Semester : Second

Sr No	Course Title	Abbrevation	Course Type	Course Code	Total IKS Hrs for Sem.	CL	TL	LL	Self Learning (Activity/ Assignment /Micro Project)	Notional Learning Hrs /Week	Credits	Paper Duration (hrs.)	FA-TH Max	SA-TH Max	Total Max	Total Min	FA-PR Max	FA-PR Min	SA-PR Max	SA-PR Min	SLA Max	SLA Min	Total Marks
						Actual Contact Hrs./Week							**Theory**				**Based on LL & TL - Practical**				**Based on Self Learning**		
General (All Compulsary) Compulsory - 7																							
1	APPLIED MATHEMATICS	AMS	AEC	312301	2	3	1	-	-	4	2	3	30	70	100	40	-	-	-	-	-	-	100
2	APPLIED SCIENCE	ASC	DSC	312308	4	4	-	4	-	8	4	1.5	30	70*#	100	40	50	20	50@	20	-	-	200
3	ELEMENTS OF ELECTRONICS	EOE	DSC	312309	1	3	-	4	3	10	5	3	30	70	100	40	25	10	25@	10	25	10	175
4	FUNDAMENTAL OF ELECTRICAL ENGINEERING	FEE	DSC	312310	0	3	-	4	3	10	5	3	30	70	100	40	25	10	25@	10	25	10	175
5	PROFESSIONAL COMMUNICATION	PCO	SEC	312002	0	-	-	2	-	2	1	-	-	-	-	-	25	10	25@	10	-	-	50
6	SOCIAL AND LIFE SKILLS	SFS	VEC	312003		-	-	1	1	2	1	-	-	-	-	-	25	10	-	-	25	10	50
7	BASIC MECHANICAL ENGINEERING	BME	SEC	312006	2	2	-	2	-	4	2	-	-	-	-	-	50	20	50@	20	-	-	100
	Total				9	15	1	17	7	40	20		120	280	400		200		175		75		850

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.

Course Category : Discipline Specific Course Core (DSC) : 3, Discipline Specific Elective (DSE) : 0, Value Education Course (VEC) : 1, Intern./Apprenti./Project./Community (INP) : 0, AbilityEnhancement Course (AEC) : 1, Skill Enhancement Course (SEC) : 2, GenericElective (GE) : 0

APPLIED MATHEMATICS   Course Code : 312301

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 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/ Electronics & Computer Engg./**
Programme Code	**: AA/ AE/ AI/ AL/ AN/ AO/ AT/ BD/ CE/ CH/ CM/ CO/ CR/ CS/ CW/ DE/ DS/ EE/ EJ/ EP/ ET/ EX/ HA/ IC/ IE/ IF/ IH/ IS/ IX/ IZ/ LE/ ME/ MK/ MU/ PG/ 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 integration to find area, volume, mean value and root mean square value for given engineering related problems.
- CO3 - Apply the differential equation to find the solutions of given programme specific problems.
- CO4 - Employ numerical methods to solve programme specific problems.
- CO5 - Use probability distributions to solve elementary engineering problems.

Semester - 2, K Scheme

APPLIED MATHEMATICS **Course Code : 312301**

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Paper Duration	Assessment Scheme											Total Marks
				Actual Contact Hrs./Week			SLH	NLH			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		
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.	Improved Lecture Demonstration Chalk-Board Presentations Video Demonstrations

Semester - 2, K Scheme

APPLIED MATHEMATICS
Course Code : 312301

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.
2	TLO 2.1 Solve given examples based on definite Integration. TLO 2.2 Use properties of definite integration to solve given problems. TLO 2.3 Utilize the concept of definite integration to find the following (a) Area under the curve (b) Area between given two curves (c) Volume of revolution (d) Mean value (e) Root mean square value	**Unit - II Definite Integration and Applications** 2.1 Definite Integration: Definition, rules of definite integration with simple examples. 2.2 Properties of definite integral (without proof) and simple examples. 2.3 Applications of integration: area under the curve, area between given two curves, volume of revolution, mean value and root mean square value.	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. TLO 3.5 Solve given programme specific problems using the category of 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. 3.4 Application of differential equations and related engineering problem(s).	Video Demonstrations Presentations Chalk-Board Improved Lecture Presentations
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 using given methods. TLO 4.3 Apply the concept of numerical integration to solve given engineering problems. TLO 4.4 Solve problems using Yuktibhasa iterative methods for finding approximate square root. (IKS)	**Unit - IV Numerical Methods and Numerical Integrations** 4.1 Solution of algebraic equations: Bisection method, Regula falsi method and Newton –Raphson method. 4.2 Solution of simultaneous equations containing three Unknowns by Gauss elimination method. 4.3 Solution of simultaneous equations containing three Unknowns by iterative methods: Gauss Seidal and Jacobi's method. 4.4 Numerical Integration: Trapezoidal rule, Simpson's 1/3 rd rule, Simpson's 3/8 th rule. (Without proof) 4.5 Yuktibhasa iterative methods for finding approximate square root. (IKS)	Video SCILAB Spreadsheet Chalk-Board Improved Lecture Presentations

Semester - 2, K Scheme

APPLIED MATHEMATICS   Course Code : 312301

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.
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 ORANGER 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	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, area between two curves and volume of revolution.	6	Area under the curve, area between two curves and volume of revolution.	1	CO2
LLO 7.1 Solve examples on mean value and root mean square value.	7	Mean value and root mean square value.	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 D.E. using variable separable method and homogeneous method.	9	*Variable separable method and homogeneous method.	1	CO3
LLO 10.1 Solve first order first degree D.E. 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.	1	CO3
LLO 12.1 Solve problems on Bisection method and Regula falsi method.	12	*Bisection method and Regula falsi method.	1	CO4
LLO 13.1 Solve problems on Newton-Raphson method and Gauss elimination method.	13	Newton- Raphson method and Gauss elimination 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 Solve examples on Trapezoidal rule, Simpson's 1/3 rd rule and Simpson's 3/8 th rule.	15	Trapezoidal rule, Simpson's 1/3 rd rule and Simpson's 3/8 th rule.	1	CO4

Semester - 2, K Scheme

APPLIED MATHEMATICS   **Course Code : 312301**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 16.1 Solve problems on Bisection method, Regula falsi method, Newton-Raphson method using spreadsheet .	16	Bisection method, Regula falsi method, Newton- Raphson method problems using spreadsheet.	1	CO4
LLO 17.1 Use Yuktibhasa iterative methods for finding approximate value of square root and cube root. (IKS)	17	*Yuktibhasa iterative methods for finding approximate value of square root and cube root. (IKS)	1	CO4
LLO 18.1 Solve engineering problems using Binomial distribution.	18	*Binomial Distribution	1	CO5
LLO 19.1 Solve engineering problems using Poisson distribution.	19	*Poisson Distribution	1	CO5
LLO 20.1 Solve engineering problems using Binomial distribution.	20	*Normal Distribution	1	CO5
LLO 21.1 Solve problems on Laplace transform and properties of Laplace transform.	21	# Laplace transform and properties of Laplace transform.	1	CO2
LLO 22.1 Solve problems on Inverse Laplace transform and properties of Inverse Laplace transform.	22	# Inverse Laplace transform and properties of Inverse Laplace transform.	1	CO2

Note : out of above suggestive LLOs -

- Minimum 12 for 2 LL Hrs./Week or 24 for 4 LL hrs./Week are to be Performed.
- '*' Marked Practicals (LLOs) Are mandatory
- Judicial mix of LLOs are to be performed to complete minimum requirement of 12 / 24 as applicable

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

Micro project

- NA

Assignment

- NA

Note :
NA

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

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

Semester - 2, K Scheme

APPLIED MATHEMATICS **Course Code : 312301**

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	9	2	6	4	12
2	II	Definite Integration and Applications	CO2	10	2	4	10	16
3	III	Differential Equation	CO3	10	2	6	8	16
4	IV	Numerical Methods and Numerical Integrations	CO4	8	2	4	8	14
5	V	Probability Distribution	CO5	8	2	4	6	12
		Grand Total		45	10	24	36	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

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APPLIED MATHEMATICS   Course Code : 312301

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
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, including calc
8	https://www.purplemath.com/	Purplemath is a great resource for students seeking help with algebra and other foundational math to
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
12	https://ocw.mit.edu/index.htm	The Massachusetts Institute of Technology (MIT) offers free access to course materials for a wide ra

Semester - 2, K Scheme

APPLIED MATHEMATICS   **Course Code : 312301**

Semester - 2, K Scheme

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	Paper Duration	Assessment Scheme											Total Marks
				Actual Contact Hrs./Week			SLH	NLH			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	
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.

