of given wire.	2	CO1
LLO 2.1 Compare young's modulii of different materials of wires .	2	Comparison of Young's modulii of given materials of wires.	2	CO1
LLO 3.1 Use of inclined plane to find the downward force.	3	* Determination of relationship between angle of inclination and downward force using inclined plane.	2	CO1
LLO 4.1 Use projectile motion to find the range from initial launch speed and angle	4	*Determination of range of projectile	2	CO1
LLO 5.1 Use helical spring to find force constant .	5	* Determination of force constant using helical spring .	2	CO2
LLO 6.1 Use resonance tube method to determine velocity of sound	6	* Determination of velocity of sound using resonance tube method.	2	CO2
LLO 7.1 Use Simple pendulum to find acceleration due to gravity .	7	* Determination of acceleration due to gravity by using simple pendulum .	2	CO2
LLO 8.1 Use ultrasonic distance – meter to measure distance of object .	8	Determination of distance of object using ultrasonometer.	2	CO2
LLO 9.1 Use ultrasonic interferometer to determine velocity of sound	9	Determination of velocity of ultrasonic sound waves in different liquids using ultrasonic interferometer .	2	CO2
LLO 10.1 Use photo electric cell to find dependence of the stopping potential on the frequency of given light source.	10	Determination of the dependence of the stopping potential on the frequency of given light source .(Virtual Lab)	2	CO3
LLO 11.1 Determine I-V characteristics of the given photo electric cell.	11	* Determination of I-V characteristics of photoelectric cell.	2	CO3

APPLIED SCIENCE **Course Code : 312308**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 12.1 Determine I-V characteristics of given light dependent resistor.	12	* Determination of I-V characteristics of LDR.	2	CO3
LLO 13.1 Find divergence of given laser .	13	Determination of the divergence of laser beam.	2	CO3
LLO 14.1 Use LASER beam to find the refractive index of glass plate	14	Determination of refractive index of glass plate using laser beam. (Virtual Lab)	2	CO3
LLO 15.1 Find the wavelength of given laser.	15	Determination of wavelength of helium neon laser (Virtual Lab)	2	CO3
LLO 16.1 Prepare KMnO4 solution. LLO 16.2 Prepare standard oxalic acid. LLO 16.3 Standardize KMnO4 solution.	16	Standardization of KMnO4 solution using standard oxalic acid and preparation of Fe alloy sample.	2	CO4
LLO 17.1 Set up titration Assembly. LLO 17.2 Record the observations. LLO 17.3 Calculate percentage of iron in haematite ore by titration method .	17	* Determination of the percentage of iron present in given Haematite ore by KMnO4 solution.	2	CO4
LLO 18.1 Prepare Cu ore sample. LLO 18.2 Calculate percentage of Cu .	18	* Determination of percentage of copper in given copper ore .	2	CO4
LLO 19.1 Prepare EDTA solution of known concentration. LLO 19.2 Determine total hardness of water by titration.	19	*Calculation of total hardness, temporary hardness and permanent hardness of water sample by EDTA method.	2	CO5
LLO 20.1 Prepare acid solution of known concentration. LLO 20.2 Determine alkalinity of water sample.	20	* Determination of the alkalinity of a given water sample.	2	CO5
LLO 21.1 Determine turbidity by using a Nephelometer or simulation.	21	Determination of turbidity of a given water sample by Nephelometric method by using Nephelometer or simulation.	2	CO5
LLO 22.1 Set up titration Apparatus LLO 22.2 Record the observations. LLO 22.3 Calculate dissolved oxygen.	22	Determination of dissolved oxygen in the given water sample.	2	CO5
LLO 23.1 Prepare AgNO3 Solution of known concentration. LLO 23.2 Calculate chloride content in water sample.	23	Determination of chloride content in the given water sample by Mohr's method.	2	CO5
LLO 24.1 Use universal indicator for PH values. LLO 24.2 Calculate PH value by using PH meter.	24	* Determination of pH value of given solution using pH meter and universal indicator.	2	CO5
LLO 25.1 Use of oven for appropriate temperature settings. LLO 25.2 Calculate moisture and ash content in coal samples.	25	* Determination of the moisture and ash content in a given coal sample using proximate analysis.	2	CO6
LLO 26.1 Set up a Bomb Calorimeter. LLO 26.2 Calculate calorific value.	26	* Determination of calorific value of given solid fuel using Bomb calorimeter.	2	CO6
LLO 27.1 Use gravimetric analysis method LLO 27.2 calculate the percentage of	27	Calculate the percentage of Sulphur in a given coal sample by ultimate analysis. (Gravimetric analysis)	2	CO6

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
Sulphur.				
LLO 28.1 Standardize conductivity meter. LLO 28.2 Measure the conductance of given solutions.	28	Determination of conductance of given electrolyte by using a conductivity meter.	2	CO6
LLO 29.1 Set up conductometric titration assembly. LLO 29.2 Record conductance. LLO 29.3 Determine specific conductance and equivalence conductance.	29	* Determination of specific conductance and equivalence conductance of given salt sample solution.	2	CO6
LLO 30.1 Set up conductometric titration assembly. LLO 30.2 Record conductance. LLO 30.3 Determine equivalence point.	30	Determination of equivalence point of acetic acid and ammonium hydroxide using conductivity meter.	2	CO6

Note : Out of above suggestive LLOs -

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

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING) : NOT APPLICABLE

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Searle's apparatus(with slotted mass of 0.5 kg each)	1,2
2	Experimental setup for characteristics of LDR, optical bench .Source of light ,LDR .	11
3	Laser Source (He Ne, diode laser), optical bench , graph paper, glass plate	12,13,14
4	Nephelometer ; Auto-ranging from 20-200 NTU,+/- 2% of reading plus 0.1 NTU, power 220 Volts +/- 10% AC 50 Hz	21
5	pH meter reading up to pH14; ambient temp. -40 to 700 C.; pH/mV resolution:13 bit	24
6	Electric oven inner size 18''x18''x18''; temperature range 100 to 2500 C with the capacity of 40 lt.	25
7	Bomb calorimeter Temperature Resolution:0.001°C Oxygen Filling Automatic /Manual	26
8	Conductivity meter; conductivity range – 0.01 uS /cm to 200 mS/cm, Cell constant – digital 0.1 to 2.00; Temp. range – 0 to 100°C	28,29,30
9	An inclined plane , a trolly or a roller , pan , weight box , spring balance spirit level, strong thread , meter scale .	3
10	Retort stand, helical spring , 6 slotted weight of 50 grams ., scale , stop watch.	4
11	Resonance tube , Tuning forks of different frequencies	5
12	Metallic bob , strong thread , stopwatch .	6
13	Ultrasonometer	7
14	ultrasonic interferometer	8
15	Experimental setup for characteristics of photoelectric cell	9,10
16	Electronic balance, with the scale range of 0.001g to 500g. pan size 100 mm; response time 3-5 sec.; power requirement 90-250 V, 10 watt.	All

IX. SUGGESTED 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

APPLIED SCIENCE **Course Code : 312308**

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Properties of matter and kinematics	CO1	9	3	4	4	11
2	II	Waves and Oscillations	CO2	10	3	5	4	12
3	III	Modern Physics (Photoelectricity , X rays, LASER and nanotechnology)	CO3	11	3	5	4	12
4	IV	Metals and Alloys	CO4	10	2	3	5	10
5	V	Water Treatment	CO5	8	3	4	4	11
6	VI	Fuels and Combustion	CO6	12	3	5	6	14
Grand Total				**60**	**17**	**26**	**27**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Two unit tests of 30 marks (Physics 15 marks,Chemistry-15 marks) and average of two unit tests.
- For laboratory learning 50 marks (Physics 25 marks,Chemistry-25 marks).

Summative Assessment (Assessment of Learning)

- End semester assessment of 50 marks for laboratory learning (Physics 25 marks,Chemistry-25 marks).
- End semester assessment of 70 marks through online MCQ examination.

XI. SUGGESTED COS - POS MATRIX FORM

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

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

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Aryabhatta	The Surya Siddhanta	Baptist mission press, Calcutta
2	Haliday, David; Resnik, Robert and Walker, Jearl	Fundamentals of Physics	John Wiley & sons, Hoboken, USA, 2014 ISBN : 812650823X.
3	Hussain Jeevakhan	Applied Physics II	Publisher: Khanna Book Publishing ISBN: 9789391505578.
4	Narlikar, J.V.;Joshi , A. W.; Ghatak A.K. et al	Physics Textbook Part I - Class XII	National Council of Education Research and Training, New Delhi, 2013, ISBN : 8174506314

Sr.No	Author	Title	Publisher with ISBN Number
5	Narlikar, J.V.;Joshi , A. W.; Ghatak A.K. et al	Physics Textbook Part II - Class XII	National Council of Education Research and Training, New Delhi, 2013, ISBN : 8174506713
6	Jain and Jain	Engineering Chemistry	National Council of Education Research and Training, New Delhi, 2010, ISBN : 8174505083
7	Dara, S. S.	Engineering Chemistry	National Council of Education Research and Training, New Delhi, 2015, ISBN : 8174505660
8	Bagotsky V.S.	Fundamental of electrochemistry	National Council of Education Research and Training, New Delhi, 2013, ISBN : 8174506314.
9	Agnihotri Rajesh	Chemistry for Engineers	Wiley India Pvt. Ltd. New Delhi, 2014, ISBN: 9788126550784.
10	Anju Rawlley, Devdatta V. Saraf	Applied Chemistry with Lab Manual	Khanna Book Publishing Co. (P) Ltd. New Delhi, 2021, ISBN- 978-93-91505-44-8
11	Vairam S.	Engineering Chemistry	Wiley India Pvt. Ltd. New Delhi, 2013, ISBN: 9788126543342

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.iberdrola.com/sustainability/green-hydrogen	Green hydrogen
2	https://vedicheritage.gov.in/vedic-heritage-in-present-context/metallurgy	Ancient indian metallurgy (IKS)
3	https://vlab.amrita.edu/?sub=2&brch=193&sim=575&cnt=4	Determine turbidity by using a simulation
4	https://www.britannica.com/science/metallurgy	Metals and alloy
5	https://phet.colorado.edu/en/simulations/ph-scale	PH and POH
6	https://archive.nptel.ac.in/courses/103/105/103105110/	Solid fuel
7	www.physicsclassroom.com	Concepts of Physics
8	www.fearofphysics.com	Fundamental terms in Physics
9	https://iksindia.org	IKS

Note :

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

BASIC ELECTRONICS **Course Code : 312314**

Programme Name/s	**: Automation and Robotics/ Digital Electronics/ Electronics & Tele-communication Engg./ Electrical and Electronics Engineering/ Electronics & Communication Engg./ Electronics Engineering/ Instrumentation & Control/ Industrial Electronics/ Instrumentation/ Medical Electronics/ Electronics & Computer Engg.**
Programme Code	**: AO/ DE/ EJ/ EK/ ET/ EX/ IC/ IE/ IS/ MU/ TE**
Semester	**: Second**
Course Title	**: BASIC ELECTRONICS**
Course Code	**: 312314**

I. RATIONALE

Diploma engineers must deal with the various electronic components while maintaining various electronic equipment/systems. The use of basic electronics components and handling of various electronics systems will help them troubleshoot electronics equipment used in industry or in the consumer market etc. This course is developed to empower the students to apply their knowledge to solve broad electronic engineering application problems.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to attend following industry identified competency through various teaching learning experiences: • Maintain electronic equipment/systems comprising of discrete electronic components.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Use relevant diode in electronics circuits.
- CO2 - Use BJT in electronics circuits .
- CO3 - Use of BJT as amplifier and switch ..
- CO4 - Use FET and MOSFET in electronics circuits..
- CO5 - Maintain DC regulated power supply.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											Total Marks
				Actual Contact Hrs./ Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL			
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
312314	BASIC ELECTRONICS	BEL	AEC	4	-	4	-	8	4	3	30	70	100	40	50	20	25@	10	-	-	175

