SYLLABUS

DIPLOMA IN ELECTRICAL ENGINEERING

(DAY COURSES)

w.e.f. - 2025

UNIVERSITY POLYTECHNIC
FACULTY OF ENGINEERING & TECHNOLOGY
JAMIA MILLIA ISLAMIA, NEW DELHI - 110025

CONTENTS

Programme Educational Objectives (PEOs):

PEO1	Equip students with foundational knowledge in electrical engineering principles and practices, allowing them to solve real-world electrical problems effectively.
PEO2	Develop the ability to apply theoretical knowledge to practical electrical engineering tasks, including the design, analysis, and maintenance of electrical systems.
PEO3	Prepare students for the workforce by imparting the necessary technical, practical, and interpersonal skills to meet the demands of the electrical engineering industry.
PEO4	Foster a culture of innovation and continuous learning, enabling students to adapt to evolving technological advancements and industry trends in electrical engineering.
PEO5	Promote awareness of sustainable practices and ethical responsibility in the design, implementation, and maintenance of electrical systems, with an emphasis on minimizing environmental impact.

Programme Outcomes (POs):

PO1	Apply knowledge of mathematics, science, and engineering fundamentals to the solution of complex electrical engineering problems.
PO2	Identify, formulate, and analyze engineering problems related to electrical systems and equipment, using appropriate techniques and tools.
PO3	Design electrical systems, components, or processes that meet specific needs, considering safety, environmental, and societal concerns.
PO4	Use modern tools and software effectively for analysis, design, and simulation of electrical systems while understanding the limitations of these tools.
PO5	Communicate effectively in both written and verbal formats and work effectively in teams to solve electrical engineering problems, demonstrating leadership and collaboration skills.

STRUCTURE OF DIPLOMA IN ELECTRICAL ENGINEERING PROGRAM

S. No.	Category of Courses	Category Code of Courses	Breakup of Credits
1.	Humanities & Social Science Courses	HS	8
2.	Basic Science Courses	BS	14
3.	Engineering Science Courses	ES	21
4.	Program Core Courses (Branch specific)	PC	41
5.	Program Elective Courses (Branch specific)	PE	19
6.	Open Elective Courses (from other technical and/or emerging subjects)	OE	6
7.	Project	PR	11
	Seminar	SE	
	Summer Internship (in industry or elsewhere)	SI	
8.	Audit Courses	AU	Nil
		Total	**120**

EVALUATION SCHEME FOR THREE YEAR DIPLOMA COURSE IN ELECTRICAL ENGINEERING (DAY COURSES) - I YEAR

First Semester

S. No.	Code No	Subject	Course Type	Periods/Week			Credits	Distribution of Marks		
				L	T	P		IA	UE	Total
Theory Courses										
1.	CEES101	Engineering Mechanics	ES	2	1	0	3	60	90	150
2.	EEBS102	Applied Chemistry	BS	2	1	0	3	60	90	150
3.	MEES103	Fundamentals of Mechanical Engineering	ES	2	1	0	3	60	90	150
4.	EEES104	Fundamentals of Electrical Engineering	ES	2	0	0	2	40	60	100
5.	EEBS105	Applied Mathematics-I	BS	2	1	0	3	60	90	150
Practical Courses										
1.	CEES111	Engineering Mechanics Lab	ES	0	0	2	1	30	20	50
2.	EEBS112	Applied Chemistry Lab	BS	0	0	2	1	30	20	50
3.	EEES114	Fundamentals of Electrical Engineering Lab	ES	0	0	2	1	30	20	50
4.	MEES116	Engineering Workshop Practice	ES	0	0	4	2	60	40	100
5.	EEHS117	Sports and Yoga	HS	0	0	2	1	30	20	50
Total							**20**	**460**	**540**	**1000**

HS: Humanities & Social Science Courses
BS: Basic Science Courses
ES: Engineering Science Courses

EVALUATION SCHEME FOR THREE YEAR DIPLOMA COURSE IN ELECTRICAL ENGINEERING (DAY COURSES) - I YEAR

Second Semester

S. No.	Code No	Subject	Course Type	Periods/Week			Credits	Distribution of Marks		
				L	T	P		IA	UE	Total
Theory Courses										
1.	EEHS201	Communication Skills	HS	2	1	0	3	60	90	150
2.	EEBS202	Applied Physics	BS	2	1	0	3	60	90	150
3.	COES203	IT Systems and Computer Programming	ES	2	0	0	2	40	60	100
4.	ECES204	Fundamentals of Electronics Engineering	ES	2	0	0	2	40	60	100
5.	EEBS205	Applied Mathematics-II	BS	2	1	0	3	60	90	150
Practical Courses										
1.	EEHS211	Communication Skills Lab	HS	0	0	2	1	30	20	50
2.	EEBS212	Applied Physics Lab	BS	0	0	2	1	30	20	50
3.	COES213	IT Systems and Computer Programming Lab	ES	0	0	4	2	60	40	100
4.	ECES214	Fundamentals of Electronics Engineering Lab	ES	0	0	2	1	30	20	50
5.	MEES216	Engineering Graphics	ES	0	0	4	2	60	40	100
Audit Courses										
1.	EEAU200	Environmental Science	AU	2	0	0	0			
						Total	**20**	**470**	**530**	**1000**

HS: Humanities & Social Science Courses
BS: Basic Science Courses
ES: Engineering Science Courses
AU: Audit Courses
Note: Summer Internship-I of 4 weeks after 2nd semester

EVALUATION SCHEME FOR THREE YEAR DIPLOMA COURSE IN ELECTRICAL ENGINEERING (DAY COURSES) - II YEAR

Third Semester

S. No.	Code No	Subject	Course Type	Periods/Week			Credits	Distribution of Marks		
				L	T	P		IA	UE	Total
Theory Courses										
1.	EEPC301	Electrical Measurements and Measuring Instruments	PC	2	1	0	3	60	90	150
2.	ECPC302	Digital Electronics and Microprocessors	PC	2	1	0	3	60	90	150
3.	EEPC303	Electrical Circuits and Analysis	PC	2	1	0	3	60	90	150
4.	EEPC304	Electric Power Transmission and Distribution	PC	2	1	0	3	60	90	150
5.	EEPC307	Generation of Electrical Energy	PC	2	0	0	2	40	60	100
Practical Courses										
1.	EEPC311	Electrical Measurements and Measuring Instruments Lab	PC	0	0	2	1	30	20	50
2.	ECPC312	Digital Electronics and Microprocessors Lab	PC	0	0	2	1	30	20	50
3.	EEPC313	Electrical Circuits and Analysis Lab	PC	0	0	2	1	30	20	50
4.	EEPC314	Electric Power Transmission and Distribution Lab	PC	0	0	2	1	30	20	50
5.	EESI316	Summer Internship-I	SI	0	0	0	2	100		100
						Total	**20**	**500**	**500**	**1000**