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.

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

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.
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 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.	**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 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).	Improved lecture Presentations Demonstration Video Demonstrations
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

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.
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 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.	**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. 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 $H_2 - O_2$ fuel cell, Ni-Cd battery and Lithium ion battery	Chalk-Board Demonstration Case Study Video Demonstrations

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
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 $KMnO_4$ solution. LLO 16.2 Prepare standard oxalic acid. LLO 16.3 Standardize $KMnO_4$ solution.	16	Standardization of $KMnO_4$ solution using standard oxalic acid and preparation of Fe alloy sample.	2	CO4

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
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 Sulphur.	27	Calculate the percentage of Sulphur in a given coal sample by ultimate analysis. (Gravimetric analysis)	2	CO6
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

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

- Minimum 12 for 2 LL Hrs./Week or 24 for 4 LL hrs./Week are to be Performed.
- '*' Marked Practicals (LLOs) Are mandatory
- Judicial mix of LLOs are to be performed to complete minimum requirement of 12 / 24 as applicable

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	An inclined plane , a trolly or a roller , pan , weight box , spring balance spirit level, strong thread , meter scale .	3
3	Retort stand, helical spring , 6 slotted weight of 50 grams ., scale , stop watch.	4
4	Resonance tube , Tuning forks of different frequencies	5
5	Metallic bob , strong thread , stopwatch .	6
6	Ultrasonometer	7
7	ultrasonic interferometer	8
8	Experimental setup for characteristics of photoelectric cell	9,10
9	Experimental setup for characteristics of LDR, optical bench .Source of light ,LDR .	11
10	Laser Source (He Ne, diode laser), optical bench , graph paper, glass plate	12,13,14
11	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
12	Nephelometer ; Auto-ranging from 20-200 NTU,+/- 2% of reading plus 0.1 NTU, power 220 Volts +/- 10% AC 50 Hz	21
13	pH meter reading up to pH14; ambient temp. -40 to 700 C.; pH/mV resolution:13 bit	24
14	Electric oven inner size 18''x18''x18''; temperature range 100 to 2500 C with the capacity of 40 lt.	25
15	Bomb calorimeter Temperature Resolution:0.001°C Oxygen Filling Automatic /Manual	26

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
16	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

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	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
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

Sr.No	Link / Portal	Description
8	www.fearofphysics.com	Fundamental terms in Physics
9	https://iksindia.org	IKS

ELEMENTS OF ELECTRONICS

Course Code : 312309

Programme Name/s	: **Electrical Engineering/ Electrical Power System**
Programme Code	: **EE/ EP**
Semester	: **Second**
Course Title	: **ELEMENTS OF ELECTRONICS**
Course Code	: **312309**

I. RATIONALE

Diploma in Electrical Engineering students need to maintain and operate electronics systems. This course deals with basic operating principles and handling of electronics devices to troubleshoot electronics circuits used in Electrical system.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Use electronic components and circuits in electrical equipment and systems

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Identify various electronic components
- CO2 - Use semiconductor diodes in different applications.
- CO3 - Use semiconductor transistors in different applications.
- CO4 - Use different types of Oscillators as per requirement
- CO5 - Test operation of 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		
312309	ELEMENTS OF ELECTRONICS	EOE	DSC	4	-	4	2	10	5	3	30	70	100	40	25	10	25@	10	25	10	175

ELEMENTS OF ELECTRONICS **Course Code : 312309**

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 Differentiate between given active and passive electronic components. TLO 1.2 Calculate value of given resistor and capacitor using colour code and printed information. TLO 1.3 Interpret with sketches given signal. TLO 1.4 Compare characteristics of given voltage and current source	**Unit - I Electronic components and Signals** 1.1 Active and passive components 1.2 Resistor,Capacitor,inductor,symbols,applications,colour codes, specifications 1.3 Concept of Unipolar and Bipolar Devices. 1.4 Classification of signals-sinusoidal, triangular and square 1.5 Signal waveform ,Time and Frequency domain, Representation, Amplitude,Frequency,phase,wavelength 1.6 Voltage and current source Ideal and non ideal Sources Dependent voltage and current sources .	Chalk-Board Assignment Demonstrations Hands-on

MSBTE Approval Dt. 29/11/2023 **Semester - 2, K Scheme**

ELEMENTS OF ELECTRONICS
Course Code : 312309

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.
2	TLO 2.1 TLO 2.1 Check the operation of the given diode TLO 2.2 TLO 2.2 Plot V-I characteristic of the given diode TLO 2.3 TLO 2.3 Describe working Principle of given type of Rectifier without and with Filter. TLO 2.4 TLO 2.4 Explain given type of wave shaping circuits	**Unit - II Semiconductor Diodes** 2.1 Construction, symbol, working principle, specification, applications ,types of biasing and V-I characteristic of Zener diode ,LED , Photo diode. Working principle and applications of OLED 2.2 Rectifiers- Full wave center tapped and Bridge Rectifier, circuit diagram, wave forms ,working principle . Rectifier IC KBU 808 Pin diagram and applications 2.3 Parameters of rectifier: Average DC value of current and voltage, ripple factor, PIV of diode, TUF and efficiency of rectifier. 2.4 Need of filters ,Types- C,LC,CLC,L ,circuit diagram wave forms and working principle. 2.5 Wave shaping circuits Linear and non linear wave shaping - RC integrator, RC Differentiator, Diode based Clipper circuits , Diode based Clamper. Circuits	Chalk-Board Assignment Presentations Hands-on
3	TLO 3.1 Describe the working of the given type of transistors TLO 3.2 Compare the performance of three type of transistor configurations. TLO 3.3 Solve simple numerical on Current gains. TLO 3.4 Use transistor for various applications (Amplifier and Switch) . TLO 3.5 Explain working of given type of JFET and MOSFET.	**Unit - III Semiconductor Transistors** 3.1 Current operating Devices, Bipolar Junction Transistor- Types NPN , PNP, symbol, construction and working principle . 3.2 Need of biasing ,Types- Fixed bias and Voltage divider bias 3.3 Regions of operation and their significance - Cut off region , Active region and Saturation region 3.4 Transistor configurations: CB, CE, CC, working , comparison and applications 3.5 Transistor parameters- Alpha, Beta, Gama, Input, and output resistance, Relationship between alpha and beta, numerical on same. 3.6 Applications- Transistor as an amplifier- Small signal and power amplifier , Class A, Class B, Class C, Class AB Amplifier , Transistor as a switch , 3.7 Voltage operating devices, Construction Of JFET(N-Channel and P channel),symbol ,working principle, different parameters of JFET and applications. 3.8 MOSFET: Construction ,symbol ,working principle of Enhancement and Depletion MOSFET, and their applications.	Chalk-Board Assignment Demonstration Hands-on