Total IKS Hrs for Sem. : 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, *# On Line Examination , @$ Internal Online Examination

Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If 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 Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Describe working principle, characteristics, and application of the given type of diode. TLO 1.2 Describe the working of given type of rectifier. TLO 1.3 Calculate ripple factor, PIV, and efficiency of the given type of filter. TLO 1.4 Describe the need and working of rectifier filter circuit.	**Unit - I Applications of Diode** 1.1 Different types of diodes and their materials: Construction, Symbol, working principle, applications, Forward and reverse biasing and V-I characteristics of following diodes: P-N junction diode, Zener diode, LED, Photo diode, Schottky diode, 1.2 Diode as rectifier: Types of Rectifiers, Half wave, Full wave (bridge rectifier and center tapped), circuit operation, Input- output waveform for voltage and current, Parameters of rectifier: Average DC value, value of current and voltage, ripple factor, ripple frequency, PIV of diode, TUF, efficiency of rectifier. 1.3 Types of Filters: Shunt capacitor, Series inductor, LC and CLC filter. 1.4 Rectifier IC – KBU 808 IC pin diagram and application .	Chalk-Board Video Demonstrations
2	TLO 2.1 Describe the working principle of the given type of transistor. TLO 2.2 Calculate current gain for given configuration of BJT TLO 2.3 Compare configuration of transistors. TLO 2.4 Justify the need of biasing method. TLO 2.5 Describe the procedure to minimize the thermal runaway effect.	**Unit - II Bipolar Junction Transistor** 2.1 Current operating device. 2.2 Different types of transistors: PNP, NPN. 2.3 Transistor configurations: CB, CE, CC Transistor characteristics (input, and output) in different transistor configuration. Relation between alpha ,beta, gama. Comparison between CB, CC and CE. 2.4 4 BJT biasing: Need of DC load Line, Operating point, stabilization, thermal runaway, heat sink. Types of biasing: fixed biasing, base bias with emitter feedback, voltage divider.	Chalk-Board Video Demonstrations
3	TLO 3.1 Explain with sketches the working principle of the given type of amplifier. TLO 3.2 Describe working of Single Stage Transistor Amplifier. TLO 3.3 Calculate Voltage gain and bandwidth TLO 3.4 Describe working of Multistage amplifiers TLO 3.5 Describe working of BJT as a Switch	**Unit - III BJT Amplifiers** 3.1 Classification of amplifier, BJT as an amplifier. 3.2 Single Stage Amplifier: Working , various currents (Ib, Ic,Ie), Voltage gain of CE amplifier (no derivations required), Frequency response of CE amplifier. Simple numericals. 3.3 Multistage amplifiers: General Multistage BJT based amplifiers 3.4 Types of BJT amplifier coupling: Circuit diagram, operation frequency response and applications of Direct coupled, RC coupled and transformer coupled. 3.5 BJT as a Switch	Chalk-Board Video Demonstrations
4	TLO 4.1 Explain the working of given type of FET TLO 4.2 Explain the given type of FET biasing method. TLO 4.3 Describe working	**Unit - IV Field Effect Transistor** 4.1 Voltage operating device, Construction of JFET (N-channel and P- channel), symbol, working principle and characteristics (Drain and Transfer characteristics) , different parameters of FET . FET applications 4.2 FET Biasing: Source self-bias, drain to source bias.	Chalk-Board Video Demonstrations

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
	of FET Amplifier. TLO 4.4 Explain working of given type of MOSFET. TLO 4.5 Differentiate working principle of FET and MOSFET on the basis of the given characteristics of curve.	4.3 Common source FET amplifier. 4.4 MOSFET: Construction, working principle and characteristics of Enhancement and depletion MOSFET, MOSFET handling.	
5	TLO 5.1 Describe the working of the DC regulated power supply. TLO 5.2 Calculate output voltage of the given Zener voltage regulator circuit.. TLO 5.3 Describe the working of 78XX and 79XX fixed voltage IC Regulator. TLO 5.4 Describe the working of IC 723 as Low and High voltage regulator. TLO 5.5 Explain block diagram of Switch Mode Power supply.	**Unit - V Regulators and Power supply** 5.1 Need of Regulated power supply . Basic block diagram of DC regulated power supply and function of each block 5.2 Load and Line regulation. 5.3 Zener diode voltage regulator 5.4 Fixed voltage IC Regulator: Three terminal Pin diagram, working and application of 78XX and 79xx series. 5.5 Variable voltage IC Regulator : IC 723 pin diagram , block diagram, working. Low voltage regulator, High voltage regulator 5.6 Switch Mode Power supply : Need of SMPS , block diagram and functions of blocks.	Chalk-Board Site/Industry Visit

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

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Test PN junction Diode in forward bias. LLO 1.2 Plot the V-I characteristics of PN junction diode and determine cut in voltage. LLO 1.3 Calculate static and Dynamic resistance of diode.	1	* Test the performance of PN Junction diode	2	CO1
LLO 2.1 Test Zener Diode in reverse bias. LLO 2.2 Plot V-I characteristics of Zener Diode in reverse bias. .	2	* Test the performance of zener diode	2	CO1
LLO 3.1 Build the circuit for Photo Diode . LLO 3.2 Observe the change in current with change in light intensity of the source LLO 3.3 Plot distance VS Photo diode Current	3	* Check the performance of photo diode by varying the light intensity as well as the distance of the light source.	2	CO1
LLO 4.1 Construct the circuit for Half Wave Rectifier using PN junction Diode on. LLO 4.2 Plot Output Waveform for sinusoidal input.	4	* Construct and Test the half wave rectifier.	2	CO1
LLO 5.1 Build the circuit for Half Wave Rectifier with LC filter/ Pi filter	5	* Build and Test the half wave rectifier with LC filter/ π filter	2	CO1

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
using PN junction Diode. LLO 5.2 Obsrve and draw input & output waveforms for sinusoidal wave .				
LLO 6.1 Prepare the circuit for Full Wave Centre Tapped Rectifier using PN junction Diode. LLO 6.2 Observe and draw input & output waveform for sinusoidal wave.	6	* Prepare and Test the full wave rectifier using two diodes.	2	CO1
LLO 7.1 Build the circuit for Full Wave Bridge Rectifier using PN junction Diode LLO 7.2 Observe and draw input & output waveform for sinusoidal wave.	7	* Build and Test the full wave Bridge rectifier on bread board using two diodes.	2	CO1
LLO 8.1 Build the circuit for Full Wave Rectifier using PN junction Diode with LC/Pi filter. LLO 8.2 Calculate ripple factor for given setup.	8	* Use LC/ π filter with full wave rectifier to measure ripple factor	2	CO1
LLO 9.1 Construct the circuit for full wave rectifier using IC KBU 808 with filter LLO 9.2 Observe and draw input & output waveform for sinusoidal wave.	9	* Construct and Test the full wave rectifier on bread board using IC KBU 808 with filter.	2	CO1
LLO 10.1 Build the circuit for 7 Segment LED display FND 507/508. LLO 10.2 Observe numeric output for 0-9	10	Bulid and Test the performance parameters of 7 Segment LED display FND 507/508.	2	CO1
LLO 11.1 Identify the terminals of the PNP and NPN transistor for TO-5, TO-220, TO-66 LLO 11.2 Select of transistor for different max. voltage, current and switching speed	11	* Identify and select transistors using datasheets	2	CO2
LLO 12.1 Build the circuit for BJT in common base configuration. LLO 12.2 Plot input and output characteristics of common base configuration.	12	Build and Test the performance of BJT working in CB mode.	2	CO2
LLO 13.1 Select the specific transistor for different max. voltage, current and switchingspeed LLO 13.2 Prepare the circuit for BJT in common emitter configuration.	13	* Prepare and Test the performance of BJT working in CE mode	2	CO2
LLO 14.1 Build the circuit for BJT voltage divider bias circuit. LLO 14.2 Locate Q point on Load line.	14	* Build and Test the BJT voltage divider bias circuit for given input	2	CO2
LLO 15.1 Test the performance parameters of BJT as Switch LLO 15.2 Identify Cutoff and saturation regions	15	* Construct and Test the performance parameters of BJT as Switch.	2	CO2
LLO 16.1 Build single stage Common emitter amplifier.	16	* Build and Test the performance of single stage Low Power Common emitter amplifier	2	CO3

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 16.2 Plot frequency response for Common emitter amplifier.				
LLO 17.1 Build the circuit for BJT common emitter (CE) amplifier using simulation software (like SPICE/ Multisim) LLO 17.2 Plot Output Waveform for sinusoidal input. LLO 17.3 Plot frequncy response curve .	17	Simulate and Test output waveform and frequency response of single stage common emitter (CE) amplifier using simulation software (like SPICE / Multisim)	2	CO3
LLO 18.1 Build the circuit for BJT two stage RC coupled common emitter (CE) amplifier. LLO 18.2 Plot frequency response	18	* Build and Test the performance of RC coupled two stage amplifier.	2	CO3
LLO 19.1 Build the circuit for FET in common source configuration. LLO 19.2 Plot characteristics for drain to source voltage VDS verses drain current ID for different Values of VGS	19	* Test the performance of FET drain characteristics	2	CO4
LLO 20.1 Build the circuit for FET in common source configuration. LLO 20.2 Plot characteristics for Gate to source voltage VGS verses drain current ID LLO 20.3 Calculate transconductance.	20	* Check the performance of FET transfer characteristics and calculate transconductance	2	CO4
LLO 21.1 Build the circuit for FET in common source configuration. LLO 21.2 Plot characteristics for Gate to source voltage VGS verses drain current ID	21	* Build and Test the performance of common source FET amplifier	2	CO4
LLO 22.1 Test the voltages &waveforms at various Test points of regulated dc power supply.	22	Test the various blocks of regulated dc power supply.	2	CO5
LLO 23.1 Identify the various faults in the Regulated DC power supply.	23	* Find out faults at different stages of regulated dc power supply.	2	CO5
LLO 24.1 Rectify the various faults in the Regulated DC power supply	24	* Trouble shoot given DC regulated power supply.	2	CO5
LLO 25.1 Construct Zener voltage regulator for given voltage. LLO 25.2 Calculate load and line regulation.	25	Construct and test the performance of Zener voltage regulator for given voltage.	2	CO5
LLO 26.1 Build the circuit for Positive voltage regulator using 78XX IC. LLO 26.2 Calculate load and line regulation.	26	* Build and Test the performance of Positive voltage regulator using 78XX , three terminal IC for given voltage.	2	CO5
LLO 27.1 Build the circuit for Negative voltage regulator using 78XX IC. LLO 27.2 Calculate load and line regulation.	27	Build and Test the performance of Negative voltage regulator using 79XX, three terminal IC for given voltage.	2	CO5
LLO 28.1 Construct the circuit for Dual voltage regulator using 78XX and 79XX IC. LLO 28.2 Calculate load and Line	28	* Construct and test the performance of Dual voltage regulator using 78XX and 79XX ,three terminal IC for given voltage	2	CO5

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
regulation.				
LLO 29.1 Build LOW voltage regulator circuit using IC LM723 (2V-7V). LLO 29.2 Calculate load and line regulation.	29	* Build and Test the performance of LOW voltage regulator using IC LM723 for given voltage.(2 V-7V)	2	CO5
LLO 30.1 Build High voltage regulator circuit using IC LM723 (7V-30V) LLO 30.2 Calculate load and line regulation.	30	Build and Test the performance of HIGH voltage regulator using IC LM723 for given voltage.(7V-30V)	2	CO5

Note : Out of above suggestive LLOs -

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

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

Micro project

- Build Audio amplifier using BJT.
- Build the circuit for 3v battery charger.
- Build Clap switch Using transistor.
- Build audio amplifier using IC LM386.
- Build power supply using LM317.
- Prepare a chart of different types of Rectifiers showing their specifications and applications

Assignment

- Study working of OLED display.
- study of different Audio amplifier ICs (min 4).
- Study working of MOSFET as variable capacitor.
- select specific FET and Study datasheet for same.