PC: Program Core Courses
SI: Summer Internship Courses

EVALUATION SCHEME FOR THREE YEAR DIPLOMA COURSE IN ELECTRICAL ENGINEERING (DAY COURSES) - II YEAR

Fourth Semester

S. No.	Code No	Subject	Course Type	Periods/Week			Credits	Distribution of Marks		
				L	T	P		IA	UE	Total
Theory Courses										
1.	EEPC401	Electrical Machines-I	PC	2	1	0	3	60	90	150
2.	EEPC402	Power Electronics	PC	2	1	0	3	60	90	150
3.	EEPE403	Switchgear and Protection	PE	2	1	0	3	60	90	150
4.	EEPE404	Electrical Instrumentation	PE	2	1	0	3	60	90	150
5.	EEPC405	Building Electrification	PC	2	0	0	2	40	60	100
Practical Courses										
1.	EEPC411	Electrical Machines-I Lab	PC	0	0	2	1	30	20	50
2.	EEPC412	Power Electronics Lab	PC	0	0	2	1	30	20	50
3.	EEPE413	Switchgear and Protection Lab	PE	0	0	2	1	30	20	50
4.	EEPE414	Electrical Instrumentation Lab	PE	0	0	2	1	30	20	50
5.	EEPR416	Minor Project	PR	0	0	4	2	60	40	100
Audit Courses										
1.	EEAU400	Essence of Indian Knowledge and Tradition	AU	2	0	0	0			
						Total	**20**	**460**	**540**	**1000**

PC: Program Core Courses
PE: Program Elective Courses
PR: Project Courses
AU: Audit Courses
Note: Summer Internship-II of 4 weeks after 4th semester

EVALUATION SCHEME FOR THREE YEAR DIPLOMA COURSE IN ELECTRICAL ENGINEERING (DAY COURSES) - III YEAR

Fifth Semester

S. No.	Code No	Subject	Course Type	Periods/Week			Credits	Distribution of Marks		
				L	T	P		IA	UE	Total
Theory Courses										
1.	EEPC501	Electrical Machines –II	PC	2	1	0	3	60	90	150
2.	EEPC502	Electrical Testing and Commissioning	PC	2	1	0	3	60	90	150
3.	EEPE503	Control System Engineering	PE	2	1	0	3	60	90	150
4.	EEPE504	Utilization and Traction	PE	2	0	0	2	40	60	100
5.	EEOE505	Renewable Energy Technologies	OE	2	1	0	3	60	90	150
Practical Courses										
1.	EEPC511	Electrical Machines –II Lab	PC	0	0	2	1	30	20	50
2.	EEPC512	Electrical Testing and Commissioning Lab	PC	0	0	2	1	30	20	50
3.	EEPE513	Control System Engineering Lab	PE	0	0	2	1	30	20	50
4.	EESI516	Summer Internship-II	SI	0	0	2	2	60	40	100
5.	EEPR517	Major Project-I	PR	0	0	2	1	50		50
						Total	**20**	**480**	**520**	**1000**

PC: Program Core Courses
PE: Program Elective Courses
OE: Open Elective Courses
SI: Summer Internship Courses
PR: Project Courses

EVALUATION SCHEME FOR THREE YEAR DIPLOMA COURSE IN ELECTRICAL ENGINEERING (DAY COURSES) - III YEAR

Sixth Semester

S. No.	Code No	Subject	Course Type	Periods/Week			Credits	Distribution of Marks		
				L	T	P		IA	UE	Total
Theory Courses										
1.	EEPC601	Electrical Energy Management	PC	2	1	0	3	60	90	150
2.	EEPE602	Electric Vehicles	PE	2	1	0	3	60	90	150
3.	EEHS603	Entrepreneurship & Start-ups	HS	2	1	0	3	60	90	150
4.	COOE605	Artificial Intelligence	OE	2	1	0	3	60	90	150
Practical Courses										
1.	EEPC611	Electrical Workshop Lab	PC	0	0	4	2	60	40	100
2.	EEPE612	Electric Vehicles Lab	PE	0	0	4	2	60	40	100
3.	EESE616	Seminar	SE	0	0	2	1	50		50
4.	EEPR617	Major Project-II	PR	0	0	6	3	90	60	150
Audit Courses										
1.	EEAU600	Indian Constitution	AU	2	0	0	0			
						Total	**20**	**500**	**500**	**1000**

PC: Program Core Courses
PE: Program Elective Courses
OE: Open Elective Courses
HS: Humanities & Social Science Courses
SE: Seminar Courses
PR: Project Courses
AU: Audit Courses

Course Code	:	CEES101
Course Title	:	Engineering Mechanics
Number of Credits	:	3 (L:2, T: 1, P: 0)
Prerequisites	:	NIL
Course Category	:	ES

Course Objectives:
Following are the objectives of this course:

- To obtain resultant of various forces and support reactions through condition of equilibrium.
- To know the centre of gravity and moment of inertia of composite.
- To understand motion, work, power and energy.
- To understand role of friction in equilibrium problems.
- To know fundamental laws of machines and their applications to various engineering problems.

Course Contents:

Unit–I Basics of Mechanics and Force System

Basics of Mechanics: Significance and relevance of Mechanics, Applied mechanics, Statics, Dynamics. Space, time, mass, particle, flexible body and rigid body, scalar and vector quantity, units of measurement (SI units) - Fundamental units and derived units.
Force Systems: units, representation as a vector and by Bow's notation, characteristics and effects of a force, principle of transmissibility of force, force system and its classification, resolution of a force -orthogonal components of a force, Composition of forces – Resultant, analytical method for determination of resultant for concurrent, non-concurrent and parallel co-planar force systems– Law of triangle, parallelogram and polygon of forces.

Unit– II Equilibrium

Force: Equilibrium and Equilibrant, Free body and Free body diagram, Analytical and graphical methods of analyzing equilibrium, Lami's Theorem – statement and explanation, Application for various engineering problems.
Moment: Moment of a force, Varignon's theorem, Types of beam, supports (simple, hinged, roller and fixed) and loads acting on beam (vertical and inclined point load, uniformly distributed load, couple), Beam reaction for cantilever, simply supported beam with or without overhang – subjected to combination of point load and uniformly distributed load, beam reaction graphically for simply supported beam subjected to vertical point loads only.