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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 working principle of Oscillator with its need. TLO 4.2 Compare the performance of the given feedback. TLO 4.3 Explain Barkhausen's criterion. TLO 4.4 Describe working of the given type of oscillator with circuit diagram.	**Unit - IV Oscillators** 4.1 Oscillator: Need, Definition 4.2 Types of feedback: Positive feedback, Negative feedback. Barkhausen's criterion 4.3 Oscillator: Circuit Diagram , working and comparison of RC ,LC, and Crystal oscillator. 4.4 Types of RC oscillator- Wien bridge and RC Phase shift Oscillator Frequency calculation 4.5 Types of LC oscillator-Colpitts oscillators ,Hartley oscillators.Frequency calculation	Chalk-Board Assignment Demonstration Hands-on
5	TLO 5.1 Explain parameters of voltage regulators. TLO 5.2 Calculate output voltage of the given regulator. TLO 5.3 Check the working of the given type of regulator ICs. TLO 5.4 Explain working of SMPS.	**Unit - V Regulators and power supply.** 5.1 Voltage regulation Load and line regulation :Definition, formulae 5.2 Block diagram, Construction, and operation of DC Regulated power supply 5.3 Basic Zener diode as a voltage regulator. 5.4 Regulator IC's: IC's 78XX,79XX ,IC 723 as fixed, variable and Dual Regulated DC power supply 5.5 Switch mode power supply: Need, block diagram and working.	Chalk-Board Assignment Demonstration Hands-on

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 Identify active and passive components in given circuit LLO 1.2 Measure the value of given resistors on Digital Multimeter(DMM) LLO 1.3 Test Diode and LED on Digital Multimeter.	1	Identification of Active and Passive components and DMM handeling.	4	CO1
LLO 2.1 Measure amplitude, time period and frequency of given signal on CRO	2	Measurement of amplitude, time period and frequency of given signal on CRO	2	CO1
LLO 3.1 Check PN junction Diode in forward bias. and Plot the V-I characteristics of PN junction diode and determine cut in voltage.	3	Check the performance of PN Junction diode.	2	CO2
LLO 4.1 Check the performance of Zener diode in forward and reverse biasing	4	* Check performance of Zener diode.	2	CO2
LLO 5.1 Build the circuit for Photo Diode and Observe the change in current with change in light intensity of the source	5	Test the performance of photo diode by varying the light intensity as well as the distance of the light source.	2	CO2

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Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 6.1 Construct and test half wave rectifier on breadboard .	6	* Construct and Test the half wave rectifier.	2	CO2
LLO 7.1 Prepare the circuit for Half Wave Rectifier with LC filter/ pi filter using PN junction Diode . LLO 7.2 Observe and draw input & output waveforms for sinusoidal wave .	7	*Prepare and Test the half wave rectifier with LC filter/ π filter	2	CO2
LLO 8.1 Build the circuit for Full Wave Centre Tapped Rectifier using PN junction Diode. LLO 8.2 Observe and draw input & output waveform for sinusoidal wave	8	*Build and Test the full wave rectifier using two diodes	2	CO2
LLO 9.1 Construct the circuit for Full Wave Bridge Rectifier using PN junction Diodes LLO 9.2 Observe and draw input and output waveform for sinusoidal wave	9	* Construct and Test the full wave Bridge rectifier on bread board using four diodes	2	CO2
LLO 10.1 Build the circuit for Full Wave Rectifier using PN junction Diode with LC/Pi filter LLO 10.2 Calculate ripple factor for given setup.	10	*Use LC/ π filter with full wave rectifier to measure ripple factor.	2	CO2
LLO 11.1 Prepare the circuit for full wave rectifier using IC KBU 808 with filter LLO 11.2 Observe and draw input & output waveform for sinusoidal wave.	11	* Prepare and Test the full wave rectifier on bread board using IC KBU 808 with filter.	2	CO2
LLO 12.1 Build/Test positive Clipper circuit. LLO 12.2 Build/Test negative Clipper circuit.	12	*Build clipper circuit and observe the waveforms.	2	CO2
LLO 13.1 Construct and Test Positive Clamper Circuit LLO 13.2 Construct and Test negative Clamper Circuit	13	* Construct clamper circuit and observe waveforms.	2	CO2
LLO 14.1 Identify the terminals of the PNP and NPN transistor for TO-5, TO-220, TO-66 LLO 14.2 Selection of transistor for different parameters as max. voltage, current and switching speed	14	Identify and select transistors for given application using datasheets	2	CO3
LLO 15.1 Build the circuit for BJT in common base configuration LLO 15.2 Plot input and output characteristics of common base configuration	15	Build and Test the performance of BJT in CB mode	2	CO3
LLO 16.1 Construct the circuit for BJT in common emitter configuration. LLO 16.2 Plot input and output characteristics of common emitter configuration.	16	* Construct and test the circuit for BJT in common emitter configuration.	2	CO3

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Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 17.1 Test the performance parameters of BJT as Switch LLO 17.2 Identify Cutoff and saturation regions.	17	*Test the performance parameters of BJT as Switch	2	CO3
LLO 18.1 Build the circuit for FET in common source configuration. LLO 18.2 Plot characteristics for drain to source voltage VDS verses drain current ID for different Values of VGS	18	* Check the performance of FET drain Characterstics.	2	CO3
LLO 19.1 Build the circuit for FET in common source configuration LLO 19.2 Plot characteristics for Gate to source voltage VGS verses drain current ID and calculate transconductance.	19	Test the performance of FET transfer characteristics and calculate transconductance.	2	CO3
LLO 20.1 Build the circuit and measure the frequency of given LC Oscillator circuit LLO 20.2 Build the circuit and measure the frequency of given RC Oscillator circuit	20	Measure the frequency of given Oscillator circuit	2	CO4
LLO 21.1 Test the voltages &waveforms at various Test points of regulated dc power supply. LLO 21.2 Identify the various faults in the Regulated DC power supply	21	*Find out faults at different stages of regulated DC power supply	2	CO5
LLO 22.1 Rectify the various faults in the Regulated DC power supply.	22	*Trouble shoot given DC regulated power supply	2	CO5
LLO 23.1 Build Zener voltage regulator for given voltage. LLO 23.2 Calculate load and line regulation.	23	*Build and Test the performance of Zener voltage regulator for given voltage.	2	CO5
LLO 24.1 Construct the circuit for Positive voltage regulator using 78XX IC. LLO 24.2 Calculate load and line regulation.	24	* Construct and Test the performance of Positive voltage regulator using 78XX , three terminal IC for given voltage.	2	CO5
LLO 25.1 Prepare the circuit for Dual voltage regulator using 78XX and 79XX IC LLO 25.2 Calculate load and Line regulation.	25	* Prepare and Test the performance of Dual voltage regulator using 78XX and 79XX ,three terminal IC for given voltage	2	CO5
LLO 26.1 Build LOW/High voltage regulator circuit using IC LM723. Calculate load and line regulation	26	*Test the performance of IC 723 as Regulator.	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)

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ELEMENTS OF ELECTRONICS   **Course Code : 312309**

Micro project

- Transistor as switch- Build /Test transistor switch circuit on General purpose PCB for various input signals
- Diode: Build a circuit on general purpose PCB to clip a positive half cycle at 1.5 v of a waveform with input signal 5Vpp, and prepare the report
- Diode: Build a circuit on general purpose PCB to clamp a waveform at 3.0 V using diode and passive components.
- Photodiode: Build a circuit on breadboard to turn the relay on and off by using photo diode and prepare a report.
- Rectifier: Build a half wave rectifier for 6V, 500mA output current on general purpose PCB.
- Rectifier: Build a full wave bridge rectifier with capacitor filter for 6V, 500mA output current on general purpose PCB
- Using Data sheets compare various electronic parameters of different types of JFET and MOSFET.
- Transistor as switch- Build /Test transistor switch circuit on General purpose PCB for various input signals
- Transistor- Build a circuit to switch on and off the LED using BJT as a switching component
- Voltage Regulator: Build a circuit of DC regulated power supply on general purpose PCB for 9V and 500mA output
- Oscillator: Build circuit to generate audio frequency.
- Prepare display boards/models/charts to visualize the appearance of electronic active and passive components.