Note :

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

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Variable DC Power supply 0-30V with display for voltage and current, 2Amp SC protection	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,19,20,22,23,24

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
2	LT Spice /Lab view/H Spice /P Spice /HS Spice / Multisim/ Proteus/Octeva or any other relevant open source software	17
3	Computer System with advanced Configuration Hardware requirement as per selected software	17
4	DSO 30/50/100 MHz Frequency Digital read out USB interface	4,5,6,7,8,9,16,22
5	CRO 20/30/100 MHz Frequency Dual Channel External Trigger CT mode facility or any other better specifications	4,5,6,7,8,9,16,22,18
6	Function Generator 0-2 MHz with Sine, square and triangular output with variable frequency and amplitude	4,5,6,7,8,9,16,22,18
7	Analog multimeter& Digital multimeter	All
8	Different types of cables and connectors	All

IX. SUGGESTED 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	Applications of Diode	CO1	12	4	4	6	14
2	II	Bipolar Junction Transistor	CO2	12	4	4	6	14
3	III	BJT Amplifiers	CO3	14	4	6	6	16
4	IV	Field Effect Transistor	CO4	12	4	6	4	14
5	V	Regulators and Power supply	CO5	10	4	4	4	12
Grand Total				**60**	**20**	**24**	**26**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Progrssive test ,Assignment, Microproject , Termwork
- 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 Term Examination, Laboratory performance.

XI. SUGGESTED COS - POS MATRIX FORM

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

CO4	2	2	1	1	1	1	1			
CO5	2	2	2	1	2	2	2			

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

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Mehta, V.K. Mehta, Rohit Mehta	Principles of Electronics	S.Chand New Delhi, edition-2008 ISBN-13: 978- 8121927833
2	Sedha, R.S.	A Text book of Applied Electronics	S.Chand (G/L) & Company Ltd; ISBN-13 978-8121904209
3	P.Ramesh Babu	Electronics Device and Circuits	Scitech Publications (India) Pvt Ltd ,ISBN-13 978-8183712156
4	Theraja B.L. (Author), Sedha R.S. (Author)	Principles of Electronic Devices and Circuits (Analog and Digital)	S Chand & Company,ISBN-13 978-8121921992
5	B.L.Theraja	Basic Electronics (solid State)	S Chand;ISBN-13 978-8121925556
6	Albert P. Malvino, David J. Bates	Electronic Principles	McGraw Hill; ISBN-13 978-9354602399
7	D. P. Kothari , I. J. Nagrath	Basic Electronics	McGraw Hill Education,ISBN-13 978-9352606467
8	Roberrt L.Boylestead	Electronics Circuit and Circuit theory	Pearson Education India, ISBN-13 978-9332542600

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://nptel.ac.in/courses/122106025	Basic Electronics and Lab, IIT Madras Prof. T.S. Natarajan
2	https://archive.nptel.ac.in/ courses/108/101/108101091/	Basic Electronics, IIT Bombay
3	4. https://learn.sparkfun.com/tutorials/ transistors	Transistor basics
4	https://www.multisim.com/	online multisim live software/ free student evalution software download for limited time
5	https://alternativeto.net/software/multisim/	alernative softwares to multisim
6	https://www.labcenter.com/	demo version of Proteus software
7	https://learn.sparkfun.com/tutorials/transistors	Simulation

Note :

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

ELEMENTS OF ELECTRICAL ENGINEERING **Course Code : 312315**

Programme Name/s	**: Automation and Robotics/ Digital Electronics/ Electronics & Tele-communication Engg./ Electrical and Electronics Engineering/ Electronics & Communication Engg./ Electronics Engineering/ Instrumentation & Control/ Industrial Electronics/ Instrumentation/ Medical Electronics/ Electronics & Computer Engg.**
Programme Code	**: AO/ DE/ EJ/ EK/ ET/ EX/ IC/ IE/ IS/ MU/ TE**
Semester	**: Second**
Course Title	**: ELEMENTS OF ELECTRICAL ENGINEERING**
Course Code	**: 312315**

I. RATIONALE

A 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.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Use electrical equipment efficiently for different electronic engineering application.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											
				Actual Contact Hrs./ Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
312315	ELEMENTS OF ELECTRICAL ENGINEERING	EEE	SEC	3	-	2	1	6	3	3	30	70	100	40	25	10	25@	10	25	10	175

Total IKS Hrs for Sem. : 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, *# On Line Examination , @$ Internal Online Examination

Note :

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

7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	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 and parallel magnetic circuit. TLO 1.4 Describe laws related to magnetic circuit. TLO 1.5 Classify the types of induced electromotive force	**Unit - I Magnetic circuits** 1.1 Define and state units of Magnetic flux, Flux density, Magnetomotive force, Magnetic field strength, Permeability. 1.2 Electric circuit and magnetic circuit analogy and differences. 1.3 Series and parallel 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 Electromotive force and its inductances.	Presentations Chalk-Board Video Demonstrations Model Demonstration
2	TLO 2.1 Compare AC quantities with DC quantities. TLO 2.2 Describe terminology related to A.C. fundamentals. TLO 2.3 Describe different forms of representation for electrical quantity. TLO 2.4 Analyze A.C. circuits for different types of load. TLO 2.5 Explain generation of three phase induced emf. TLO 2.6 Analyze three phase circuit for star and delta connection.	**Unit - II A.C fundamentals for single phase and polyphase circuits** 2.1 Define A.C. and D.C. quantities, advantages of A.C over DC. 2.2 Single phase sinusoidal A.C. wave: instantaneous value, cycle, amplitude, time period, frequency, angular frequency, R.M.S. value, average value for sinusoidal waveform. 2.3 Vector, polar and complex 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, vector diagram and waveform. 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.	Video Demonstrations Presentations Chalk-Board
3	TLO 3.1 Explain construction and working principle of given type of transformer. TLO 3.2 Select different types of transformer for the particular application. TLO 3.3 Describe construction and the working of DC motor. TLO 3.4 Select the type of DC motor for given application.	**Unit - III Transformers and DC motors** 3.1 Transformer construction and working principle, emf equation, voltage ratio, transformation ratio. 3.2 Auto-transformer, Pulse transformer and Isolation transformer construction, working principle and applications. 3.3 DC motor construction and working principle. 3.4 Different types of DC motors with its schematic diagram. 3.5 Applications of DC motors.	Chalk-Board Model Demonstration Video Demonstrations Presentations

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
4	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.	**Unit - IV Fractional horse power motors** 4.1 Construction, working principle and application of split phase 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 linear induction motor	Model Demonstration Presentations Chalk-Board Flipped Classroom
5	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.	**Unit - V Electrical protective devices** 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), Moulded 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

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

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Use Faraday's law of electro-magnetic induction. LLO 1.2 Classify types of induced emf.	1	*Demonstration of Faraday's law of electro-magnetic induction for statically and dynamically induced emf.	2	CO1
LLO 2.1 Use Faraday's law of electro-magnetic induction. LLO 2.2 Observe mutual induced emf in transformer.	2	*Demonstration of Mutually induced EMF by using single-phase transformers.	2	CO1
LLO 3.1 Use cathode ray oscilloscope. LLO 3.2 Identify different parameters on CRO.	3	*Measure frequency, Time period, Peak value, RMS value of sinusoidal AC waveform using CRO.	2	CO2
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.	4	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
LLO 5.1 Connect star connected three phase load. LLO 5.2 verify relationship between line and phase quantities.	5	*Connect three phase star connected balanced load and verify the relationship between line voltage and phase voltage, line current and phase current.	2	CO2

ELEMENTS OF ELECTRICAL ENGINEERING **Course Code : 312315**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 6.1 Connect delta connected three phase load. LLO 6.2 verify relationship between line and phase quantities.	6	Connect three phase delta connected balanced load and verify the relationship between line voltage and phase voltage, line current and phase current.	2	CO2
LLO 7.1 Calculate transformation ratio of transformer. LLO 7.2 Connect transformer to given load.	7	*Determine the transformation ratio current ratio of single phase transformer.	2	CO3
LLO 8.1 Identify pin configuration of pulse transformer. LLO 8.2 Check electrical isolation between input and output of pulse transformer.	8	Demonstration of working of pulse transformer by observing input pulse and output pulse of pulse transformer on CRO.	2	CO3
LLO 9.1 Identify different parts DC motor. LLO 9.2 Identify different types of DC motor.	9	Identify different types of DC motor by observing terminal connections and also identify different parts of DC motor.	2	CO3
LLO 10.1 Connect DC motor to DC supply. LLO 10.2 Select particular starter for particular motor starting.	10	*Start any DC motor using corresponding starter and observe speed on tachometer.	2	CO3
LLO 11.1 Connect single phase induction motor to the supply. LLO 11.2 Change the direction of rotation of single phase induction.	11	*Start single phase induction motor and reverse the direction of rotation of it.	2	CO4
LLO 12.1 Connect the universal motor to the supply. LLO 12.2 Change the direction of rotation of universal motor.	12	Start universal motor and reverse the direction of rotation of it.	2	CO4
LLO 13.1 Connect the linear induction motor to the supply. LLO 13.2 Observe linear motion of induction motor.	13	Identify different parts of linear induction motor and start it.	2	CO4
LLO 14.1 Select fuse for particular application. LLO 14.2 Select circuit breaker for particular application.	14	*Identify different types of fuses and circuit breakers. State their specification for suitable application.	2	CO5
LLO 15.1 Explain connection of earthing for domestics application. LLO 15.2 Test available of earthing for given switch board.	15	Testing of earthing using a test lamp and comment on it.	2	CO5

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.

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

- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

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

Assignment

- 1) Search the different types of applications in which a transformer is required and prepare a report on it.

2) Prepare a report on different types of applications of single-phase motors. State the types of motors with their particular applications.
3) Prepare a PowerPoint presentation or animation to show the working of the DC motor.
4) Observe the different types of switchgear used at home and write a report on their types, ratings and applications.

To build a simple electrical circuit

- 1) Construct a closed circuit using,

one dry cell battery, one small light bulb holder, one small light bulb, small wire
stripper tape (scotch, masking, or electrical)
Answer the following questions:
a) What is the difference between an open and a closed circuit?
b) What is voltage?
c) How many connections to the battery are necessary for the light bulb to light up?
2) Prepare a switchboard to control one lamp, one socket with protection and indication.

Micro project

- **1) Magnetic circuits**: Collect the information for different types of magnetic materials and draw a B-H curve for the respective material.

2) A.C. Fundamentals: Visit a nearby industry and observe the different parameters such as frequency, voltage, current, power and prepare a report based on it.
3) Polyphase circuits: Observe the three-phase power distribution panel in their institute and prepare a report on it.
4) Transformer: Collect information regarding different types of transformers available in the laboratory and prepare a report on it.
5) Fractional horsepower motor: Visit the local market or use the internet and prepare a report based on i) Manufacturers ii) Technical specifications iii) Earthing arrangement iv)Price range.
6) Visit your institute workshop and prepare a report on the different types of machines used, their specifications and manufacturers, different types of motors used.