Unit– III Centre of Gravity and Moment of Inertia

Centre of Gravity: Centre of gravity and centroid of geometrical plane figures (square, rectangle, triangle, circle, semi-circle, quarter circle). Centroid of composite figures composed of not more than three geometrical figure. Centre of Gravity of simple solids (Cube, cuboid, cone, cylinder, sphere, hemisphere), Centre of Gravity of composite solids composed of not more than two simple solids.
Moment of Inertia: Definition, M.I. of plane lamina, Radius of gyration, section modulus, Parallel and Perpendicular axes theorems (without derivations), M.I. of rectangle, square, circle, semi-circle, quarter circle and triangle section (without derivations), M.I. of symmetrical and unsymmetrical I-section, Channel section, T-section, Angle section, Hollow sections and built up sections about centroidal axes and any other reference axis, Polar moment of Inertia of solid circular sections.

Unit–IV Motion, Work, Power and Energy

Rectilinear Motion: Newton's law of motion, momentum, conservation of momentum, impulse, torque
Circular motion: Angular motion, Equation of motion, angular momentum, torque, centripetal and centrifugal force.
Work, Power & Energy: Definition of terms, Work Energy principles, Conservation of Mechanical Energy, simple numerical problems.

Unit– V Friction and Simple Lifting Machine

Friction: Friction and its relevance in engineering, types and laws of friction, limiting equilibrium, limiting friction, co-efficient of friction, angle of friction, angle of repose, relation between coefficient of friction and angle of friction, equilibrium of bodies on level surface subjected to force parallel and inclined to plane, equilibrium of bodies on inclined plane subjected to force parallel to the plane only.
Simple lifting machine: Simple lifting machine, load, effort, mechanical advantage, applications and advantages, velocity ratio, efficiency of machines, law of machine, Ideal machine, friction in machine, maximum mechanical advantage and efficiency, reversible and non-reversible machines, conditions for reversibility, velocity ratios of Simple axle and wheel, Differential axle and wheel, Worm and worm wheel, Single purchase and double purchase crab winch, Simple screw jack, Weston's differential pulley block, geared pulley block.

References:

1. D.S. Bedi, Engineering Mechanics, Khanna Publications, New Delhi (2008)
2. Khurmi, R.S., Applied Mechanics, S. Chand & Co. NewDelhi.
3. Bansal RK, A text book of Engineering Mechanics, Laxmi Publications.

4. Ramamrutham, Engineering Mechanics, S. Chand & Co. NewDelhi.
5. Ram, H. D.; Chauhan, A. K., Foundations and Applications of Applied Mechanics, Cambridge University Press.
6. Meriam, J.L.,Kraige, L.G., Engineering Mechanics-Statics, Vol. I, Wiley Publication, New Delhi.
7. Upadhay A.K, Applied Mechanics, S.K. Kataria & Sons, New Delhi.

Course Outcomes:

After completing this course, student will be able to:

CO1	Determine unknown forces and support reactions of different engineering systems.
CO2	Find the centroid, centre of gravity and moment of inertia of various components in engineering systems.
CO3	Apply work, power, energy concept to solve rectilinear and circular motion problems
CO4	Apply the principles of friction in various conditions for useful purposes.
CO5	Select the relevant simple lifting machine(s) for given purposes.

Course Code	:	CEES111
Course Title	:	Engineering Mechanics Lab.
Number of Credits	:	1 (L:0, T:0, P:2)
Prerequisites	:	NIL
Course Category	:	ES

Course Objectives:

Following are the objectives of this course:

- To obtain resultant of various forces and calculate support reactions through conditions of equilibrium for various structures
- To understand role of friction in equilibrium problems
- To know fundamental laws of machines and their applications to various engineering problems

List of Experiments: (Minimum 10 experiments to be performed)

1. To find the M.A., V.R., Efficiency and law of machine for Differential Axle and Wheel.
2. To find the M.A., V.R., Efficiency and law of machine for Simple Screw Jack.
3. Derive Law of machine using Worm and worm wheel.
4. Derive Law of machine using Single purchase crab.
5. Derive Law of machine using double purchase crab.
6. Derive Law of machine using Weston's differential or wormed geared pulley block.
7. Determine resultant of concurrent forces by Y-stem applying Law of Polygon of forces using force table.
8. Determine resultant of concurrent forces by Y-stem graphically.
9. Determine resultant of parallel forces by Y-stem graphically.
10. Verify Lami's theorem.
11. Study forces in various members of Jib crane.
12. Determine support reactions for simply supported beam.
13. Obtain support reactions of beam using graphical method.
14. Determine coefficient of friction for motion on horizontal and inclined plane.
15. Determine centroid of geometrical plane figures.

References:

1. Bedi D.S., Engineering Mechanics, Khanna Publishing House
2. Khurmi, R.S., Applied Mechanics, S. Chand & Co. New Delhi.
3. Bansal RK, A text book of Engineering Mechanics, Laxmi Publications.
4. Ramamrutham, Engineering Mechanics, S., S Chand & Co. New Delhi.
5. Ram, H.D.; Chauhan, A.K. Foundations and Applications of Applied Mechanics,

Cambridge University Press.

Course Outcomes:

After completing this course, student will be able to:

CO1	Determine unknown force(s) of different engineering systems.
CO2	Apply the principles of friction in various conditions for useful purposes.
CO3	Select the relevant simple lifting machine(s) for given purposes.

Course Code	:	EEBS102
Course Title	:	Applied Chemistry
Number of Credits	:	3 (L:2, T:1, P:0)
Prerequisites	:	High School Chemistry Course
Course Category	:	BS

Course Objectives:

- To understand atomic structure concepts (Rutherford's model, Bohr's theory, quantum numbers) and chemical bonding (ionic, covalent, coordination); to study molecular structures (H_2O, NH_3, CH_4) and concentration methods (molarity, normality, mole fraction).
- To explore water hardness and its effects on industrial processes; to learn methods for determining hardness and water-softening techniques (soda lime, zeolite, ion exchange); to examine municipal water treatment and drinking water standards.
- To study metal extraction and iron-based materials (cast iron, steel); to understand heat treatment and alloys (brass, bronze, duralumin); to learn about polymers (types, preparation, applications).
- To classify and analyze the combustion of fuels, to calculate calorific values, and to study the properties of fuels (LPG, CNG); to learn about lubricants' physical and chemical properties.
- To understand the principles of electrochemistry, including oxidation-reduction reactions and corrosion types; to learn methods for preventing corrosion, such as design, alloying, cathodic protection, and coating.

Course Contents:

Unit – I Atomic Structure, Chemical Bonding and Solutions

- Rutherford model of atom, Bohr's theory, Quantum numbers – orbital concept. Shapes of *s, p* and *d* orbitals, Pauli's exclusion principle, Hund's rule of maximum multiplicity Aufbau rule, electronic configuration.
- Concept of chemical bonding – cause of chemical bonding, types of bonds: ionic bonding (NaCl example), covalent bond (H_2, F_2, HF, $BeCl_2$, BF_3, CH_4, NH_3, H_2O), coordination bond in NH_4^+.
- Solution – idea of solute, solvent and solution, methods to express the concentration of solution- molarity, normality, strength, ppm, mass percentage, volume percentage, mass by volume percentage and mole fraction.