Assignment

- Study Different types of Rectifier ICs available.
- Study working of OLED Display.

> **Note :**
>   This is a suggestive list of micro project and assignments , Similar activities can be set for relevant skill development For this course in L A scheme 2 hrs per week are allocated for self learning,Course teacher shall allocate micro project or / and assignments by considering 30 hrs SL work . Micro project may be assign for a team of 4 to 5 students .SL work shall be assessment is a formative (continuous)assessment . Depending on allocated task Course teacher shall set rubrics , This continuous assessment record will be helpful for SLA

VIII.   LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Variable DC power supply 0-30V, 2A, SC protection, display for voltage and current.	3,4,11,12,16,17,18,19
2	Cathode Ray Oscilloscope Dual Trace 20Mhz. 1 5Mega ohm Input impedance	5,6,7,8,9,10
3	Function Generator 0-2 MHz with Sine, square and triangular output with variable frequency and amplitude.	2,5,6,7,8,9,10
4	Digital Multimeter: 3 1/2 digit display, 9999 counts digital multimeter measures: Vae Vee (1000V max), Ade- Aae (10 amp max), Resistance (0-100 MS2). Capacitance and Temperature measurement	All
5	Lux meter 3000 Lumen. Battery operated hand held type	4
6	Trainer Kits/Breadboard for Rectifiers, Regulators, Transistors, JFET	5,6,7,8,9,10,11,13,14,16,17,18,19

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	Electronic components and Signals	CO1	10	4	4	4	12

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Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
2	II	Semiconductor Diodes	CO2	14	4	6	6	16
3	III	Semiconductor Transistors	CO3	14	4	6	6	16
4	IV	Oscillators	CO4	12	4	4	6	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)

- Each practical will be assessed considering 60% weightage to process and 40% product based on the nature of practicals.
- Two formative assessment tests for 30 marks and average of two unit tests.

Summative Assessment (Assessment of Learning)

- End semester assessment of 25 marks for laboratory learning
- End semester assessment of 70 marks

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	-	1	1	1	-	2			
CO2	2	-	1	1	2	-	2			
CO3	2	1	1	1	2	1	2			
CO4	2	1	1	1	2	1	2			
CO5	2	1	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	V .K. Mehta ,Rohit Mehta	Principles of Electronics	S.Chand and Company Ram Nagar, New Delhi-110 055,11th edition 2014, ISBN 9788121924504
2	B.L.Theraja	Basic Electronics	S. Chand Publishing, 2007,ISBN:9788121925556
3	R.S.Sedha	A textbook of Applied Electronics	S Chand, New Delhi 2008, ISBN:978-8121927833

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Sr.No	Author	Title	Publisher with ISBN Number
4	Mottershead,Allen	Electronic Devices and Circuit: An introduction	Goodyear Publishing Co. New Delhi ISBN: 9780876202654
5	Horowitz, Paul Hill, Winfield	The Art of Electronics	Cambridge University Press, New Delhi 2015 ISBN: 9780521689175
6	Bell, David	Fundamentals of Electronic Devices and Circuits	Oxford University Press, International edition, USA,2015,ISBN:9780195425239
7	Vijay Baru, Rajendra Kaduskar, Sunil T. Gaikwad	Basic Electronic Engineering	Dreamtech press,New Delhi,2015,ISBN:9789350040126

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.youtube.com/watch?v=Fwj_d3uO5g8	Diodes
2	http://www.eleccircuit.com	Electronic circuit
3	https://www.electroschematics.com/tools/	Electronic tools
4	www.futurlec.com	Electronic tools/components
5	www.alldatasheet.com	Datasheets
6	www.nptel.iitm.ac.in	Electronic circuits
7	www.electronics-tutorials	Electronic circuits
8	https://www.learningaboutelectronics.com/	Voltage Regulator
9	https://www.animations.physics.unsw.edu.au/	Electronic tools/components/Circuit

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FUNDAMENTAL OF ELECTRICAL ENGINEERING   **Course Code : 312310**

Programme Name/s	: **Electrical Engineering/ Electrical Power System**
Programme Code	: **EE/ EP**
Semester	: **Second**
Course Title	: **FUNDAMENTAL OF ELECTRICAL ENGINEERING**
Course Code	: **312310**

I. RATIONALE

Technologists in electrical engineering are expected to handle electrical machines, instruments, devices and equipment. The basic aim of this course is that, the student must understand the basic concepts, principles and laws of electric and magnetic circuits and practical thereof. The basic aim of this course is that the student must develop the basic concepts, fundamental laws of electric circuits, magnetic circuits,electromagnetic induction,Capacitors,Batteries and practical thereof. This course will enable the students to apply the fundamental concepts of electrical engineering to understanding of other higher level subjects in further study.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Apply basic principles of electrical engineering to solve the simple electrical 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 - Determine various parameters used in electric circuit.
- CO2 - Use basic laws of electrical engineering in D.C. Circuits.
- CO3 - Use capacitor and battery in electrical circuits.
- CO4 - Use principles of magnetism in Magnetic Circuits.
- CO5 - Apply Laws of electromagnetism in electrical circuit and systems.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme						Assessment Scheme												
				Actual Contact Hrs./Week			SLH	NLH	Credits	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	
312310	FUNDAMENTAL OF ELECTRICAL ENGINEERING	FEE	DSC	4	-	4	2	10	5	3	30	70	100	40	25	10	25#	10	25	10	175

FUNDAMENTAL OF ELECTRICAL ENGINEERING Course Code : 312310

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 Interpret the given electric parameters. TLO 1.2 Explain the given terms of electric circuit. TLO 1.3 Explain the given effect of the electric current TLO 1.4 Calculate work, power and energy for the given circuit.	**Unit - I Basic Electrical Parameters** 1.1 Direct Current (DC),Alternating Current (AC), Voltage Source and Current Source: Ideal and Practical. 1.2 Electric Current, Electric Potential, Potential Difference(PD), Electro-Motive Force(EMF) 1.3 Electrical Work, Power and Energy. 1.4 Resistance, Resistivity, Conductivity, Effect of Temperature on Resistance 1.5 Types of Resistor and their application 1.6 Heating Effect, Magnetic Effect, Chemical Effect of Electric current	Chalk-Board Presentations Demonstration Model Demonstration Video Demonstrations
2	TLO 2.1 Apply Ohm's law to calculate internal resistance of the given circuit. TLO 2.2 Calculate equivalent resistance for the given circuit. TLO 2.3 Categorize the given type of network TLO 2.4 Apply the Kirchhoff's current law and Kirchhoff's voltage law to calculate the electrical quantities in the given circuit.	**Unit - II D.C. Circuits** 2.1 Ohm's Law, Internal resistance of source, internal voltage drop, Terminal Voltage. 2.2 Resistance in Series, Resistance in Parallel. (theory and numerical) 2.3 Active, Passive, Linear, Non-linear Circuit, Unilateral Circuit and Bi-lateral Circuit, Passive and Active Network, Node, Branch, Loop, Mesh. 2.4 Comparison of Kirchhoff's Current Law, Kirchhoff's Voltage Law (Simple numericals).	Chalk-Board Demonstration Video Demonstrations Presentations