Note :

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

ELEMENTS OF ELECTRICAL ENGINEERING **Course Code : 312315**

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Single phase 230V, 50Hz, 1Hp Induction motor	11
2	Single phase 230V, 50Hz, 1/4Hp Universal motor	12
3	Single or three phase linear induction motor	13
4	Single Phase 230/115 V, 50Hz, 1 or 5 kVA Transformer	2,7
5	Single Phase 0-270V, 50Hz, 10A Auto-transformer	2,7,11
6	Cathode Ray Oscilloscope (CRO) 20MHz, Dual channel	3,4,8
7	Single phase 230V, 50Hz, 2A Inductive Load bank	4
8	Single phase 230V, 50Hz, 2A Capacitive Load bank	4
9	Single phase 230V, 10A Resistive Load bank	4,5,6
10	Pulse transformer 1:1:1 4503 or 1:1 4502	8
11	Different types of DC motor	9,10

IX. SUGGESTED 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**

X. 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

XI. SUGGESTED COS - POS MATRIX FORM

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

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
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
6	J.B. Gupta	A Course in Electrical Installation Estimating & Costing	S.K. Kataria & Sons, ISBN: 978-93-5014-279-0
7	K. B. Raina and S. K. Bhattacharya	Electrical design, estimation and costing, Second edition	New age international limited publisher, New Delhi, ISBN:978-8122443585

XIII . 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-animati on/	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_i s_list_by_category_id/5	IS standard

Note :

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

Programme Name/s	**: Architecture Assistantship/ Automobile Engineering./ Artificial Intelligence/ Agricultural Engineering/ Artificial Intelligence and Machine Learning/ Automation and Robotics/ Architecture/ Cloud Computing and Big Data/ Civil Engineering/ Chemical Engineering/ Computer Technology/ Computer Engineering/ Civil & Rural Engineering/ Construction Technology/ Computer Science & Engineering/ Fashion & Clothing Technology/ Dress Designing & Garment Manufacturing/ Digital Electronics/ Data Sciences/ Electrical Engineering/ Electronics & Tele-communication Engg./ Electrical and Electronics Engineering/ Electrical Power System/ Electronics & Communication Engg./ Electronics Engineering/ Food Technology/ Computer Hardware & Maintenance/ Instrumentation & Control/ Industrial Electronics/ Information Technology/ Computer Science & Information Technology/ Instrumentation/ Interior Design & Decoration/ Interior Design/ Civil & Environmental Engineering/ Mechanical Engineering/ Mechatronics/ Medical Laboratory Technology/ Medical Electronics/ Production Engineering/ Printing Technology/ Polymer Technology/ Surface Coating Technology/ Computer Science/ Textile Technology/ Electronics & Computer Engg./ Travel and Tourism/ Textile Manufactures/**
Programme Code	**: AA/ AE/ AI/ AL/ AN/ AO/ AT/ BD/ CE/ CH/ CM/ CO/ CR/ CS/ CW/ DC/ DD/ DE/ DS/ EE/ EJ/ EK/ EP/ ET/ EX/ FC/ HA/ IC/ IE/ IF/ IH/ IS/ IX/ IZ/ LE/ ME/ MK/ ML/ MU/ PG/ PN/ PO/ SC/ SE/ TC/ TE/ TR/ TX**
Semester	**: Second**
Course Title	**: PROFESSIONAL COMMUNICATION**
Course Code	**: 312002**

I. RATIONALE

Communication is key to 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 are essential for engineering professionals to instruct, guide and motivate peers/ subordinates to achieve desired goals at work place. Strong Communication skills are highly valued in the professional world and contribute to career growth and opportunities. Thus, this course has been designed to enhance the professional communication skills for effective presentation both in written and oral forms at workplace.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

1. Communicate effectively at workplace. 2. Issues can be identified and resolved by brainstorming solutions 3. Effective communication ensures strong decision making

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

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

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

PROFESSIONAL COMMUNICATION **Course Code : 312002**

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme												
				Actual Contact Hrs./ Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
312002	PROFESSIONAL COMMUNICATION	PCO	SEC	-	-	2	-	2	1	-	-	-	-	-	25	10	25@	10	-	-	50

Total IKS Hrs for Sem. : 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, *# On Line Examination , @$ Internal Online Examination

Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If 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 Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
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 suggestive remedies TLO 1.3 Use different types of verbal and non–verbal communication for the given situation	**Unit - I Professional Communication : An Overview** 1.1 Definition of professional communication- Importance, relevance, Elements and process of communication 1.2 7 C's of Professional Communication (Clarity, Conciseness, correctness, Coherent, concrete, courteous and Complete) 1.3 Types –Verbal (Oral-Written),Formal, Informal (Grapevine), Vertical 1.4 Barriers to communication,Types of barriers (Linguistic, Psychological, Technological)	Language lab Role plays Chalk board Reference books Case studies
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, seminars . Make use of types of note taking and note making for different subjects / topics	**Unit - II Listening & Note Taking** 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
3	TLO 3.1 Prepare notices / agenda for the given type of meeting / information TLO 3.2 Prepare minutes of meeting/s	**Unit - III Office Drafting** 3.1 Format of Notice and Circular 3.2 Drafting Agenda	white board Language Lab Reference books

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
	TLO 3.3 Draft a circular for a particular information/ event	3.3 Preparing Minutes of meeting	Classroom learning
4	TLO 4.1 Compose cover letter and CV / Resume for jobs TLO 4.2 Apply E- mail Etiquette for professional purposes TLO 4.3 Compose E- mails for different official purposes	**Unit - IV Writing Skills for Professional Communication** 4.1 Job Application with Resume / CV 4.2 E-Mail Etiquettes 4.3 Writing official E- Mails to communicate intended purposes 4.4 Drafting Enquiry letter and Complaint letter	Language lab Classroom learning NPTEL Reference books
5	TLO 5.1 Compose technical reports TLO 5.2 Draft accident / Investigation/ Daily reports	**Unit - V Report Writing** 5.1 Introduction to report writing 5.2 Accident Report 5.3 Investigation Report 5.4 Daily Report	Chalk and talk Language Lab Collaborative learning Classroom learning

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

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Draw communication cycle using real life examples and explain process of communication.	1	*Communication Process and Cycle	2	CO1
LLO 2.1 Undertake the Role play / Group discussion to illustrate types / barriers to communication	2	Role plays and Group Discussion	2	CO1
LLO 3.1 Listen to audios in the language lab and make notes of it.	3	*Active Listening	2	CO2
LLO 4.1 Give a presentation / Seminar using 7 C's of Communication.	4	*Presentations / Seminars	2	CO1
LLO 5.1 Explain the types of note taking with examples and make notes on any one topic related to your curriculum.	5	*Note taking and Note Making	2	CO2
LLO 6.1 Prepare agenda for meeting and draft minutes of the meeting.	6	*Agenda and Minutes of the meeting	2	CO3
LLO 7.1 Draft circulars for the given situation .	7	*Office Drafting	2	CO3
LLO 8.1 Respond to job advertisements referring newspapers, LinkedIn. Write cover letter with resume /CV.	8	*Type Job Application with Resume / CV	2	CO4
LLO 9.1 Type Four (formal) E-mails using ethics and etiquette.	9	* E- Mail writing	2	CO4
LLO 10.1 Write a detailed report on Accident/ Investigation .	10	*Technical Report writing	2	CO5
LLO 11.1 Prepare a case study related to linguistic barriers : language ,pronunciation, punctuation, technical jargon and suggest remedies for the same.	11	*Barriers to Communication	2	CO1
LLO 12.1 Draft complaint / enquiry letter for various situations	12	Complaint and Enquiry letter	2	CO4
LLO 13.1 List psychological barriers to communication LLO 13.2 Prepare case studies on any two	13	Psychological barriers to Communication	2	CO1

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
psychological barriers and suggest remedies to overcome the barriers				
LLO 14.1 Draw flow chart and mind mapping for any topic related to the curriculum.	14	*Listening Skills	2	CO2
LLO 15.1 Face mock interview arranged by your teacher.	15	* Typed Job Application , Resume / CV/ formal dressing and Interview	2	CO4

Note : Out of above suggestive LLOs -

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

VII. 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 life long learnings . Explain with appropriate examples and real life case studies.
- Collect (four to five) emails with technical jargons, barriers, make required corrections and keep a record of both the mails (original and Corrected one)
- 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
- Prepare a case study on Technological /Psychological barriers to communication

Reading for vocabulary and sentence structure

- Read any motivational book and present a review of the book

Note :

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

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

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

PROFESSIONAL COMMUNICATION **Course Code : 312002**

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table) : NOT APPLICABLE

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Term Work, Micro Project

Summative Assessment (Assessment of Learning)

- Practical Exam of 25 marks using language lab

XI. SUGGESTED COS - POS MATRIX FORM

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

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

XII. 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 978-13-16640-08-1
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

PROFESSIONAL COMMUNICATION **Course Code : 312002**

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

Note :

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

Programme Name/s	**: Architecture Assistantship/ Automobile Engineering./ Artificial Intelligence/ Agricultural Engineering/ Artificial Intelligence and Machine Learning/ Automation and Robotics/ Architecture/ Cloud Computing and Big Data/ Civil Engineering/ Chemical Engineering/ Computer Technology/ Computer Engineering/ Civil & Rural Engineering/ Construction Technology/ Computer Science & Engineering/ Fashion & Clothing Technology/ Dress Designing & Garment Manufacturing/ Digital Electronics/ Data Sciences/ Electrical Engineering/ Electronics & Tele-communication Engg./ Electrical and Electronics Engineering/ Electrical Power System/ Electronics & Communication Engg./ Electronics Engineering/ Food Technology/ Computer Hardware & Maintenance/ Hotel Management & Catering Technology/ Instrumentation & Control/ Industrial Electronics/ Information Technology/ Computer Science & Information Technology/ Instrumentation/ Interior Design & Decoration/ Interior Design/ Civil & Environmental Engineering/ Mechanical Engineering/ Mechatronics/ Medical Laboratory Technology/ Medical Electronics/ Production Engineering/ Printing Technology/ Polymer Technology/ Surface Coating Technology/ Computer Science/ Textile Technology/ Electronics & Computer Engg./ Travel and Tourism/ Textile Manufactures**
Programme Code	**: AA/ AE/ AI/ AL/ AN/ AO/ AT/ BD/ CE/ CH/ CM/ CO/ CR/ CS/ CW/ DC/ DD/ DE/ DS/ EE/ EJ/ EK/ EP/ ET/ EX/ FC/ HA/ HM/ IC/ IE/ IF/ IH/ IS/ IX/ IZ/ LE/ ME/ MK/ ML/ MU/ PG/ PN/ PO/ SC/ SE/ TC/ TE/ TR/ TX**
Semester	**: Second**
Course Title	**: SOCIAL AND LIFE SKILLS**
Course Code	**: 312003**

I. RATIONALE

Rationale : Life skills can be defined as abilities that enable humans to deal effectively with the demands and challenges of life. Social skills are a subset of life skills that are needed for successful, healthy relationships to easily adapt when moving from one social situation to the next. They help regulate our emotions effectively and develop enduring, supportive relationships, we're happier and healthier. This is why developing life skills and eventually social skills is key not only to being successful in life, it's key for our health and well-being. Thus, Teaching of Social and life skills provide students with essentials of knowing , understanding attitudes, values, morals ,social skills and better equip them to handle stress and build their self efficacy, self esteem and self confidence.

Note : The course offers five different alternatives(modules) for achieving above outcomes . Students must complete any one module from the following given options.

a. MODULE-I : Unnat Maharashtra Abhiyan (UMA)
b. MODULE-II : National Service Scheme (NSS)
c. MODULE-III : Unniversal Human Values
d. MODULE-IV: Value Education (Unnati Foundation)
e. MODULE-V : Financial Literacy (NABARD)

The institute can choose to offer any one MODULE to the groups of the students by taking into consideration the resources required and resources available in the institute . Different group of students maybe offered different MODULE based on their choices .