Unit – II Water

- Classification of soft and hard water, salts causing water hardness, unit of hardness and simple numerical on water hardness.

- Problems caused by the use of hard water in boiler (scale and sludge, foaming and priming, corrosion etc), and quantitative measurement of water hardness by EDTA method. Estimation of dissolved oxygen, free chlorine, chloride ion and alkalinity.
- Water softening techniques – soda lime process, zeolite process and ion exchange process. Municipal water treatment (in brief only) – sedimentation, coagulation, filtration, sterilisation. Water for human consumption for drinking and cooking purposes from any water sources and enlist Indian standard specification of drinking water (collecting data and understand standards).

Unit – III Engineering Materials

- Natural occurrence of metals – minerals & ores of iron. Pig Iron, Cast iron, Steel and Heat treatment of steal.
- Alloys – definition, purposes of alloying. Composition, properties and uses of Brass, Bronze, Gun metal, Invar and Duralumin.
- Polymers – monomer, homo and co polymers, simple reactions involved in preparation and their application of thermoplastics and thermosetting polymers (PVC, PS, PTFE, nylon–6, nylon-6,6 and Bakelite), rubber and vulcanization of rubber.

Unit – IV Chemistry of Fuels and Lubricants

- Definition of fuel and combustion of fuel, classification of fuels, calorific values (HCV and LCV). Calculation of HCV and LCV using Dulong's formula. Fractional distillation of crude petroleum, octane number and cetane number.
- Chemical composition, calorific values and applications of LPG, CNG, Water gas, Coal gas and Producer gas.
- Lubrication – function and characteristic properties of good lubricant, classification with examples, lubrication mechanism – hydrodynamic and boundary lubrication, physical properties (viscosity and viscosity index, oiliness, flash and fire point, cloud and pour point) and chemical properties of lubricant (acid number, saponification value).

Unit – V Electro Chemistry

- Electronic concept of oxidation, reduction and redox reactions. Definition of terms: electrolytes, non-electrolytes with suitable examples.
- Introduction to Corrosion of metals: Definition, types of corrosion: Chemical and Electrochemical corrosion, Galvanic corrosion, Concentration corrosion, Pitting corrosion and Stress corrosion.
- Protection of corrosion by Proper designing, Alloying, Cathodic and anodic protection and Coating methods.

References:

1. Anju Rawlley & Devdatta Vinayakrao Saraf, Applied Chemistry (with lab manual), Khanna Book Publishing Co. (P) Ltd. Delhi.
2. Chemistry for Class XI& XII (Part-I, Part-II), N.C.E.R.T., Delhi.
3. Agarwal, & Shikha, Engineering Chemistry, Cambridge University Press, New Delhi.
4. C.N. R. Rao, Understanding Chemistry, Universities Press (India) Pvt. Ltd.
5. Dara, S. S. & S.S.Umare, Engineering Chemistry, S.Chand. Publication, New Delhi.
6. Jain & Jain, Engineering Chemistry, Dhanpat Rai and Sons, New Delhi.
7. S. Vairam, Engineering Chemistry, Wiley India Pvt.Ltd., New Delhi.
8. Rajesh Agnihotri, Chemistry for Engineers, Wiley India Pvt. Ltd.
9. Laboratory Manual Chemistry (Class XI and Class XII), NCERT.
10. G. H. Hugar & A. N. Pathak, Applied Chemistry Laboratory Practices (Vol. I and Vol. II), NITTTR Publications, Chandigarh.

Course Outcomes:

The students will be able to:

CO1	Explain atomic models, describe the concept of quantum numbers, and predict the shape and properties of molecules based on different types of chemical bonding, including ionic, covalent, and coordination bonds, as well as calculate the concentration of solutions using various methods.
CO2	Classify water as hard or soft, understand the causes of water hardness, calculate water hardness, and describe methods of water softening and municipal water treatment processes, while adhering to Indian standards for drinking water.
CO3	Identify the natural occurrence of metals, understand the properties and uses of alloys like brass, bronze, and duralumin, and explain the characteristics and applications of polymers, including thermoplastics, thermosetting plastics, and rubber.
CO4	Classify fuels based on their combustion properties, calculate calorific values using Dulong's formula, and describe the types of lubrication, the properties of lubricants, and their functions in industrial applications.
CO5	Explain redox reactions, differentiate between electrolytes and non-electrolytes, identify types of corrosion, and outline methods for preventing corrosion in metals.

Course Code	:	EEBS112
Course Title	:	Applied Chemistry Lab
Number of Credits	:	1 (L:0, T:0, P:2)
Prerequisites	:	High School Chemistry Course
Course Category	:	BS

Course Objectives:

- **Quantitative Chemical Analysis**
  Students will perform chemical analyses to determine the purity of oxalic acid, analyze NaOH and KOH mixtures, and estimate various water quality parameters such as hardness, chloride ions, free chlorine, dissolved oxygen, and alkalinity.

- **Water Hardness and Quality Assessment**
  Students will estimate temporary, permanent, and total water hardness using the EDTA method and assess water quality by measuring chloride ions, free chlorine, and dissolved oxygen.

- **Physical Property Measurements**
  Students will determine the viscosity of lubricating oils using the Redwood Viscometer and estimate the moisture content in coal samples.

Course Contents:

1. To determine the purity percentage of oxalic acid in a given impure mixture.
2. To analyse a mixture of NaOH and KOH (given a solution contacting 2.5g mixture of NaOH and KOH per litre).
3. To estimate the calcium and magnesium hardness in the given water sample.
4. To estimate the Chloride ion (Cl^-) in the given water sample.
5. To estimate the free Chlorine (Cl_2) in the given water sample.
6. To estimate the dissolved Oxygen (D.O) in the given water sample.
7. To estimate the Alkalinity in the given water sample.
8. To estimate the temporary, permanent and total hardness in the given water sample by EDTA method.
9. To determine the viscosity of a lubricating oil by Redwood Viscometer.
10. To determine the moisture percentage in a coal sample.

References

1. Anju Rawlley & Devdatta Vinayakrao Saraf, Applied Chemistry (with lab manual), Khanna Book Publishing Co. (P) Ltd. Delhi.
2. Laboratory Manual Chemistry (Class XI and Class XII), NCERT.

3. G. H. Hugar & A. N. Pathak, Applied Chemistry Laboratory Practices (Vol. I and Vol. II), NITTTR Publications, Chandigarh.