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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.
3	TLO 3.1 Describe the construction of the given type of capacitor. TLO 3.2 Explain the working of the capacitor in the given circuit. TLO 3.3 Calculate equivalent capacitance in the given D.C. circuit. TLO 3.4 Define Battery and state its types and connections TLO 3.5 Plot charging and discharging curves for the given capacitor and battery.	**Unit - III Capacitors and Battery** 3.1 Capacitor, it's construction, Parallel Plate Capacitor 3.2 Various connections of capacitor. 3.3 Energy Stored in Capacitor. 3.4 Charging and Discharging of Capacitor. 3.5 Breakdown voltage and Di-electric strength. 3.6 Applications of Capacitor 3.7 Types of battery, Construction, series and parallel connection of Battery 3.8 Charging and Discharging of Capacitor and battery	Chalk-Board Video Demonstrations Presentations Model Demonstration Hands-on
4	TLO 4.1 Interpret the terms related to a magnetic circuit. TLO 4.2 Calculate various parameters of the given magnetic circuit. TLO 4.3 Compare the series and parallel magnetic circuit based on the given criteria. TLO 4.4 Plot B-H curve and hysteresis loop of the given magnetic materials.	**Unit - IV Magnetic Circuits** 4.1 Magnetic lines of force, Flux, Flux density, Magnetic flux intensity. 4.2 Magneto-Motive-Forces (MMF), Ampere Turns (AT), Reluctance, Permeance, Reluctivity. 4.3 Electric and Magnetic circuit: Series Magnetic and Parallel Magnetic Circuit. 4.4 Magnetization Curve (B-H Curve) 4.5 Magnetic Hysteresis, Hysteresis Loop, Applications.	Chalk-Board Video Demonstrations Demonstration Model Demonstration Presentations
5	TLO 5.1 Describe the use of Faraday's laws of electromagnetic induction in the given application. TLO 5.2 Distinguish between the given type of e.m.fs. TLO 5.3 Apply Faraday's laws to calculate induced e.m.f. in the given circuit. TLO 5.4 Calculate self-inductance and energy stored in the magnetic field of the given circuit.	**Unit - V Electromagnetic Induction** 5.1 Development of Induced e.m.f. and Current, Faraday's Laws of Electromagnetic Induction. 5.2 Static and dynamic emf, Lenz's Law, Fleming's Right hand rule 5.3 Self Inductance, Coefficient of Self-inductance (L), Mutual inductance, Coefficient of Mutual inductance (M), self induced e.m.f. and mutually induced e.m.f, Coefficient of Coupling. 5.4 Inductance in series 5.5 Types of inductor, their application and Energy Stored in Magnetic Field	Chalk-Board Model Demonstration Video Demonstrations 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 *Draw layout of Electrical Engineering laboratory.	1	Preparation of Layout of Electrical Engineering Laboratory.	2	CO1
LLO 2.1 *Operate the fire extinguishers and prepare charts of the safety rules to be followed in the electrical lab	2	Operation of fire extinguisher and preparation of safety rules charts	2	CO1
LLO 3.1 *Use relevant electric tools for various applications	3	Check lab supply system and make use of relevant electric tools for various applications.	2	CO1

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Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 4.1 *Verify Ohm's Law	4	Verification of Ohm's Law	2	CO1 CO2
LLO 5.1 *Able to connect and read multi range analog meters (Ammeter, Voltmeter)	5	Read analog meters for measurement of various electrical quantities in AC/DC circuits.	2	CO1
LLO 6.1 *Operate Multimeter and Clip-On meter for the measurement of AC/DC Current, Voltage and Resistance in the given circuit.	6	Use of Multimeter and Clip-On meter for the measurement of AC/DC Current, Voltage and Resistance in the given circuit	2	CO1 CO2
LLO 7.1 *Check frequency, Time period, Peak Value and Average Value of the given A.C. wave on CRO	7	Measurement of frequency, Time period, Peak Value and Average Value of the given A.C. wave on CRO.	2	CO1 CO2
LLO 8.1 *Verify Kirchoff's Voltage Law	8	Verification of Kirchoff's Voltage Law	2	CO1
LLO 9.1 *Verification of Kirchoff's Current Law.	9	Verification of Kirchoff's Current Voltage Law	2	CO1 CO2
LLO 10.1 **Use rheostat as current regulator and potential divider.	10	Use of rheostat as current regulator and potential divider	2	CO1 CO2
LLO 11.1 *Determine PD,EMF and internal resistance of DC source .	11	Determination of PD,EMF and internal resistance of DC source .	2	CO1 CO2
LLO 12.1 *Verify the properties of circuit of series connected resistance.	12	Verification of parameters of two/three resistances connected in series connection.	2	CO1 CO2
LLO 13.1 *Verify the properties of circuit of parallel connected resistance.	13	Verification of parameters of two/three resistances connected in parallel connection.	2	CO1 CO2
LLO 14.1 Determine the time constant (RC) by plotting the charging curves of a capacitor(C) through resistor (R)	14	Plot the charging characteristics of capacitor and find the time constant (RC).	2	CO1 CO3
LLO 15.1 Determine the time constant (RC) by plotting the discharging curves of a capacitor(C) through resistor (R)	15	Plot the discharging characteristics of capacitor and find the time constant (RC).	2	CO1 CO3
LLO 16.1 * Find the equivalent capacitance in the series connected circuits	16	Verification of the equivalent capacitance in series connected circuits	2	CO1 CO3
LLO 17.1 *Find equivalent capacitance of the parallel connected circuits	17	Verification of equivalent capacitance of the parallel connected circuits	2	CO1 CO3
LLO 18.1 Determine the Rise characteristics of Electric current in a circuit consisting of resistance and inductance in the circuit.	18	Plot the Rise characteristics of Electric current in a circuit consisting of resistance and inductance in the circuit.	2	CO1 CO4
LLO 19.1 Determine the Decay characteristics of Electric current in a circuit consisting of resistance and inductance in the circuit.	19	Plot the decay characteristics of Electric current in a circuit consisting of resistance and inductance in the circuit.	2	CO1 CO4
LLO 20.1 *Find B-H curve for the given magnetic material	20	Plot B-H curve for the given magnetic material.	2	CO4
LLO 21.1 *Obtain magnetization curve for magnetic material	21	Plot magnetization curve for magnetic core	2	CO4
LLO 22.1 *Plot Hysteresis Loop for the given transformer coil	22	Study of Hysterisis loop for the given transformer coil	2	CO4

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Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 23.1 *Verify Faraday's Law of Electromagnetic Induction (Statically Induced EMF)	23	Verification of Faraday's Law of Electromagnetic Induction (Statically Induced EMF)	2	CO4 CO5
LLO 24.1 *Verify Faraday's Law of Electromagnetic Induction (Dynamically Induced EMF)	24	Verification of Faraday's Law of Electromagnetic Induction (Dynamically Induced EMF)	2	CO4 CO5
LLO 25.1 Verify Fleming's Right Hand Rule	25	Verification of Fleming's Right Hand Rule	2	CO4 CO5
LLO 26.1 Verify Fleming's Left Hand Rule	26	Verification of Fleming's Left Hand Rule	2	CO4 CO5
LLO 27.1 *Determine Charging and discharging Curves of Battery.	27	Plot the Charging and discharging Curves of Battery	2	CO1 CO3

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

- a.Types of Electrical equipment: Prepare chart showing real-life examples indicating various types of electrical equipment.
- b. Resistance: Collect samples of resistors and prepare models of simple series circuit and parallel circuit.
- c. Capacitance: Collect samples of capacitors and prepare models of simple series circuit and parallel circuit.
- d. Inductance: Collect samples of inductors and prepare models of simple series circuit and parallel circuit.
- e. Batteries : Collect samples and specifications of various batteries of different make and prepare chart of the same.
- f. EV-Batteries : Collect samples and specifications of various EV-batteries of different make and prepare chart of the same.
- g. Connect battery in series connection and measure voltage across each battery and total voltage .
- h. Connect battery in parallel connection and measure voltage across each battery and total voltage

Assignment

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

Suggested Student Activity

- a. Illustrate situations wherein electrical energy is required.
- b. Prepare models in the form of mini-projects.
- c. Prepare power point presentation related to basics of electrical engineering.

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d. Prepare a chart of electric circuit elements and relevant industrial application.

e. Prepare question bank referring old MSBTE question papers.