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

SOCIAL AND LIFE SKILLS **Course Code : 312003**

Demonstrate critical social and life skills ethics, resilience, positive attitude , integrity and self-confidence at workplace and society at large.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Enhance the ability to be fully self-aware and take challenges by overcoming all fears and insecurities and grow fully.
- CO2 - Increase self-knowledge and awareness of emotional skills and emotional intelligence at the place of study/work.
- CO3 - Provide the opportunity to realizing self-potential through practical experience while working individually or in group.
- CO4 - Develop interpersonal skills and adopt good leadership behaviour for self-empowerment and empowerment of others.
- CO5 - Set appropriate life goals with managing stress and time effectively.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
312003	SOCIAL AND LIFE SKILLS	SFS	VEC	-	-	-	2	2	1	-	-	-	-	-	-	-	-	-	50	20	50

Total IKS Hrs for Sem. : 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, *# On Line Examination , @$ Internal Online Examination

Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If 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 Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Explain developmental needs and connection of various stakeholders TLO 1.2 Enlist the local problems TLO 1.3 Design a	**MODULE I : Activities Under Unnat Maharashtra Abhiyan (UMA)** 1.1 Introduction to Societal Needs and respective stakeholders : Regional societal issues that need engineering intervention 1.2 Multidisciplinary approach-linkages of	i) Group discussion ii) Role play iii) Case study iv) Seminar and presentation **Implementation guidelines suggested**

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
	methodology for fieldwork TLO 1.4 Select the attributes of engineering and social system for measurement, quantification, and documentation TLO 1.5 Measure & quantify the quantities / systems parameters TLO 1.6 Write a report using information collected tStudy the data collected from fieldwork and conclude the observations	academia, society and technology 1.3 Stakeholders' involvement 1.4 Introduction to Important secondary data sets available such as census, district economic surveys, cropping pattern, rainfall data, road network data etc 1.5 Problem Outline and stakeholders : Importance of activity and connection with Mapping of system components and stakeholders (engineering / societal) 1.6 Key attributes of measurement 1.7 Various instruments used for data collection - survey templates, simple measuring equipments 1.8 Format for measurement of identified attributes/ survey form and piloting of the same 1.9 Fieldwork : Measurement and quantifications of local systems such as agriculture produce, rainfall, Road network, production in local industries, Produce /service which moves from A to B 1.10 Analysis and Report writing Report writing containing- 1. Introduction of the topic 2. Data collected in various formats such as table, pie chart, bar graph etc 3. Observations of field visits and data collected.	The course will be implemented in eight sessions and fieldwork: a) Session I - Introduction to development paradigm, fieldwork and case study as pedagogy b) Session II - VII - Society, stakeholders and value creation, measurements, rudimentary analysis and reporting c) Session VIII - Final closure session feedback and assessment d) Field work - 1. Pilot Visit - Pilot of survey instrument 2. Survey Visit 1 - Data gathering / Information Collection 3. Survey Visit 2 - Data gathering 4. Summary Visit - Closure after analysis **Methodology:** Considering the nature of the course designed, following points shall be considered while implementing the course. i) Regroup in the batches of 5-6 students for conducting the fieldwork from the bigger group. ii) Assign a few batches of the students for this course to all the faculty members. iii) A group of course teachers will visit local governance bodies such as Municipal Corporations, Village Panchayats, Zilla Parishads, Panchayat Samitis to assess the small technological / engineering needs in their area of work. iv) The group of course teachers will carry out initial field visits to evaluate the various possibilities of field visits / various scenarios where in students can conduct field work to measure / quantify the parameters / attributes.
2	TLO 2.1 Adopt a Village or Slum for providing	**MODULE II : National Service Scheme (NSS)**	(i) The teachers should visit the village / slum before adopting it

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
	needed services to the community TLO 2.2 Carry out Survey to identify the problems of village community TLO 2.3 Unsertake Special camping about developmental programs TLO 2.4 Establish the liaisons between government and other developmental agencies for the implementations of various development schemes of Government	2.1 Contacting Village/Area Leaders 2.2 Primary socio economic survey of few villages in the vicinity of the institute. 2.3 Selection of the village for adoption - conduct of activities 2.4 Comprehensive Socio Economic Survey of the Village/Area 2.5 Identification of Problem(s) 2.6 Dissemination of information about the latest developments in agriculture, watershed management, wastelands development, non-conventional energy, low cost housing, sanitation, nutrition and personal hygiene, schemes for skill development, income generation, government schemes, legal aid, consumer protection and allied fields. 2.7 A liaison between government and other development agencies for the implementation of various development schemes in the selected village / slum.	for NSS activities. (ii) The selected area should be compact. (iii) The community people should be receptive to the ideas of improving their living standard. They should also be ready to coordinate and involve in the projects undertaken by the NSS for their upliftment. (iv) The areas where political conflicts are likely to arise should be avoided by the NSS units. (v) The area should be easily accessible to the NSS volunteers to undertake frequent visits to slums.
3	TLO 3.1 Demonstrate Love and Compassion (Prem and Karuna) in the society TLO 3.2 Follow the path of Truth (Satya) TLO 3.3 Practice Non-Violence (Ahimsa) TLO 3.4 Follow the Righteousness (Dharma) TLO 3.5 Attain Peace (Shanti) in Life TLO 3.6 Provide Service (Seva) to the needy person/ community. TLO 3.7 Demonstrate Renunciation (Sacrifice) Tyaga TLO 3.8 Practice Gender Equality and Sensitivity	**MODULE-III : Universal Human Values** 3.1 Love and Compassion (Prem and Karuna): Introduction, Practicing Love and Compassion (Prem and Karuna) 3.2 Truth (Satya) : Introduction, Practicing Truth (Satya) 3.3 Non-Violence (Ahimsa) : Introduction, Practicing Non-Violence (Ahimsa) 3.4 Righteousness (Dharma) : Introduction, Practicing Righteousness (Dharma) 3.5 Peace (Shanti) : Introduction, Practicing Peace (Shanti) 3.6 Service (Seva) : Introduction, Practicing Service (Seva) 3.7 Renunciation (Sacrifice) Tyaga : Introduction, Practicing Renunciation (Sacrifice) Tyaga 3.8 Gender Equality and Sensitivity: Introduction, Practicing Gender Equality and Sensitivity	i) Lectures ii) Demonstration iii) Case Study iv) Role Play v) Observations vi) Portfolio Writing vii) Simulation viii) Motivational talks by Practitioners ix) Site/Industry Visit
4	TLO 4.1 Demonstrate Puntuality appropriately TLO 4.2 Practice Cleanliness, Hygiene and Orderliness for self and others	**MODULE-IV: Value Education (Unnati Foundation)** 4.1 Punctuality, Icebreaker and Simple Greeting, Understanding & Managing Emotions, Introducing Self, The power of a Positive Attitude, Talking about one's Family, Talking about one's Family, Making a Positive Impression, Give word list for a Word based 4.2 Cleanliness , Hygiene and Orderliness , Likes and Dislikes, Developing Confidence in Self and Others, Strengths and Weaknesses, Listening Skills , Greeting	i) Video Demonstrations ii) Flipped Classroom iii) Case Study iv) Role Play v) Collaborative learning vi) Cooperative Learning vii) Chalk-Board

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
	TLO 4.3 Take Responsibility and Calculated Risks TLO 4.4 Demonstrate Gratitude and Appreciations TLO 4.5 Show Determination & Persistence about work TLO 4.6 Give Respect as per the social norms and practice TLO 4.7 Respect Team Spirit to the acceptable level TLO 4.8 Practice Caring & Sharing among fellow citizens/community TLO 4.9 Demonstrate Honesty TLO 4.10 Practice for Forgive and Forget	gestures, Gender Equality and Sensitivity 4.3 Responsibility, OCSEM- Visual Comprehension and Word Based Learning, Goal Setting – Make it happen, Follow, Like & Share Unnati Social Media - Facebook / Instagram/ Twitter Introducing Others, Time Management, Talking about the daily routine, Money Management 4.4 Gratitude and Appreciation , Asking Simple Questions & Asking for the price , Stress Management, Student Referral process ,Comprehending & Paraphrasing Information, A Plate of Rice and Dignity of Labour, Topics for Public Speaking, Placement Process , OCSEM-E-Newspaper, Critical Thinking to overcome challenges 4.5 Determination and Persistence, Guiding and Giving Directions, Language Etiquette & Mannerism, . Unnati Philosophy , b. Unnati Branding - Follow, Like & Share Unnati Social Media - Facebook / Instagram/ Twitter, Simple instructions to follow procedures, Assertiveness, Give topics for Debate, Describing a person/ Objects, Refusal Skills, Word List for Word based Learning 4.6 Respect, Comparing , OCSEM - Public Speaking, Student referral process, Attending a phone call, Being a Good Team Player , Placement Process, At a Restaurant, Workplace ethics 4.7 Team Spirit, Inviting someone, OCSEM - Picture Reading & Word, a. Unnati Philosophy & b. Unnati Branding - Follow, Like & Share Unnati Social Media - Facebook / Instagram/ Twitter, Apologizing, Apologizing, Dealing effectively with Criticism, Introduce Importance of Self Learning and upskilling 4.8 Caring and Sharing , Handling Customer queries, Flexibility & Adaptibility, Student referral process, Writing a Resume, OCSEM-Public Speaking, Placement Process, Meditation/ Affirmation & OCSEM-Debate, Introduce Certif-ID, how to create Certif-ID Project , 4.9 Honesty, Email etiquette & Official Email communication, Alcohol & Substance use & abuse, Describing a known place , Leadership Skills, Describing an event, OSCEM-Picture Reading & Visual Comprehension 4.10 Forgive and Forget, Facing and Interview, OSCEM-Public Speaking ,	

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
		Attending a telephonic/Video interview & Mock Interview , Affirmation , Pat-a-Back & Closure (Valediction , Unnati Branding, Student Testimonials), Meditation/ Affirmation & Sponsor connect (Speak to UNXT HO)	
5	TLO 5.1 Develop Literacy About Savings and Investments in the community TLO 5.2 Attain Literacy About Financial Planning TLO 5.3 Demonstrate skills about Financial Transactions TLO 5.4 Use Literacy skills About Income, expenditure and budgeting TLO 5.5 Use measures about Inflation in the market. TLO 5.6 Use Literacy/ Knowledge About Loans TLO 5.7 Explain the Importance of Insurance TLO 5.8 Follow Dos and Donts about finances	**MODULE-V : Financial Literacy** 5.1 Introduction - Life Goals and financial goals 5.2 Savings and Investments - Three pillars of investments, Popular asset classes, Government schemes, Mutual Funds, Securities markets (Shares and bonds), Gold, Real Estate, Do's and Don'ts of investments 5.3 Retirement planning 5.4 Cashless transactions 5.5 Income, expenditure and budgeting – Concepts and Importance 5.6 Inflation- Concept, effect on financial planning of an individual 5.7 Loans – Types, Management of loans, Tax benefits 5.8 Insurance – Types, Advantages, selection 5.9 Dos and Donts in Financial planning and Transactions	i) Online/Offline Mode of Instructions ii) Video Demonstrations iii) Presentations iv) Case Study v) Chalk-Board vi) Collaborative learning

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES : NOT APPLICABLE.

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

Suggestive list of activities during Regular as well as Special Camping (NSS Activities)

- Following list is only an illustrative list of the type of activities that can be undertaken. Under the programme it would be open to each NSS Unit to undertake one of these programmes or any other activity which may seem desirable to them according to local needs. The NSS Unit should aim at the integrated development of the area selected for its operation which could be a village or a slum. It has also to be ensured that at least a part of the programme does involve manual work.

(a) Environment Enrichment and Conservation:
The activities under this sub-theme would inter-alia, include:
(i) plantation of trees, their preservation and upkeep
(ii) Construction & maintenance of village streets, drains
(iii) Cleaning of village ponds and wells;
(iv) Popularization and construction of Gobar Gas Plants, use of non-conventional energy;
(v) Disposal of garbage & composting;
(vi) Prevention of soil erosion and work for soil conservation,
(vii) Watershed management and wasteland development
(viii) Preservation and upkeep of monuments, and creation of consciousness about the preservation of cultural heritage among the community.