Course Outcomes

The students will be able to:

CO1	Recall and explain the principles and methods used in the quantitative analysis of chemical substances, including the estimation of purity, hardness, chloride ions, and dissolved oxygen in water samples.
CO2	Demonstrate the ability to apply appropriate analytical techniques, such as titration and viscosity measurement, to determine chemical concentrations and physical properties in various samples, including water, lubricants, and coal.
CO3	Analyse experimental data, evaluate the results for accuracy and precision, and assess the impact of different factors (e.g., impurities, water quality) on the outcomes of chemical and physical measurements.

Course Code	:	MEES103
Course Title	:	Fundamentals of Mechanical Engineering
Number of Credits	:	3 (L:2, T:1, P:0)
Prerequisites	:	NIL
Course Category	:	ES

Course Objectives:

- To demonstrate the safety care and precautions in various mechanical shops, while working with tools and machines.
- To understand working principles of lathe operations and power transmission.
- To understand laws of thermodynamics and heat transfer Processes.
- To understand the working principles of heat engines
- To understand working principles of power developing and power absorbing devices

Course Contents:

Unit – I Introduction to Mechanical Shops

Introduction to workshop practice, safety, care and precaution in workshop, Material, operations & tools used in carpentry shop, fitting shop, smithy shop, Welding Shop, Principle of operation of Arc welding and gas welding, tools and equipment used in arc and gas welding, soldering and brazing.

Unit – II Lathe & its Operations

Description and function of various parts of a lathe, Classification and specification of various types of lathe, Lathe operations - Plain and step turning, facing, taper turning, drilling, reaming, boring, threading and knurling, Milling Machine, Shaper and Planer Machines, Drilling Machine, Grinding Machine

Modes of Power Transmission: Transmission of Power through belt: flat belt V belt open belt and cross belt device, Derivation of tension ratio for flat belt, power transmission through chain and gears, Spur, Helical, Bevel, Rack and Pinion

Unit – III Basic Thermodynamics, Steam Boiler and Steam Turbine

Fundamental concept of Thermodynamics: Introduction, Define Systems, Thermodynamic Equilibrium, Properties, State, Process and Cycle, Elementary introduction to Zeroth, First and Second laws of thermodynamics, Practical application of thermodynamics;

Steam boiler: Introduction, classification, boiler accessories and mountings, construction and working of Cochran boiler, Babcock & Wilcox boiler; Steam turbine: Impulse and Reaction Turbines

Unit – IV Heat Engines

Heat Engines: Introduction, classifications, Components of IC engines, Cylinder, crankcase, crankpin, crank, crankshaft, connecting rod, wrist pin, piston, cooling pins cylinder heads, exhaust valve, inlet valve; Working of four-stroke and two-stroke petrol and diesel engines; Comparison of two stroke and four stroke engines; Comparison of C. I. and S. I. engines

Unit – V Thermal & Fluid Systems

Refrigeration and Air Conditioning System: Introduction and applications, Ton of refrigeration (TR), coefficient of performance, vapour compression cycle, vapour absorption cycle, Window air conditioner
Pumps: working principle of Reciprocating and centrifugal pump
Air compressor: working principle of rotary air compressor (root blower, vane blower), Fluid systems: Working principle of hydraulic jack, hydraulic lift, hydraulic coupling

Reference Books:

1. M.P. Poonia & S.C. Sharma, Basic Mechanical Engineering, Khanna Pub. House, Delhi
2. M. L. Mathur, F. S. Mehta and R. P. Tiwari , Elements of Mechanical Engineering, Jain Brothers, New Delhi
3. B. S. Raghuvanshi, Workshop Technology (Vol.1 & 2), Dhanpath Rai and Sons, New Delhi.
4. *J. Benjamin*, Textbook of *Basic Mechanical Engineering*, Publisher: Kollam : Pentex
5. *Roy Chaudhary*, Basic *Engineering* Thermodynamic. Tata McGraw Hill, Delhi.

Course Outcomes:

The student will be able to:

CO1	Identify tools used in various mechanical workshops.
CO2	Understand functions and operations of machine tools including milling, shaping, grinding and lathe machines and mode of power transmission in machines.
CO3	Explain laws of thermodynamics and its practical application of thermodynamics.
CO4	Illustrate various parts of internal combustion engine.
CO5	Understand basics of pump, compressor and refrigeration and air-conditioning systems.

Course Code	:	EEES104
Course Title	:	Fundamentals of Electrical Engineering
Number of Credits	:	2 (L: 2, T: 0, P: 0)
Prerequisites	:	High School Physics and Mathematics Course
Course Category	:	ES

Course Objectives:

- To provide basic knowledge of electric and magnetic quantities and their units.
- To teach the basic concepts of electric and magnetic circuits as well as their inter-relations.
- To learn the various electrical rules/laws/theorems to help students deal with electrical engineering applications in industrial processes of different fields.
- To understand the concepts of alternating current and voltage, impedance, and phase angle.
- To learn the construction and principle of different types of transformers and rotating machines.

Course Contents:

Unit – I Electric Circuits

Basic concepts of charge; Electrical quantities and their units, Ohm's law; Resistance, Resistances in series; Resistances in parallel; Kirchhoff's laws & their applications; Network theorems; Laws of resistance; Temperature coefficient of resistance; Grouping of cells; Numerical problems.

Unit – I Electromagnetism

Introduction to electromagnetism; Magnetic field at the axis of a solenoid; Force on a current carrying conductor placed in the magnetic field; Force between two parallel current carrying conductors.

Faraday's laws of electromagnetic induction; Lenz's law; Dynamically and statically induced emfs; Self and mutual inductances; Coefficient of coupling; Simple numerical problems.

Unit – III Magnetic Circuits

Magnetic flux & flux density; Magnetizing force; Magneto motive force (MMF); Absolute and relative permeability; Reluctance; Series and parallel magnetic circuits; Ampere-turn calculations; Leakage flux; Leakage factor; Analogy between electric and magnetic circuits; Numerical problems.

Unit – IV A.C. Circuits

Concept of alternating current and voltage; Cycle; Frequency; Periodic time; Amplitude; Angular velocity; Average value; RMS value; Form factor; Peak factor; Impedance; Phase angle; Mathematical and phasor representation of alternating emf and current; A.C. through pure resistance, pure inductance & pure capacitance; Concept of conductance, susceptance & admittance; Power factor, A.C in R-L, R-C, R-L-C series and parallel circuits.

Unit – V Transformer and Rotating Machines

General construction and principle of different type of transformers; Emf equation and transformation ratio of transformers; Auto transformers; Construction and working principle of motors; Basic equations and characteristic of motors; B-H curve; Concept of eddy current and hysteresis; Hysteresis loop; Eddy current and hysteresis losses.

References:

1. Ritu Sahdev, Basic Electrical Engineering, Khanna Publishing House.
2. Mittle and Mittal, Basic Electrical Engineering, McGraw Education, New Delhi, 2015.
3. Saxena, S. B. Lal, Fundamentals of Electrical Engineering, Cambridge University Press.
4. Theraja, B. L., Electrical Technology Vol – I, S. Chand Publications, New Delhi.
5. Theraja, B. L., Electrical Technology Vol – II, S. Chand Publications, New Delhi.
6. Jegathesan, V., Basic Electrical and Electronics Engineering, Wiley India, New Delhi.