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

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Rheostat (0-90 Ohm,5A), Nichrome wire wound rheostat on epoxy resin or class F insulating tube with two fixed and one sliding contact, DC Source, Milliameter	4
2	Lugs, Wire crimping tool, Soldering Gun, Banana clips	5
3	1.CRO with probe,10Hz-30MHz,01No 2.Rheostat of suitable rating 3. Autotransformer of suitable rating	7
4	1.EMF source: Ampere=0-1A ,Voltage=0-20V ,1 No. 2 Voltmeter: Suitable Voltage range,2 No. 3 Ammeter: Suitable current range,1 No 4 Series resistance: Suitable resistance in ohm,2 No.	12
5	1.EMF source: Ampere:0-1A ,Voltage:0-20V ,1 No. 2 Voltmeter: Suitable Voltage range,2 No. 3 Ammeter: Suitable current range,1 No. 4 Parallel resistance: Suitable resistance in ohm,2 No.	13
6	1.EMF source: Ampere=0-1uA,Voltage=0-20V,1 No. 2.Voltmeter: Suitable voltage,1 No. 3. Ammeter: Suitable current,1 No. 4.Capacitors: Suitable capacitor,1 No. 5.Resistance: Suitable resistance ,1 No. 6.Stop watch: Suitable stop watch 1 No.	14
7	1.EMF source: Ampere=0-1uA,Voltage=0-20V,1 No. 2.Voltmeter: Suitable voltage,1 No. 3. Ammeter: Suitable current,1 No. 4.Capacitors: Suitable capacitor,1 No. 5.Resistance: Suitable resistance ,1 No. 6.Stop watch: Suitable stop watch 1 No.	15
8	1.EMF source: Ampere=0-1A, Voltage=0-20V :1 No. 2.Voltmeter : Suitable Voltage,1 No. 3.Ammeter :Suitable Current,1 No. 4.Capacitor:Suitable Capacitor in Farad ,3 No.	16
9	1.EMF source: Ampere=0-1A, Voltage=0-20V :1 No. 2.Voltmeter : Suitable Voltage,1 No. 3.Ammeter :Suitable Current,1 No. 4.Capacitor:Suitable Capacitor in Farad ,3 No.	17
10	1.EMF source : Ampere:0-1A,Voltage:0-300V ,1 No. 2.Voltmeter : Suitable voltage,1 No. 3.Ammeter: Suitable current,1 No. 4.Inductive coil :Suitable Inductor 1 No.	23

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Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
11	1.EMF source: Ampere=0-1A,Voltage:0-300V ,1 No. 2.Voltmeter:Suitable Voltage,1 No. 3.Ammeter :Suitable current,1 No. 4.Inductive coil: Suitable inductor,1 No.	24
12	1.DC motor: Suitable motor:1No	26
13	1.EMF source: Ampere: 0-1A,Voltage:0-300V ,1 No. 2. Voltmeter: Suitable voltage:1 No. 3.Ammeter: Suitable current: 1 No. 4.Inductive coil: Suitable inductor,1 No.	21
14	1.EMF source: Ampere: 0-1A,Voltage:0-300V ,1 No. 2. Voltmeter: Suitable voltage:1 No. 3.Ammeter: Suitable current: 1 No. 4.Inductive coil: Suitable inductor,1 No.	20
15	1:EMF source: Ampere: 0-1A,Voltage:0-300V ,1 No. 2:Voltmeter:Suitable Voltage,1 No. 3:Ammeter: Suitable current,1 No. 4.Transformer :(0.5/1kVA)Suitable transformer,1 No.	22
16	Fire Extinguisher Kit	2
17	Electrical Drawing of the Laboratory	1
18	1.EMF source: Ampere:0-1A,Voltage:0-20V ,1 No. 2.Voltmeter Suitable voltage1 No. 3.Ammeter: Suitable current1 No. 4.Rheostat : Suitable load in ohm,1 No. 5. Resistive Load,1No	10
19	1.DC Generator: Suitable rating,1No	25
20	Stripper, Hammer, Plier, Nose Plier, Multi-meter, tester ,Tachometer, Megger,Standard Wire Gauge crimping tool, wire gauge etc	3
21	Multi-meter, Clip -On Meter, Ammeter ,Voltmeter, Rheostat,etc	6
22	1.Battery or D.C. Supply: Suitable Range 2. Single Pole Two Way Switch 3. Multi-meter 4. Stopwatch 5.A Choke Coil or a resistor in series with inductor	18
23	1.Battery or D.C. Supply: Suitable Range 2. Single Pole Two Way Switch 3. Multi-meter 4. Stopwatch 5.A Choke Coil or a resistor in series with inductor	19
24	1. D.C. Dual Power Supply, 1No 2.D.C. Voltmeter of Suitable Range,3No 3. Rheostat of Suitable Range,3No	8
25	1.Rheostat of suitable range, 3 No 2.D.C. Dual Power Supply ,suitable range,1 No 3.D.C. milli-Ammeter, suitable range,3 No	9

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Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
26	1.EMF source: Ampere=0-1uA,Voltage=0-20V,1 No. 2.Voltmeter: Suitable voltage,1 No. 3. Ammeter: Suitable current,1 No. 4.Capacitors: Suitable capacitor,1 No. 5.Resistance: Suitable resistance ,1 No. 6.Stop watch: Suitable stop watch 1 No. 7. Suitable EV-Battery Data	27

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	Basic Electrical Parameters	CO1	10	2	6	4	12
2	II	D.C. Circuits	CO2	12	4	6	4	14
3	III	Capacitors and Battery	CO3	12	4	6	4	14
4	IV	Magnetic Circuits	CO4	12	4	4	6	14
5	V	Electromagnetic Induction	CO5	14	4	4	8	16
		Grand Total		**60**	**18**	**26**	**26**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Two unit tests of 30 marks will be conducted and average of two unit tests considered.
- For formative assessment of laboratory learning 25 marks.
- Each practical will be assessed considering appropriate % weightage to process and product and other instructions of assessment.

Summative Assessment (Assessment of Learning)

- End semester summative assessment of 25 marks for laboratory learning.
- End semester assessment of 70 marks through offline mode of 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	-	-	2			
CO2	3	1	1	1	1	-	2			
CO3	3	1	1	2	2	-	2			

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FUNDAMENTAL OF ELECTRICAL ENGINEERING　　　　　　　**Course Code : 312310**

CO4	3	1	1	2	2	-	2		
CO5	3	1	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	Theraja, B. L. Theraja, A. K.	A Text Book of Electrical Technology Vol-I	S.Chand and Co. New Delhi 2014 ISBN: 9788121924405
2	Mittle, V. N.	Basic Electrical Engg.	Tata McGraw-Hill, New Delhi ISBN : 978-0-07-0088572-5
3	Hughes, Edward	Electrical Technology	Pearson Education, New Delhi ISBN-13: 978-0582405196
4	S. B. Lal Seksena and Kaustuv Dasgupta	Fundamentals of Electrical Engineering Part-1	Cambridge University Press, New Delhi ISBN : 9781107464353
5	Jegathesan V., Vinoth Kumar K., Saravanakumar R.	Basic Electrical and Electronics Engineering	Wiley India, New Delhi 2014 ISBN : 97881236529513
6	Husain Ashfaq	Fundamentals of Electrical Engineering	Dhanpat Rai & Co. (p) Ltd-delhi, ISBN: 978-8177000436

XIII .　LEARNING WEBSITES & PORTALS

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

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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 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/ 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/ EP/ ET/ EX/ FC/ HA/ IC/ IE/ IF/ IH/ IS/ IX/ IZ/ LE/ ME/ MK/ ML/ MU/ PG/ PN/ PO/ SC/ 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. 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
• Communicate effectively at workplace.

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 & 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 enquiry letter, complaint letter , Job application with resume / CV, Compose effective E mails .
- CO5 - Write Industrial reports.

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		
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.