(b) Health, Family Welfare and Nutrition Programme:

(i) Programme of mass immunization;
(ii) Working with people in nutrition programmes with the help of Home Science and medical college students;
(iii) Provision of safe and clean drinking water;
(iv) Integrated child development programmes;
(v) Health education, AIDS Awareness and preliminary health care.
(vi) Population education and family welfare programme;
(vii) Lifestyle education centres and counselling centres.
© Programmes aimed at creating an awareness for improvement of the status of women: (i) programmes of educating people and making them aware of women's rights both constitutional and legal;
(ii) creating consciousness among women that they too contributed to economic and social well-being of the community;
(iii) creating awareness among women that there is no occupation or vocation which is not open to them provided they acquire the requisite skills; and
(iv) imparting training to women in sewing, embroidery, knitting and other skills wherever possible.

(d) Social Service Programmes:

(i) work in hospitals, for example, serving as ward visitors to cheer the patients, help the patients, arranging occupational or hobby activities for long term patients; guidance service for out-door-patients including guiding visitors about hospital's procedures, letter writing and reading for the patients admitted in the hospital; follow up of patients discharged from the hospital by making home visits and places of work, assistance in running dispensaries etc.
(ii) work with the organisations of child welfare;
(iii) work in institutions meant for physically and mentally handicapped;
(iv) organising blood donation, eye pledge programmes;
(v) work in Cheshire homes, orphanages, homes for the aged etc.;
(vi) work in welfare organisations of women;
(vii) prevention of slums through social education and community action;

(e) Production Oriented Programmes:

(i) working with people and explaining and teaching improved agricultural practices;
(ii) rodent control land pest control practices;
(iii) weed control;
(iv) soil-testing, soil health care and soil conservation;
(v) assistance in repair of agriculture machinery;
(vi) work for the promotion and strengthening of cooperative societies in villages;
(vii) assistance and guidance in poultry farming, animal husbandry, care of animal health etc.;
(viii) popularisation of small savings and assistance in procuring bank loans

(f) Relief & Rehabilitation work during Natural Calamities:

(i) assisting the authorities in distribution of rations, medicine, clothes etc.;
(ii) assisting the health authorities in inoculation and immunisation, supply of medicine etc.;
(iii) working with the local people in reconstruction of their huts, cleaning of wells, building roads etc.;
(iv) assisting and working with local authorities in relief and rescue operation;
(v) collection of clothes and other materials, and sending the same to the affected areas;

(g) Education and Recreations: Activities in this field could include:

(i) adult education (short-duration programmes);
(ii) pre-school education programmes;
(iii) programmes of continuing education of school drop outs, remedial coaching of students from weaker sections;
(iv) work in crèches;
(v) participatory cultural and recreation programmes for the community including the use of mass media for

instruction and recreation, programmes of community singing, dancing etc.;
(vi) organisation of youth clubs, rural land indigenous sports in collaboration with Nehru Yuva Kendras;
(vii) programmes including discussions on eradications of social evils like communalism, castism, regionalism, untouchability, drug abuse etc.;
(viii) non- formal education for rural youth and
(ix) legal literacy, consumer awareness.

Note :

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

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Simple engineering measurement devices GPS data collection tools GIS open source softwares- Google Earth and QGIS MS office suite	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table) : NOT APPLICABLE

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

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

Summative Assessment (Assessment of Learning)

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1					03	03	03			
CO2					02	02	03			

CO3	01	01	01		03	03	03			
CO4		01	01	01	03	03	03			
CO5		02		01	03	03	03			

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

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	IRAP, Hyderabad, CTARA, IIT Bombay and UNICEF, Mumbai	Compendium of Training Materials for the Capacity Building of the Faculty and Students of Engineering Colleges on 'IMPROVING THE PERFORMANCE OF RURAL WATER SUPPLY AND SANITATION SECTOR IN MAHARASHTRA' Districts Economic survey reports	UNICEF
2	Central Public Health and Environmental Engineering Organisation	Manual on Water Supply and Treatment	Ministry of Urban Development, New Delhi
3	Specifications And Standards Committee	Indian Standards (IS) Codes and Indian Roads Congress (IRC) Codes	Bureau of Indian Standards and The Indian Road Congress
4	Prepared by each district administration	Districts Economic survey reports	Govt. of Maharashtra
5	Local college students, UMA staffs	Sample Case Studies on UMA website	IITB-UMA team
6	RBI	https://www.rbi.org.in/FinancialEducation/content/GUIDE310113_F.pdf	RBI
7	RBI	https://www.rbi.org.in/FinancialEducation/content/Financing%20needs%20of%20Micro%20and%20small%20Enterprises%20-%20A%20guide.pdf	RBI
8	RBI	https://www.rbi.org.in/FinancialEducation/content/I%20Can%20Do_RBI.pdf	RBI

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://gr.maharashtra.gov.in/Site/Upload/Government%20Resolutions/English/201601131501523808.pdf	Government Resolution of Government of Maharashtra regarding Unnat Maharashtra Abhiyan
2	https://gr.maharashtra.gov.in/Site/Upload/Government%20Resolutions/English/201606151454073708.pdf	Government Resolution of Government of Maharashtra regarding Unnat Maharashtra Abhiyan Guidelines
3	https://censusindia.gov.in/census.website/	A Website of Census of India
4	https://gsda.maharashtra.gov.in/english/	A Website of Groundwater Survey and Development Agency, GoM

SOCIAL AND LIFE SKILLS **Course Code : 312003**

Sr.No	Link / Portal	Description
5	https://mrsac.gov.in/MRSAC/map/map	A Website where district-wise maps showcasing different attributes developed by Maharashtra Remote Sensing Applications Centre.
6	https://ejalshakti.gov.in/jjmreport/JJMIndia.aspx	A Website of Jal Jivan Mission, Government of India
7	https://cpcb.nic.in/	A Website of Central Pollution Control Board, Government of India
8	http://www.mahapwd.com/#	A Website of Public Works Department, GoM
9	http://tutorial.communitygis.net/	A Website for GIS data sets developed by Unnat Maharashtra Abhiyan
10	https://youtu.be/G71maumVZ1A?si=TzDTxKUpLYaRos7U	A video record of lecture by Prof. Milind Sohoni, IIT Bombay, on Engineering, Development and Society
11	https://youtu.be/TUcPNwtdKyE?si=wnSWrhGc9dJTC-ac	A keynote talk by Prof. Milind Sohoni, IIT Bombay, on Interdisciplinary Engineering: The Road Ahead
12	https://youtu.be/mKJj6j_1gWg?si=ajE8s4lfB2OM63Ng	A TED talk by Prof. Milind Sohoni, IIT Bombay, on Vernacular Science: The Science of Delivery
13	https://www.ugc.gov.in/pdfnews/4371304_LifeSKill_JeevanKaushal_2023.pdf	UHV: UGC Course on life skils. Unit 4 i.e. Course 4 is to be referred
14	https://nss.gov.in/	NSS : Know about the NSS Scheme and details
15	https://www.rbi.org.in/FinancialEducation/FinancialEnterpreneure.aspx	Reference for Module V
16	https://www.rbi.org.in/FinancialEducation/content/I%20Can%20Do_RBI.pdf	Reference for Module V
17	https://www.rbi.org.in/FinancialEducation/content/Financing%20needs%20of%20Micro%20and%20small%20Enterprises%20-%20A%20guide.pdf	Reference for Module V
18	https://www.rbi.org.in/FinancialEducation/content/GUIDE310113_F.pdf	Reference for Module V

Note :

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

ELECTRONICS WORKSHOP PRACTICE **Course Code : 312008**

Programme Name/s	**: Automation and Robotics/ Digital Electronics/ Electronics & Tele-communication Engg./ Electrical and Electronics Engineering/ Electronics & Communication Engg./ Electronics Engineering/ Instrumentation & Control/ Industrial Electronics/ Instrumentation/ Medical Electronics/ Electronics & Computer Engg.**
Programme Code	**: AO/ DE/ EJ/ EK/ ET/ EX/ IC/ IE/ IS/ MU/ TE**
Semester	**: Second**
Course Title	**: ELECTRONICS WORKSHOP PRACTICE**
Course Code	**: 312008**

I. RATIONALE

Engineering Diploma holders in Electronics and Allied branches expected to identify and test various Components, Switches, Relays, Connectors, Cables, Network cables and must be able to Solder and De solder SMD components.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help students to attain the following industry/employer expected outcome through various teaching learning experiences: Identification and Testing of various electronic components.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Use ESD accessories and safety systems for electronic equipment
- CO2 - Test various electronic components using relevant equipment
- CO3 - Identify various parts of SMPS, UPS, perform soldering and desoldering of SMD components
- CO4 - Identify various types of Switches, Relays, Connectors, Cables, Network and Data cables
- CO5 - Use of sensors for various parameters,

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											
				Actual Contact Hrs./ Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
312008	ELECTRONICS WORKSHOP PRACTICE	EWP	SEC	-	-	4	2	6	3	-	-	-	-	-	25	10	25@	10	25	10	75

Total IKS Hrs for Sem. : 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, *# On Line Examination , @$ Internal Online Examination

Note :

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

7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Follow safety practices TLO 1.2 Use of ESD Accessories TLO 1.3 List various protection devices	**Unit - I Safety Measures** 1.1 Electro Static Discharge (ESD): Introduction, Causes 1.2 ESD Accessories 1.3 Types of Fuses, rating of fuses 1.4 Introduction and Use of: MCB, ELCB, MCCB	Teacher input Demonstrartion in laboratory and using videos
2	TLO 2.1 Describe the use of Front panel controls on CRO/ DSO TLO 2.2 Describe the use of Front panel controls on Function Generator TLO 2.3 Plot the Characteristics of Multicolor LED TLO 2.4 State the need of Q factor TLO 2.5 Explain the procedure of Testing of PCB and Transformer TLO 2.6 State the need of Optocoupler TLO 2.7 List Various Tools involved in testing	**Unit - II Electronic Component Testing** 2.1 CRO/DSO: Various Controls on Front panel, Use for Testing of components 2.2 Function Generator: Various Controls on Front panel, Generation of different waveforms 2.3 LEDs: Multicolor LED testing 2.4 LCR Q meter: Introduction, Need of Q factor , Determination of Q factor 2.5 Testing: PCB connectivity, Transformer, Pulse Transformer 2.6 Introduction to Opto coupler, Fiber Optic Cable: Connectivity test 2.7 Various Tools: Wire cutter, wire stripper, screwdrivers, testers, IC plucker	Teacher input Demonstration in laboratory
3	TLO 3.1 Describe the block diagram of SMPS TLO 3.2 List the types of UPS TLO 3.3 Use of Temperature controlled soldering iron for SMD components	**Unit - III SMPS, UPS and Soldering Desoldering** 3.1 SMPS: Introduction, Various Blocks, observe waveforms at output of each block 3.2 UPS: Introduction, Types- offline, online, UPS ratings, relation between KVA rating and battery backup 3.3 SMD Soldering: Introduction, Soldering of SMD components 3.4 DeSoldering of SMD components	Teacher input Hands on practice Demonstration video
4	TLO 4.1 Classify the various types of connectors TLO 4.2 List the various types of relays TLO 4.3 List the applications of various types of switches TLO 4.4 Explain the procedure of setting up a network using network cables	**Unit - IV Connectors, Relays, Switches and Network cables** 4.1 Connectors: Need, Types and Identification 4.2 Relays: Need, Types and Identification 4.3 Switches: Need, Types and Identification 4.4 Cables: Need, Types and Identification 4.5 Network cables: Types and connection	Teacher input Hands on practice Demonstration video
5	TLO 5.1 Classify various types of Sensors TLO 5.2 Describe the operation of LDR TLO 5.3 Describe the operation of Hygrometer TLO 5.4 Describe the operation	**Unit - V Sensors** 5.1 Sensors: Introduction, Temperature sensors, Motion sensors, Proximity sensors, LDR, Humidity sensor [Hygrometer] 5.2 LDR Operation and specifications 5.3 Humidity sensor Hygrometer Operation and selection factors	Teacher input Hands on practice Demonstration video