Course Outcomes:

At the end of the course, the student will be able to:

CO1	Analyze electric circuits using Ohm's law, Kirchhoff's laws, and network theorems.
CO2	Understand the fundamental principles of electromagnetism, including electromagnetic induction and magnetic forces.
CO3	Design and analyze magnetic circuits, including magnetizing force, reluctance, and permeability.
CO4	Analyze and design AC circuits, including impedance, phase angle, and power factor.
CO5	Understand the construction, principle, and operation of transformers and rotating machines.

Course Code	:	EEES114
Course Title	:	Fundamentals of Electrical Engineering Lab
Number of Credits	:	1 (L: 0, T: 0, P: 2)
Prerequisites	:	High School Physics and Mathematics Course
Course Category	:	ES

Course Objectives:

- To verify Ohm's law and analyze series and parallel combinations of resistances in the circuit.
- To familiarize students with the measurement and analysis of active, reactive, and apparent power in single-phase R-L, R-C, and R-L-C ac series circuits, and to help them understand the concept of power factor and draw the impedance triangle.
- To determine the permeability of a magnetic material by plotting the B-H curve and to analyze the transformation ratio of a single-phase transformer.

List of Experiments:

1. To verify the Ohm's law and draw its I-V characteristics.
2. To verify the relation $R_T = R_1 + R_2 + R_3 + \ldots\ldots\ldots + R_N$ in series combination of resistances.
3. To verify the relation $\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \ldots\ldots\ldots \frac{1}{R_N}$ in parallel combination of resistances.
4. To determine the permeability of magnetic material by plotting its B-H curve.
5. To measure the voltage, current and power in single phase R-L series circuit. Draw its voltage, impedance and power triangle.
6. To measure the voltage, current and power in single phase R-C series circuit. Draw its voltage, impedance and power triangle.
7. To measure the voltage, current and power in single phase R-L-C series circuit. Draw its voltage, impedance and power triangle.
8. To determine the transformation ratio of single-phase transformer.

Course Outcomes:

At the end of the course, the student will be able to:

CO1	Verify Ohm's law and evaluate series and parallel combinations of resistances.
CO2	Measure and calculate active, reactive, and apparent power, as well as power factor, in single-phase R-L, R-C, and R-L-C ac series circuits, and draw the impedance triangle
CO3	Determine the permeability of a magnetic materials and find the transformation ratio of a single-phase transformer.

Course Code	:	EEBS105
Course Title	:	Applied Mathematics-I
Number of Credits	:	3 (L:2, T:1, P:0)
Prerequisites	:	Nil
Course Category	:	BS

Course Objectives:

- Develop foundational knowledge of trigonometry.
- Strengthen understanding of algebraic concepts.
- Enhance combinatorial and theoretical skills.
- Introduce determinants and matrices for problem-solving.
- Explore and apply complex numbers.

Course Contents:

Unit– I Trigonometry

Grades, radians and their conversions. Trigonometrical ratios of allied angles (without proof), sum, difference formulae and their applications (without proof). Product formulae (transformation of product to sum, differences and vice-versa). Trigonometrical ratios of multiple and sub-multiple angles, Statement of cosine formula, sine formula, Napier's, half angle formula and Heron's formula.

Unit– II Algebra

Sequences and series: Arithmetic progression, its nth term, sum to n terms. Geometric progression, its n^{th} term, sum to n terms and sum of infinite terms. Finite sum of squares and cubes of natural numbers.

Partial fraction: Definition of polynomial fraction and partial fractions, proper and improper fraction. To resolve proper fraction into partial fraction with denominator containing non-repeated linear factors, repeated linear factor and irreducible non-repeated quadratic factors.

Unit– III Combinatory and Binomial Theorem

Permutations and Combinations: Basic Counting techniques, Value of P (n, r) and C (n, r), and their applications.

Binomial Theorem: Binomial theorem (without proof) for positive integral index (expansion, general term, and middle term). Binomial theorem (without proof) for any index (expansion and general term). Binomial approximation of first and second-degree terms.

Unit– IV Determinants and Matrices

Matrices: Definition and examples of matrices, types of matrices, Basic operations, Equality of matrices, addition, multiplication of two matrices, scalar multiplication of a matrix, Transpose of a matrix, symmetric, skew-symmetric matrices, singular and non-singular matrices, cofactor matrix, adjoint of a matrix, inverse of a matrix,

Determinants: Determinants (up to 3rd order only), minors, co-factors, Properties of determinants, Solution of linear simultaneous equations in three variables by Cramer's rule and matrix inverse methods.

Unit– V Complex Numbers

Modulus and amplitude of a complex number, Conjugate of a complex number, Polar and cartesian representation of a complex number and its conversion from one form to other, Operations on complex numbers, De-Moiver's theorem and its application, cube roots and n-th roots of unity.

References:

1. H.K. Dass, Rama Verma & Rajnish Verma, Mathematics for Polytechnics, CBS Publishers.
2. R.D. Sharma, Applied Mathematics, DhanPat Rai Publications.
3. Deepak Singh, Mathematics-I, Khanna Book Publishing Co. (P) Ltd.
4. Garima Singh, Mathematics-II, Khanna Book Publishing Co. (P) Ltd.

Course Outcomes:

The students will be able to:

CO1	Apply trigonometric identities and formulas to solve problems involving angles, including those related to sum, difference, product, multiple, and sub-multiple angles.
CO2	Solve problems involving sequences and series, including arithmetic progression, geometric progression, and partial fractions, to analyze and simplify expressions.
CO3	Apply the principles of permutations and combinations to solve counting problems and use the binomial theorem for expansion and approximations.
CO4	Use matrices and determinants to solve systems of linear equations, perform matrix operations, and understand key properties and types of matrices.
CO5	Perform operations on complex numbers in both polar and Cartesian forms and apply De Moivre's theorem to solve problems involving powers and roots of complex numbers.