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 & Complete) 1.3 Types –Verbal (Oral-Written),Formal, Informal (Grapevine), Vertical 1.4 Barriers to communication 1.5 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 TLO 3.3 Draft a circular for a particular information/ event	**Unit - III Office Drafting** 3.1 Format of Notice 3.2 Drafting Agenda 3.3 Preparing Minutes of meeting 3.4 Format of Circular	white board Language Lab Reference books Classroom learning
4	TLO 4.1 Compose cover letter and CV / Resume for jobs TLO 4.2 Apply E mail Etiquettes for professional purposes TLO 4.3 Compose 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/ progress reports	**Unit - V Report Writing** 5.1 Introduction to report writing 5.2 Accident Report 5.3 Investigation Report 5.4 Progress Report	Chalk and talk Language Lab Collaborative learning Classroom learning

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

PROFESSIONAL COMMUNICATION

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 & 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	Job Application with Resume / CV	2	CO4
LLO 9.1 * Write Four (formal) E-mails using ethics and etiquette.	9	E- Mail writing	2	CO4
LLO 10.1 * Write a detailed report on Accident/ Progress/ 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 psychological barriers and suggest remedies to overcome the barriers	13	Psychological barriers to Communication	2	CO1
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	Job Application , Resume / CV & Interview	2	CO4

Note : out of above suggestive LLOs -

- Minimum 12 for 2 LL Hrs./Week or 24 for 4 LL hrs./Week are to be Performed.
- '*' Marked Practicals (LLOs) Are mandatory
- Judicial mix of LLOs are to be performed to complete minimum requirement of 12 / 24 as applicable

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

Note :
      Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than 15 (fifteen) student engagement hours during the course. In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

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

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

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

Sr.No	Link / Portal	Description
4	http://www.makeuseof.com	Dale Carnegie's free resources

Semester - 2, K Scheme

SOCIAL AND LIFE SKILLS   Course Code : 312003

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 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/ 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/ EP/ ET/ EX/ FC/ HA/ HM/ IC/ IE/ IF/ IH/ IS/ IX/ IZ/ LE/ ME/ MK/ ML/ MU/ PG/ PN/ PO/ SC/ TC/ TE/ TR/ TX**
Semester	**: Second**
Course Title	**: SOCIAL AND LIFE SKILLS**
Course Code	**: 312003**

I. RATIONALE

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

III. COURSE LEVEL LEARNING OUTCOMES (COS)

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Semester - 2, K Scheme

SOCIAL AND LIFE SKILLS   Course Code : 312003

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	-	-	1	1	2	1		-	-	-	-	25	10	-	-	25	10	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.

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

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

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED : NOT APPLICABLE

Semester - 2, K Scheme

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

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

X. ASSESSMENT METHODOLOGIES/TOOLS : NOT APPLICABLE

XI. SUGGESTED COS - POS MATRIX FORM : NOT APPLICABLE

XII. SUGGESTED LEARNING MATERIALS BOOKS : NOT APPLICABLE

XIII . LEARNING WEBSITES & PORTALS : NOT APPLICABLE

Semester - 2, K Scheme

BASIC MECHANICAL ENGINEERING   Course Code : 312006

Programme Name/s	: **Electrical Engineering/ Electrical Power System**
Programme Code	: **EE/ EP**
Semester	: **Second**
Course Title	: **BASIC MECHANICAL ENGINEERING**
Course Code	: **312006**

I. RATIONALE

Electrical power supply system is needed for operating various mechanical equipment. Electrical engineer has to take care of installation and maintenance of mechanical systems like refrigeration and air conditioning, portable generators, industrial material handling system and power generation plants. This course will help to understand various mechanical systems for identifying different mechanical faults.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Interpret various mechanical faults in industrial mechanical systems.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Find faults in Thermal Power Plant using acquired knowledge and skills in a given situation.
- CO2 - Diagnose faults of Material handling system using acquired knowledge and skills.
- CO3 - Identify faults of Hydraulic turbines and Hydraulic pumps in a given situation.
- CO4 - Diagnose faults of given Air compressor and Refrigeration system using acquired knowledge and skills.

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	
312006	BASIC MECHANICAL ENGINEERING	BME	SEC	2	-	2	-	4	2	-	-	-	-	-	50	20	50@	20	-	-	100

BASIC MECHANICAL ENGINEERING   **Course Code : 312006**

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 List components of steam boilers and turbines TLO 1.2 Explain working of portable generator TLO 1.3 Identify different faults in different power plant equipment	**Unit - I Power plants equipment** 1.1 Layout of Thermal Power Plant, Major thermal power plants in India 1.2 Introduction to steam boilers- Babcock-Wilcox boilers, Lamont and Loeffler boilers 1.3 Introduction to steam Turbines- Impulse and reaction turbine 1.4 Layout of Portable Generator, Manufacturers and specifications of portable generator 1.5 Introduction to portable generators: I.C engine 1.6 Mechanical parameters measurement-Introduction to •Pressure measurement: Bourdon tube pressure gauge •Temperature measurement: Optical pyrometer, Thermocouple •Heat measurement: Calorimeter •Speed measurement of rotating elements: Tachometer, Stroboscope 1.7 Preliminary mechanical faults occurred in steam boilers and turbines	Demonstrate various models/Charts of boilers and turbines .

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BASIC MECHANICAL ENGINEERING   Course Code : 312006

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.
2	TLO 2.1 Use of mechanical components in simple Machines/ equipment TLO 2.2 Select appropriate material handling system. TLO 2.3 Identify faults in Industrial Material handling systems	**Unit - II Industrial Material handling systems and components** 2.1 Mechanical components for motion and power transmission: Types and uses of • Gears • Belt drives • Chain drives • Bearings • Couplings 2.2 Introduction to material handling systems: Manufacturers, specifications, construction and working of • Material transfer lifts, • Conveyors, • Overhead cranes 2.3 Preliminary mechanical faults occurred in Industrial Material handling systems	Demonstration of various mechanical components using charts and models
3	TLO 3.1 List different components of hydraulic turbines and Pumps. TLO 3.2 Explain working of hydraulic pumps. TLO 3.3 Identify faults in hydraulic equipment	**Unit - III Hydraulic pumps, turbines, and equipment** 3.1 Layout of Hydraulic Power Plant, Major hydraulic power plants in India 3.2 Introduction to hydraulic turbines: construction and working of Pelton wheel, Francis turbine, Kaplan turbine 3.3 Introduction to hydraulic pumps: construction and working centrifugal pump, reciprocation pump and submersible pump 3.4 Preliminary mechanical faults occurred in Centrifugal, reciprocating, and submersible pumps	Demonstrate working of Hydraulic power plant /Pumps using Chart/models
4	TLO 4.1 Explain working of air compressor. TLO 4.2 List different components of refrigerator and air conditioner. TLO 4.3 Explain working of refrigerator and air conditioner. TLO 4.4 Identify faults in Refrigeration and air conditioning equipment system	**Unit - IV Compressor, Refrigeration and Air conditioning equipment** 4.1 Introduction to Compressor- Manufacturers, Specifications, construction and working of reciprocating compressor, screw compressor 4.2 Introduction to Refrigeration and Air conditioning : Vapour compression cycle, Construction and working of simple domestic refrigerator and window air conditioner, Manufacturers and specification 4.3 Preliminary mechanical faults occurred in reciprocating compressor and Refrigeration and air conditioning equipment	Demonstrate air compressor, Refrigeration system and air conditioning system using charts.