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
	of temp sensor IC	5.4 Temperature sensor IC characteristics	

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

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Identification of various ESD safety accessories and their applications	1	* Use various ESD safety accessories	2	CO1
LLO 2.1 Identify various types of fuses, fuse carriers, MCB, ELCB and MCCB with ratings	2	* Use various types of protection devices	2	CO1
LLO 3.1 Operate the CRO and use various controls on front panel	3	* Identify the controls of CRO/ DSO	2	CO2
LLO 4.1 Operate CRO/DSO in component testing mode LLO 4.2 Test the passive components R , L and C using CRO/DSO LLO 4.3 Test the active components Diode , Transistor using CRO/DSO	4	*Component testing using CRO	2	CO2
LLO 5.1 Operate the function generator and use various controls on front panel	5	Identify the controls of function generator	2	CO2
LLO 6.1 Generate square/sine/triangular wave of specified frequency and amplitude and observe on CRO/DSO	6	* Generate the different types of waveform by using function generator on CRO/DSO	2	CO2
LLO 7.1 Identify the single colour and multi colour LED. LLO 7.2 Test multicolor LED using DMM and D C power supply.	7	* Testing of multi colour LEDS	2	CO2
LLO 8.1 Set LCR Q meter for Quality factor measurement LLO 8.2 Measure Q of given L using LCR Q meter LLO 8.3 Measure Q of given C using LCR Q meter	8	*Determine Q factor of given component by using LCR Q meter	2	CO2
LLO 9.1 Test the continuity of printed track on a PCB using multi- meter	9	* Use of continuity tester	2	CO2
LLO 10.1 Measure the input and output voltage of transformer	10	Testing of transformer	2	CO2
LLO 11.1 Identify the various types of capacitors LLO 11.2 Determine its value of capacitor by color code LLO 11.3 Interpret the value of capacitor by reading information printed on it.	11	Determine the value of capacitor .	2	CO2
LLO 12.1 Observe input output wave forms of given pulse transformer	12	*Testing of pulse transformer	2	CO2
LLO 13.1 Identify opto electronic devices LLO 13.2 Plot transfer transfer characteristics of the Optocoupler	13	Opto electronic devices	2	CO2
LLO 14.1 Identify type of fiber optic cable LLO 14.2 Set up analog link to test optic cable connectivity	14	*Optical Fiber analog link	2	CO2
LLO 15.1 Identify the various tools: wire cutter, wire stripper, screwdrivers, testers, IC plucker used in electronics laboratories	15	* Electronic workshop tools	2	CO2

ELECTRONICS WORKSHOP PRACTICE **Course Code : 312008**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 15.2 Use appropriate tool for given application				
LLO 16.1 Identify various parts of SMPS LLO 16.2 Measure output voltage of SMPS	16	* Switch Mode Power Supply (SMPS).	2	CO3
LLO 17.1 Identify various types of UPS LLO 17.2 Measure the output voltage of UPS	17	Uninterrutable power supply (UPS).	2	CO3
LLO 18.1 Use of temperature controlled soldering iron for SMD components soldering	18	* Soldering the SMD component on the PCB	2	CO3
LLO 19.1 Use of appropriate desoldering tool for desoldering of SMD components from PCB	19	* Desolder the SMD component from the PCB	2	CO3
LLO 20.1 Find out various tools available with PCB layout software LLO 20.2 Prepare PCB layout for given discrete component circuit by using relevant PCB layout software	20	* Use of PCB layout software	2	CO3
LLO 21.1 Identify various types of connectors: USB type A, B, C, Lightning type, USB mini and micro connectors	21	* USB connectors	2	CO4
LLO 22.1 Identify various types of relays: Rotary, Reed, Solid state, Remote control and voltage stabilizer relays LLO 22.2 Select relay for given application	22	* Types of relays	2	CO4
LLO 23.1 Identify various types of switches: Toggle, Rotary, Slider, Lever, Micro switches, Thumbwheel, Piano, Tactile switches LLO 23.2 Select appropriate switch for given application.	23	*Types of switches.	2	CO4
LLO 24.1 Identify type of cables: RCA, HDMI, display port cable LLO 24.2 Select appropriate cable for given applications	24	* Types of cables	2	CO4
LLO 25.1 Identify the computer network cable LLO 25.2 Test network cable: CAT5, CAT6 Cable, using cable tester LLO 25.3 Prepare cable for network connection using crimping tools,	25	* Computer Networking Cables	4	CO4
LLO 26.1 Identify various temperature sensors such as RTD, Thermocouple, Thermistor and IC based temperature sensors, LLO 26.2 Plot the characteristics of temperature sensor IC LM335	26	* Temperature sensor	2	CO5
LLO 27.1 Use of hair hygrometer to measure humidity or use any other sensor (related to program) and measure the parameter	27	Use of hair hygrometer / other sensor	2	CO5
LLO 28.1 Configure local and network printer	28	Install local and network printer by applying various types of configuration settings	2	CO5
LLO 29.1 Take a print of a signal from DSO by connecting it to a printer.	29	* Interface DSO to a printer	2	CO5
LLO 30.1 Configure the scanner and printer LLO 30.2 Identify various faults of printers	30	Configure scanner and Printer	4	CO5

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

Note : Out of above suggestive LLOs -

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

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

Micro project

- Assemble switch board with two switches
- Build a BJT based amplifier circuit and observe the output waveform
- Design a PCB layout by using relevant software for discrete or IC based components
- Design a relay based circuit to turn ON and OFF the LED

Assignment

- Prepare a report on various ESD and safety accessories by visiting a nearby industry
- Prepare a comparative chart for different types of printers
- Prepare report on electronic system maintenance tools

Note :

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

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	ESD equipment: ESD Table Mat Color: BLUE Material: antistatic Thickness: 2mm Mat Size: Can be provide as per requirement Pattern: Plain Length: 2M X 15M Shape: Roll 2m X 15m,can be provided in As per requirement Usage: ESD protection	1,2
2	Pulse transformer: core volume of 2.57x10 -4 m 3 average gap between layers of 0.002 m, 14 turns primary circuit, 108 turns secondary, 30 kV of secondary voltage, 1.5 k output impedance level	12
3	Clamp meters: AC current (50/60 Hz) real effective value Sector / accuracy 200 AAC / ±2.5% + 8 digits DC current Sector / accuracy 200 ADC / ±2.0% + 5 digits Testing AC voltage (50/60Hz) real effective value 600 VAC ±(1.5% + 8 digits) Testing DC voltage 600 VDC ±(1.5% + 2 digits) Ohms 999.9 ? ±(1.5% + 8 digits) Illumination of measurement point white LEDs Diameter of the conductor maximum of 18mm Display backlit LCD with 3 2/3 positions Power 2 AAA batteries	12,16,17
4	Opto Coupler : Test voltage for Isolation is 5000VRMS Max collector current allowed by a transistor is 100mA I/O coupling capacitance is below 0.5pF Current Transfer Ration/	13

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
	CTR is 10% I/O isolation voltage is 500VRMS Typical Rise & Fall Time: 3us Forward Voltage of an IR LED ranges from 1.2V to 1.5V Max voltage across C&E terminals of a phototransistor is70V The Forward Current of an IR LED ranges from 10mA to 80mA Max Reverse Current of IR LED is 10uA Max Reverse Voltage of IR LED i	
5	opto-isolators : withstand input-to-output voltages up to 10 kV and voltage transients with speeds up to 25 kV/?s	13
6	SMPS: Electrical Characteristics 12V, 20A 1. Input Voltage 100 - 270V AC 2. Output Voltage 12 V DC 3. Output Current 20A 4. Leakage Current @ 230 V ac < 2mA 5. Line regulation < 1% 6. Load regulation < 1% 7. Ripple content 150mV p-p 8. Dielectric strength: Between Input & Output 2 kV AC Between Input & Earth 1.5kV AC Between Output & Earth 1.5kV AC	16
7	UPS Specifications : UPS mode Mains AC LOW Cut 170+/- 5V Mains AC LOW Cut recovery 175+/- 5V Mains AC HIGH Cut 265+/- 5V Mains AC LOW Cut recovery 260+/- 5V INVERTER mode Mains AC LOW Cut 120+/- 5 V Mains AC LOW Cut recovery 125+/- 5 V Mains AC HIGH Cut 285+/- 5 V Mains AC HIGH Cut recovery 280+/- 5 V	17
8	Temperature controlled soldering Gun: Accurate and advanced temperature Control with micro controller technology User-friendly operation. Set / Read of temperature Increase and Decrease of keys to set temperature once set the read temperature will display after two seconds by default. Temperature control accuracy ± 1°C Last set value of temperature is stored in memory Power consumption 60 W Input voltage 170 to 270 V Temperature range 180 to 270 V (180 to 480 °C). Temp stability ± 10°C Tem	18,19
9	PCB layout software: Circuitmaker	20
10	Computer System: Intel processor core i3 or i7 or latest with mother board Intel chipset 41/61/latest with 4 USB,1 serial port, 1 LPT port,2GB RAM DDR III,500 GB Sata Hard disk, 16” or 18.5” LCD/LED monitor, ATX cabinet with SMPS and lock system, DVD writer, Keyboard, USB mouse,1 Gigabit Network card/ latest configuration or Latest configuration (or higher version) 24	24,25,28,29,30
11	LM 335: Local sensor accuracy (max)6Operating temperature range (°C)-40 to 100Supply voltage (min) (V)5Supply voltage (max) (V)3.04Supply current (max) (µA)400 Interface type: Analog output Sensor gain (mV/°C)10RatingCatalog	26
12	Printer Type: LaserJet; Functionality – Single Function (Print only); Printer Output – Black & White only Connectivity – USB, Power: Input voltage 110 to 127 VAC (+/- 10%), 50/60 Hz (+/- 2 Hz), 3.5 amps; 220 to 240 VAC (+/- 10%), 50/60 Hz (+/- 2 Hz), 2 amps” ; “Compatible Operating Systems: Windows 2000; Windows 7; Windows 10 Pages per minute – 14 pages ; Ideal usage – Enterprise/Business, Frequent users (for fast, high quality printing) Page size supported – A4, A5, A6, B5, C5, DL, postcar	28,29
13	CRO: Dual Channel, 4 Trace CRT / TFT based Bandwidth 20 MHz/30 MHz X10 magnification 20 nS max sweep rate, Alternate triggering Component tester and with optional features such as Digital Readout , USB interface	3,4,6
14	Digital Storage Oscilloscope: 25MHz/60MHz/70MHz/100MHz Dual Channel, 4 Trace CRT / TFT based X10 magnification 20 nS max sweep rate, Alternate triggering Component tester and with optional features such as Digital Read out, USB interface. Any other Oscilloscope with additional features is also suitable with magnifying probe at least two probes, if possible isolated probe	3,4,6,29
15	Scanner type: Portable scanner Photoelectric device, 600 dpi Color CIS with 10368 pixels Effective pixels 5,100 × 8,400 pixels at 600 dpi Document size Max: 216 × 356 mm (8.5 × 14.0 inches) Min: 52 × 73.7 mm (2.0 × 2.9 inches) (Portrait) 85.6 × 54 mm (3.4 × 2.1 inches) (Landscape) Paper input, Face-down loading, Paper output, Face-down ejection Paper capacity, Single sheet of paper at 35 to 270 g/m2 Scanning resolution: 600 dpi (main scan), 600 dpi (sub scan) Output resolution:	30
16	Function Generator: Frequency range 0.1Hz to 30 MHz sine, square, triangular, ramp and pulse generator, Output amplitude 20V open circuited, Output impedance 50 ohms. Facility to indicate output frequency and amplitude on display	5,6