Course Code	:	MEES116
Course Title	:	Engineering Workshop Practice
Number of Credits	:	2 (L: 0 T: 0 P: 4)
Prerequisites	:	NIL
Course Category	:	ES

Course Objectives:

- To understand the use of different tools, equipment and safety precaution in the workshops.
- To understand, identify, select and use various marking, measuring, and holding, striking and cutting tools and equipment
- To understand and interpret job drawings, produce jobs, and acquire skills to operate inspect the job for specified dimensions

Course Contents:

S. No.	Details of Practical Content
1	**Carpentry Shop:** • Safety Precautions to be served in the shop. • Demonstration of different wood working tools/machines and different wood working processes, like plaining, marking, chiseling, grooving, turning of wood etc. • One simple job involving any one joint like mortise and tenon dovetail, bridle, half lap etc.
2	**Fitting Shop:** • Safety Precautions to be served in the shop. • Demonstration of different fitting tools different operations like chipping, filing, drilling, tapping, sawing, cutting etc. • One simple fitting job involving practice of above operations.
3	**Welding Shop:** • Safety Precautions to be served in the shop. • Demonstration of different welding tools / machines, and arc Welding, Gas Welding, MIG, MAG welding, gas cutting and rebuilding of broken parts with welding. • One simple job involving butt and lap joint.

4	**Sheet Metal shop:** • Safety Precautions to be served in the shop. • Demonstration of different sheet metal tools / machines. • Demonstration of different sheet metal operations like sheet cutting, bending, edging, end curling, lancing, soldering, brazing, and riveting. • One simple job involving sheet metal operations and soldering and riveting.
5	**Smithy Shop:** • Safety Precautions to be served in the shop. • Demonstration and detailed explanation of tools, equipment used. • One simple job involving operation of forging a square headed bolt.
6	**Machine Shop:** • Safety Precautions to be served in the shop. • Study and sketch of lathe machine, bench grinder, milling machine, drilling machine. • Study of various operations on lathe machine such as turning, step turning, taper turning, facing, and knurling.

Reference:

1. S. K. Hajara Chaudhary, Workshop Technology, Media Promoters and Publishers, New Delhi, 2015
2. H S Bawa, Mechanical Workshop Practice, McGraw Hill Education
3. B. S. Raghuwanshi, Workshop Technology, Dhanpat Rai and sons, New Delhi 2014
4. K. Venkat Reddy, Workshop Practice Manual, BS Publications, Hyderabad 2014
5. Kents Mechanical Engineering Hand book, John Wiley and Sons, New York

Course Outcomes:

At the end of the course, the student will be able to

CO1	Acquire practical skills of using various marking, measuring, holding, striking and cutting tools & equipment and machines
CO2	Understand job drawing, job material and complete jobs as per specifications in allotted time
CO3	Operate, control different machines and equipment adopting safety practices

Course Code	:	EEHS117
Course Title	:	Sports and Yoga
Number of Credits	:	1 (L:0 T:0 P:2)
Prerequisites	:	NIL
Course Category	:	HS

Course Objectives:

- To make the students understand the importance of sound health and fitness principles as they relate to better health.
- To expose the students to a variety of physical and yogic activities aimed at stimulating their continued inquiry about Yoga, physical education, health and fitness.
- To create a safe, progressive, methodical and efficient activity-based plan to enhance improvement and minimize risk of injury.

Course Contents:

- Introduction to Physical Education: Meaning & definition of Physical Education, Aims & Objectives of Physical Education, Changing trends in Physical Education
- Olympic Movement: Ancient & Modern Olympics (Summer & Winter), Olympic Symbols, Ideals, Objectives & Values, Awards and Honours in the field of Sports in India (Dronacharya Award, Arjuna Award, Dhayanchand Award, Rajiv Gandhi Khel Ratna Award etc.)
- Physical Fitness, Wellness & Lifestyle: Meaning & Importance of Physical Fitness & Wellness, Components of Physical fitness, Components of Health-related fitness, Components of wellness, Preventing Health Threats through Lifestyle Change, Concept of Positive Lifestyle
- Fundamentals of Anatomy & Physiology in Physical Education, Sports and Yoga: Define Anatomy, Physiology & Its Importance, Effect of exercise on the functioning of Various Body Systems. (Circulatory System, Respiratory System, Neuro-Muscular System etc.)
- Kinesiology, Biomechanics & Sports: Meaning & Importance of Kinesiology & Biomechanics in Physical Edu. & Sports, Newton's Law of Motion & its application in sports, Friction and its effects in Sports.
- Postures: Meaning and Concept of Postures, Causes of Bad Posture., Advantages & disadvantages of weight training, Concept & advantages of Correct Posture, Common Postural Deformities – Knock Knee; Flat Foot; Round Shoulders; Lordosis, Kyphosis, Bow Legs and Scoliosis, Corrective Measures for Postural Deformities,
- Yoga: Meaning & Importance of Yoga, Elements of Yoga, Introduction - Asanas, Pranayama, Meditation & Yogic Kriyas, Yoga for concentration & related Asanas (Sukhasana; Tadasana; Padmasana & Sha-shankasana), Relaxation Techniques for improving concentration-Yog-nidra, Yoga & Lifestyle: Asanas as preventive

measures, Hypertension: Tadasana, Vajrasana, Pavan Muktasana, Ardha Chakrasana, Bhujangasana, Sharasana,

- Obesity: Procedure, Benefits & contraindications for Vajrasana, Hastasana, Trikonasana, Ardh Matsyendrasana.
- Back Pain: Tadasana, Ardh Matsyendrasana, Vakrasana, Shalabhasana, Bhujangasana.
- Diabetes: Procedure, Benefits & contraindications for Bhujangasana, Paschimottasana, Pavan Muktasana, Ardh Matsyendrasana.
- Asthema: Procedure, Benefits & contraindications for Sukhasana, Chakrasana, Gomukhasana, Parvatasana, Bhujangasana, Paschimottasana, Matsyasana.
- Training and Planning in Sports**:** Meaning of Training, Warming up and limbering down, Skill, Technique & Style, Meaning and Objectives of Planning, Tournament – Knock-Out, League/Round Robin & Combination.
- Psychology & Sports**:** Definition & Importance of Psychology in Physical Edu. & Sports, Define & Differentiate Between Growth & Development, Adolescent Problems & Their Management, Emotion: Concept, Type & Controlling of emotions, Meaning, Concept & Types of Aggressions in Sports, Psychological benefits of exercise, Anxiety & Fear and its effects on Sports Performance, Motivation, its type & techniques.
- Doping**:** Meaning and Concept of Doping, Prohibited Substances & Methods, Side Effects of Prohibited Substances
- Sports Medicine: First Aid – Definition, Aims & Objectives, Sports injuries: Classification, Causes & Prevention, Management of Injuries: Soft Tissue Injuries and Bone & Joint Injuries
- Sports / Games: Following sub topics related to any one Game/Sport of choice of student out of: Athletics, Badminton, Basketball, Chess, Cricket, Kabaddi, Lawn Tennis, Swimming, Table Tennis, Volleyball, Yoga etc., History of the Game/Sport, Latest General Rules of the Game/Sport, Specifications of Play Fields and Related Sports Equipment, Important Tournaments and Venues, Sports Personalities, Proper Sports Gear and its Importance.