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

BASIC MECHANICAL ENGINEERING   Course Code : 312006

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Identify different components of Thermal Power Plants	1	*Identify steam boilers using models and charts	2	CO1
LLO 2.1 Observe working of Steam turbine	2	*Demonstrate working of steam turbine	2	CO1
LLO 3.1 Use temperature measuring devices	3	*Measure temperature of different equipment using temperature measuring devices.	2	CO1
LLO 4.1 Use pressure measuring devices	4	*Measure pressure of different equipment using pressure measuring devices	2	CO1
LLO 5.1 Use speed measuring devices	5	Measure speed of different rotating elements using sped measuring devices.	2	CO1
LLO 6.1 Use heat measuring devices	6	Measure heat of given fluid using calorimeter	2	CO1
LLO 7.1 Observe working of portable generator	7	Demonstrate working of portable generator	2	CO1
LLO 8.1 Select different drive system for given application with justification	8	*Identify drive system using models/ actual set up.	2	CO2
LLO 9.1 Calculate velocity ratio of given mechanical system	9	*Calculate Velocity Ratio of given gear/belt drive of suitable mechanical system.	2	CO2
LLO 10.1 Identify different components of material handling system used in Industry	10	Demonstrate working of lift / conveyor used in Industry.	2	CO2
LLO 11.1 Observe working of material handling system used in Industry	11	Demonstrate working of Overhead Crane used in Industry	2	CO2
LLO 12.1 Observe working of Hydraulic power plant.	12	*Demonstrate Working of Hydraulic Power plant using pelton wheel turbine set up or suitable turbine models /set up	2	CO3
LLO 13.1 Use of centrifugal pump for given application	13	*Identify different components of Centrifugal Pump.	2	CO3
LLO 14.1 Use of reciprocating pump for given application	14	Identify different components of Reciprocating Pump	2	CO3
LLO 15.1 Use pressure and temperature measuring devices	15	*Measure pressure, Temperature at different points of Air Compressor.	2	CO4
LLO 16.1 Calculate velocity ratio of given air compressor	16	*Calculate Speed ratio of Belt Drive used in air compressor and Driven Motor.	2	CO2 CO4
LLO 17.1 Identify different components of household refrigerator	17	*Demonstrate working of household refrigerator for identifying different components and type.	2	CO4
LLO 18.1 Identify different components of window air conditioner	18	Demonstrate working of window air conditioner for identifying different components	2	CO4
LLO 19.1 Collect information related to water lifting systems in ancient India.(IKS)	19	*Collect information of water lifting systems in ancient India relation with Hydraulic pumps (IKS)	2	CO1 CO2 CO3 CO4

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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)

NA

- NA

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Model of Babcock Wilcox Boiler	1
2	Model of Lamont Boiler	1
3	Model of Loeffler Boiler	1
4	Charts of Thermal power Plant, Steam Boilers, Steam turbines	2
5	Mercury/Alcohol Thermometers (Range 0 to 150 °C)	3,15
6	Optical Thermometer/Pyrometer (Range 30 to 400 °C)	3,15
7	Bourdon Tube Pressure Gauge (Range 0 to 15 bar)	4,15
8	Portable generator with load bank minimum capacity 2.2 kVA	7
9	Tube in Tube type water calorimeter with temperature measuring devices	6
10	Digital Tachometer (Max. speed 10000 rpm)	5,16
11	Stroboscope (Max. speed 10000 rpm)	5,16
12	Models of Different gears- Spur, Helical, Bevel, Worm and worm, Rack and Pinion	8,9
13	Models of Belt drive- Open and Cross Flat Belt, V belt	8,9
14	Models of Chain Drive- Sprockets and chain	8,9
15	Deep groove Ball bearings – Single row, self-aligned, Roller	8,9
16	Working model of Belt and Pulley for determining speed ratio	8,9
17	Working model of Gear train for determining speed ratio	8,9
18	Pelton wheel turbine set up or working models of turbines	13
19	Centrifugal pump -minimum up to single phase 0.5 HP/Reciprocating pump- minimum up to 1 HP	14
20	Household refrigerator- minimum up to 165 liter	17
21	Air Compressor- Multistage reciprocating, pressure up to 12 bar, Motor- 1 HP	15,16
22	Window air conditioner capacity minimum1.5 TR	18

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	Power plants equipment	CO1	8	0	0	0	0

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Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
2	II	Industrial Material handling systems and components	CO2	8	0	0	0	0
3	III	Hydraulic pumps, turbines, and equipment	CO3	7	0	0	0	0
4	IV	Compressor, Refrigeration and Air conditioning equipment	CO4	7	0	0	0	0
		Grand Total		**30**	**0**	**0**	**0**	**0**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Term work
- "Each practical will be assessed considering 60% weightage to process 40% weightage to product" & other instructions of Assessment.

Summative Assessment (Assessment of Learning)

- Practical
- "Each practical will be assessed considering 60% weightage to process 40% weightage to product" & other instructions of Assessment.

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	-	-	2			
CO2	2	-	-	2	-	-	2			
CO3	2	-	-	2	-	-	2			
CO4	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	P.K.Nag	Power Plant Engineering	McGraw Hill Education ,ISBN: 978-9339204044
2	R.K. Rajput	Power Plant Engineering	Tata-McGraw Hill Education. ISBN : 9788131802557

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Sr.No	Author	Title	Publisher with ISBN Number
3	K. Subramanya	Hydraulic Machines	McGraw Hill Education (India) Private, ISBN, 1259006840, 9781259006845
4	S.S.Rattan	Theory of Machines	Tata-McGraw Hill Education. ISBN, 1283187124, 9781283187121
5	C. P. Arora	Refrigeration and Air conditioning	Tata-McGraw Hill Education ISBN-13: 978-0-07-008390-5
6	Mahadevan B., Bhat Vinayak Rajat, Nagendra Pavana R.N.	Introduction to Indian Knowledge System(IKS) : concepts and Applications	PHI Learning Pvt. Ltd., ISBN -2022,9391818218, 9789391818210
7	Siddhartha Ray	Introduction to Materials Handling	New Age International Private Limited; ISBN-9788122440072

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.youtube.com/watch?v=IdPTuwKEfmA	Steam Power Plant working animation
2	https://www.youtube.com/watch?v=fk3DjD9gSsk	Principle and working of Steam boiler animation
3	https://www.youtube.com/watch?v=dVBoZ4PfZmE	Working of Steam boiler animation
4	https://www.youtube.com/watch?v=SPg7hOxFItI	Working of Steam turbine animation
5	https://www.youtube.com/watch?v=N70vbRbF36A	Mechanical Drive System
6	https://www.youtube.com/watch?v=hhE_2oVIZiI	Manual Material Handling system
7	https://www.youtube.com/watch?v=o_C2XISZ3Uc	Belt conveyor animation
8	https://www.youtube.com/watch?v=-hooifWJ1jY	Hydraulic Power Plant animation
9	https://www.youtube.com/watch?v=BaEHVpKc-1Q	Principle of Centrifugal Pump
10	https://www.youtube.com/watch?v=XpcCUtYzwy0	Centrifugal Pump working animation
11	https://www.youtube.com/watch?v=41vb6T42_Tk	Reciprocating Pump - Construction and working
12	https://www.youtube.com/watch?v=3BCiFeykRzo&t=155s	Water turbine (Francis)
13	https://www.youtube.com/watch?v=7NwxMyqUyJw	Refrigerator system working animation
14	https://www.youtube.com/watch?v=FzydmAmZM54	Window Air Conditioner working animation
15	https://www.youtube.com/watch?v=PjcdqAkP0UA	Vapour compression system construction and working
16	https://www.youtube.com/watch?v=_qyF1yolDgY	Problems & Remedies of Centrifugal Pump
17	https://www.youtube.com/watch?v=k0NOLbZXSNc	Refrigeration - System Troubleshooting
18	https://www.indiawaterportal.org/articles/persian-wheel-wate r-lifting-device-kolar-karnataka	Information on Persian wheel : The water lifting device in Kolar, Karnataka (IKS)
19	https://www.youtube.com/watch?v=eCNpJ-_iksQ&t=5s	Persian wheel : The water lifting device in Kolar, Karnataka (IKS)
20	https://rezavisblastfromthepast.co.in/2018/04/30/the-early-w aterlifting-devices-dhenkli-or-shaduf-and-the-araghatta-nori a/	The early waterlifting devices: Dhenkli or shaduf and the araghatta (Noria) (IKS)