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
17	LCR Q Meter: Parameter L-Q, C-D, R-Q and Z-Q Frequency 00 Hz, 120 Hz and 1 KHz Accuracy Basic Accuracy : 0.3% Display 5 digits display for both primary and secondary parameters L 100 Hz, 120 Hz 1 mH - 9999 H 1 KHz 0.1 mH - 999.9 H Measurement C 100 Hz, 120Hz 1 pF – 9999 mF Range 1 KHz 0.1 pF - 999.9 mF R, |Z| 0.0001V- 999.9 MV D, Q 0.0001 – 9999 D% 0.0001% - 9999% Test Level 120 Hz 0.3 Vrms (1 ±15%) (Range Auto 1 KHz and Open 100 Hz 0.42 Vrms (1±15%) Circuit) Ranging Mod Auto and Hold Equ	8
18	Digital Multimeter: Minimum 3 ½ digit 4 ½ digit display, multimeter measures Vac, Vdc (1000V max), Adc, Aac (10-amp max), Resistance (0-100 M?), diode and transistor testing mode	8,10

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table) : NOT APPLICABLE

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Each practical will be assessed considering - - 60% weightage to process and - 40% weightage to product

Summative Assessment (Assessment of Learning)

- End of the term assessment, Viva-voce, Workshop performance

XI. SUGGESTED COS - POS MATRIX FORM

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

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

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Raghuwanshi B.S.	A Course in Workshop Technology	Dhanpat Rai & Sons, New Delhi, 2017 or latest edition
2	Sarathe A.K.	Engineering Workshop Practice	Khanna Book Publishing Co.(P) Ltd. , New Delhi; 2021 or latest edition ISBN: 978-9391505516

ELECTRONICS WORKSHOP PRACTICE **Course Code : 312008**

Sr.No	Author	Title	Publisher with ISBN Number
3	Jones, Thomas H	Electronic Components Handbook	Reston Publishing, Virginia, US, latest edition, ISBN: 978-0879092221
4	Mehta V.K., Mehta Rohit	Principles of Electronics	S. Chand and Co., New Delhi-110 055, 2014, ISBN: 978-8121924504
5	Abraham Pressman , Keith Billings, Taylor Morey	Switching Power Supply Design	McGraw Hill Edition 3, April 16, 2009 ISBN: 978-0071482721
6	Susan S Mathew Saji T Chacko	Fundamentals of Electrical and Electronics Engineering	Khanna Book Publishing Co (P) Ltd. New Delhi 978-93-91505-59-2

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.boschrexroth.com/en/in/products/product-groups/a ssembly-technology/topics/manual-product	ESD Protection
2	https://electricalnotebook.com/lcr-q-meter/	LCR Q meter to measure the Q factor
3	https://nptel.ac.in/courses/108105180	SMPS Working
4	https://instrumentationtools.com/multi-color-led-works/	Multicolor LED Working
5	https://www.youtube.com/watch?v=AdaIpyOdd0w	Pulse Transformer
6	geeksforgeeks.org/how-to-set-up-a-LAN-	Network Reading material about Process to set a LAN
7	https://www.youtube.com/watch?v=cc2fyg-B5WE	Video about setting a LAN
8	https://circuitmaker.com	PCB Circuit Maker
9	https://www.services.bis.gov.in/php/BIS_2.0/bisconnect/get_i s_list_by_category_id/5	IS for electrical safety and appliances

Note :

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

PROGRAMMING IN C **Course Code : 312019**

Programme Name/s : Automation and Robotics

Programme Code : AO

Semester : Second

Course Title : PROGRAMMING IN C

Course Code : 312019

I. RATIONALE

Procedure Oriented Programming language helps the students to solve given problems with help of basic principles of C programming paradigm. This course is basically designed to create a base to develop foundation skills for Embedded C Programming required for automation and robotics applications.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry identified outcome through various teaching learning experiences: Develop applications in C using Procedure Oriented Programming skills.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Use keywords and Operators in C programs.
- CO2 - Use Control Structure to implement decision making problems in C programs.
- CO3 - Develop C programs using Arrays.
- CO4 - Implement C programs using Structures.
- CO5 - Use functions in C program to implement modular programming approach.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme												
				Actual Contact Hrs./ Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
312019	PROGRAMMING IN C	CPR	SEC	1	-	2	1	4	2	-	-	-	-	-	25	10	25@	10	25	10	75

Total IKS Hrs for Sem. : 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, *# On Line Examination , @$ Internal Online Examination

Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If 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 Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

PROGRAMMING IN C **Course Code : 312019**

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Identify the basic building blocks of C Program. TLO 1.2 Write C program using keywords. TLO 1.3 Write C program using input output statements. TLO 1.4 Write C program using arithmetic, logical and bitwise operators.	**Unit - I C Language Basic** 1.1 History of C, General structure of C program. 1.2 Header files, main() function, use of comments. 1.3 Input statement using scanf() and output statement using printf(). 1.4 Variable, Data Types, Keywords, Constants ,Type conversion. 1.5 Operators: Arithmetic, Relational, Logical, Bitwise, Assignment, Unary, Ternary, Scope Resolution.	Chalk-Board Demonstration Hands-on
2	TLO 2.1 Write 'C' program using decision making structure to solve the given problem TLO 2.2 Write 'C' program using loop statements to solve the given iterative problem TLO 2.3 Use Appropriate statements to alter the program flow in the given loop	**Unit - II Decision Making** 2.1 If statement, If-else statement, Nested if statement, else if Ladder, Switch statement. 2.2 Loop statements: While Loop, do-while Loop, for Loop, Nested for loop. 2.3 Goto statement, break statement, continue statement.	Chalk-Board Demonstration Hands-on
3	TLO 3.1 Write C program to create one and two dimensional arrays. TLO 3.2 Write C program to demonstrate operations on arrays. TLO 3.3 Write C program using an array of characters.	**Unit - III Array** 3.1 Need of Array, Types of Array: One dimensional arrays and Two dimensional array. 3.2 Array declaration and Initialization, Accessing One and Two-Dimensional array elements, Operations on array. 3.3 Array of characters	Chalk-Board Demonstration Hands-on
4	TLO 4.1 Write C program to demonstrate how to declare and initialize structure. TLO 4.2 Write C program using an array of structures	**Unit - IV Structures** 4.1 Introduction and Features of Structures. 4.2 Declaration and Initialization of Structures. 4.3 Array of Structure, Typedef, Enumerated Data Type.	Chalk-Board Demonstration Hands-on
5	TLO 5.1 Write C program using predefined string and math library functions. TLO 5.2 Write C program using user defined functions. TLO 5.3 Write C program to solve recursive problems using user defined recursive functions.	**Unit - V Functions** 5.1 Concept and need of functions. 5.2 Library functions: Math functions, String handling functions, other miscellaneous functions. 5.3 Writing User defined functions, scope of variables. 5.4 Different ways of function calling: Functions Without Arguments and Return Value, Functions With No Arguments But has a Return Value , Functions With Arguments But No Return Value, Functions That Accept Arguments and Give a Return Value , Parameter passing: call by value and call by reference. 5.5 Recursive functions.	Chalk-Board Demonstration Hands-on

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

PROGRAMMING IN C **Course Code : 312019**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Use variables, constants and keywords. LLO 1.2 Apply type conversion concept.	1	* Develop minimum two program using constants, variables and exhibiting data type conversion.	2	CO1
LLO 2.1 Use arithmetic operators to build arithmetic expressions. LLO 2.2 Use relational operators to build relational expressions.	2	Develop a C programs using arithmetic and relational operators.	2	CO1
LLO 3.1 Use logical operators to solve logical expressions. LLO 3.2 Use bitwise operators to solve bitwise operations	3	* Develop a C programs using logical and bitwise operators.	2	CO1
LLO 4.1 Apply decision making if statements for given situations.	4	* Develop a program to implement decision making statements i.e. if statement and if..else.	2	CO2
LLO 5.1 Use multi-way decision making statement to solve the problem	5	* Develop C program using if..else, while, for loop statements	2	CO2
LLO 6.1 Use break and continue statement..	6	Develop a program to demonstrate the use of break and continue statements	2	CO2
LLO 7.1 Use entry controlled while loop statement for the given situation. LLO 7.2 Use entry controlled for loop statement for the given situation.	7	* Develop a program using while and for loop to solve the given iterative problem.	2	CO2
LLO 8.1 Use exit controlled do… while loop statement for the given situation.	8	* Develop a program using do..while loop to solve the given iterative problem.	2	CO2
LLO 9.1 Apply the concepts of array.	9	* Develop a program to implement one dimensional array.	2	CO3
LLO 10.1 Perform arithmetic operations on a two-dimensional matrix.	10	* Develop a program to perform arithmetic operations on two dimensional array.	2	CO3
LLO 11.1 Perform operations using two dimensional array	11	Develop program to perform transpose operation on a two dimentional matrix	2	CO3
LLO 12.1 Apply the concept of structure.	12	* Write C program using Structure.	2	CO4
LLO 13.1 Apply the concept of array of structure.	13	Write C program to demonstrate the use of arrays of structure.	2	CO4
LLO 14.1 Use string handling library functions. LLO 14.2 Use math library functions.	14	* Develop a C program to demonstrate the use of standard library functions.	2	CO5
LLO 15.1 Define user defined function. LLO 15.2 Write a C program to call user defined function.	15	* Develop a C program using user defined functions.	2	CO5
LLO 16.1 Use recursion concept to define recursive function.	16	* Develop a C Program using recursion.	2	CO5

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
• Judicial mix of LLOs are to be performed to achieve desired outcomes.				

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

Micro project

- 1.Develop simple calculator to perform mathematical operations.

2. Develop food menu card for restaurant.
3. Develop menu driven program for invoice management system.
4. Develop menu driven program for number conversion system such as Hexadecimal to Decimal, Decimal to Binary etc.

Note :

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

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	1. Computer System (Any computer system with basic configuration RAM: 8GB Minimum, OS: DOS or Any Windows OS version 2. C Compiler (Turbo C Compiler/GCC Compiler / or any other C compiler)	All

IX. SUGGESTED 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	C Language Basic	CO1	3	0	0	0	0
2	II	Decision Making	CO2	4	0	0	0	0
3	III	Array	CO3	3	0	0	0	0
4	IV	Structures	CO4	2	0	0	0	0
5	V	Functions	CO5	3	0	0	0	0
Grand Total				**15**	**0**	**0**	**0**	**0**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Continuous Assessment based on Process and Product related performance indicators
- Each Practical will be assessed considering

60% weightage to Process
40% weightage to Product

Summative Assessment (Assessment of Learning)

- End Semester Examination, Lab performance, viva voce

XI. SUGGESTED COS - POS MATRIX FORM

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

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

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	E Balagurusamy	PROGRAMMING IN ANSI C	McGraw Hill Education,8TH EDITION ISBN: 978-9351343202
2	Yashavant Kanetkar	Let Us C: Authentic guide to C programming language	BPB Publications, 19th Edition ISBN:9789355512765
3	Kernighan Brian W, Ritchie Dennis	C Programming Language	Pearson Education India, ISBN: 978-9332549449
4	Herbert Schildt	C: THE COMPLETE REFERENCE	McGraw Hill Education, Second Edition ISBN:978-0070411838

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.w3schools.com/c/c_intro.php	C Introduction
2	https://www.geeksforgeeks.org/c-programming-language/	C Programming Language Tutorial
3	https://www.tutorialspoint.com/cprogramming/index.htm	C Tutorial
4	https://www.javatpoint.com/c-programming-language-tutorial	C Programming Language Tutorial

Note :

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