References:

1. Modern Trends and Physical Education by Prof. Ajmer Singh.
2. Light on Yoga by B.K.S. Iyengar.
3. Health and Physical Education – NCERT (11th and 12th Classes)

Course Outcomes:

On successful completion of the course the students will be able to:

CO1	Improve personal fitness and develop understanding of health fitness and psychological problems associated with the age and lifestyle
CO2	Learn techniques for increasing concentration and decreasing anxiety which leads to stronger academic performance.
CO3	Understand basic skills associated with yoga and physical activities and perform yoga movements in various combination and forms.

Course Code	:	EEBS201
Course Title	:	Communication Skills in English
Number of Credits	:	3 (L:2, T:1, P:0)
Prerequisites	:	Nil
Course Category	:	BS

Course Objectives:

- To develop confidence and proficiency in spoken English with correct pronunciation, while strengthening the four key communication skills.
- To enhance public speaking, group discussions and presentation skills, enabling students to express their ideas effectively, and succeed academically, professionally and socially.
- To foster personality development by cultivating self-confidence, adaptability, emotional intelligence and resilience.
- To strengthen leadership and teamwork abilities through collaboration, efficient team management and proactive decision-making.
- To align communication and interpersonal skills with professional ethics and career aspirations and goals for long-term success.

Course Contents:

Unit– I Basics of Communication Skills in English

- Introduction to Communication: Meaning, definition and process of communication.
- Types of Communication: Formal and informal; verbal, non-verbal and written.
- Barriers to Effective Communication: Physical, linguistic, psychological, cultural, organisational, semantic and technical barriers.
- 7 Cs of Effective Communication: Considerate, Concrete, Concise, Clear, Complete, Correct, Courteous.
- Art of Effective Communication: Choosing words, voice modulation, clarity, time management and simplification of words.
- Technical Communication.

Unit– II Soft Skills and Life Skills for Personal Excellence

- **Soft Skills**: Personal attributes and interpersonal abilities that enhance job performance and career prospects and interpersonal interactions. Soft skills help build effective relationships, clear communication and adaptability in professional environments.
- **Life Skills: T**ools for managing personal and professional challenges, developing self-awareness and self-analysis, understanding one's strengths and weaknesses. Life skills also encompass adaptability with a positive attitude, resilience to overcome

setbacks and stress; emotional intelligence to recognise, understand and manage one's emotions while responding to others, and empathy which promotes better relationships by understanding and sharing others' feelings.

Unit– III Reading Comprehension

Comprehension, Vocabulary Enrichment, Grammar Exercises based on reading of the following texts:

Section-1 (Stories)

- Sparrows by K. A. Abbas
- The Gift of the Magi by O. Henry
- The Happy Prince by Oscar Wilde
- Games at Twilight by Anita Desai

Section-2 (Poems)

- Night of the Scorpion by Nissim Ezekiel
- Stopping by Woods on a Snowy Evening by Robert Frost
- Where the Mind is Without Fear by Rabindranath Tagore
- My Mother at Sixty Six by Kamla Das

Unit– IV Professional Writing

- The Art of Paragraph Writing
- Letters: Business and Personnel
- Drafting notices, minutes of a meeting, etc.

Unit– V Vocabulary and Grammar

- Commonly used words: Word Meaning and Usage, Synonyms and Antonyms, Dictionary skills, Contextual Vocabulary
- Glossary of Official Correspondence
- One-word substitution, Idioms and Phrases
- Tenses and Verbs Usage (Through Translation between English and Hindi)
- Transformation of sentences: Interchange of Degrees of Comparison, Active and Passive Voice, Direct and Indirect Speech
- Common errors: Grammatical errors, Pronunciation errors, Vocabulary errors, Wrong use of Idiomatic Expressions, etc.

References

1. Anjana Tiwari, *Communication Skills in English.* Khanna Book Publishing Co. (P) Ltd. Delhi, 2022.
2. O'Connor, J. D. *Better English Pronunciation.* Cambridge University Press, 1980.
3. Murray, Lindley. *An English Grammar: Comprehending Principles and Rules.* Wilson and Sons, 1980.
4. Tiwari, Anjana. *Communication Skills in English.* Khanna Book Publishing Co. (P) Ltd., 2022.
5. Kumar, Kulbhushan. *Effective Communication Skills.* Khanna Publishing House, 2018.
6. Maison, Margaret M. *Examine Your English.* Orient Longman, 1964.
7. Rizvi, M. Ashraf. *Effective Technical Communication.* McGraw Hill, 2002.
8. Nielson, John. *Effective Communication Skills.* Xlibris, 2008.
9. *Cambridge Advanced Learner's Dictionary.* 4th ed., Cambridge University Press, 2018.
10. Roget, Peter Mark. *Roget's Thesaurus of English Words and Phrases.* Edited by George Davidson, Penguin Books, 2004.
11. Raman, Meenakshi, and Sangeeta Sharma. *Technical Communication: Principles and Practice.* 2nd ed., Oxford University Press, 2011.
12. Swan, Michael. *Practical English Usage.* 4th ed., Oxford University Press, 2016.
13. Balasubramanian, T. *A Textbook of English Phonetics for Indian Students.* Macmillan, 1981.
14. Murphy, Raymond. *Intermediate English Grammar.* Cambridge University Press, 1994.
15. https://wordpowermadeeasy.files.wordpress.com/2007/12/gre_wordlist.pdf

Course Outcomes:

The students will be able to:

CO1	Develop conceptual clarity on communication and its components, identify and overcome barriers to effective communication, apply the 7 Cs for clarity and precision; refine verbal and non-verbal skills through word choice, voice modulation and master technical communication for professional excellence.
CO2	Acquire essential soft and life skills to enhance personal and professional effectiveness, foster strong interpersonal relationships, cultivate adaptability and resilience, apply and demonstrate emotional intelligence and empathy for meaningful interactions and career success.
CO3	Enhance reading comprehension through diverse literary texts, enrich vocabulary, strengthen grammar and develop critical thinking and analytical skills for deeper textual interpretation. Foster a lifelong learning mindset, develop and promote empathy, resilience, cultural awareness and values such as patriotism, familial

	bonds, scientific attitude and self-awareness, logic and rationality.
CO4	Attain proficiency in professional writing by mastering paragraph structuring, composing effective business and personal letters and drafting formal documents such as notices and meeting minutes with clarity and precision.
CO5	Strengthen vocabulary and grammar skills through word usage, synonyms, antonyms, and contextual vocabulary, master official correspondence terminology, enhance accuracy in sentence transformation, tense usage and translation and rectify common errors in grammar, pronunciation and idiomatic expressions for effective communication.

Course Code	:	EEBS211
Course Title	:	Communication Skills in English Lab
Number of Credits	:	1 (L:0, T:0, P:2)
Prerequisites	:	Nil
Course Category	:	BS

Course Objectives:

- To enhance listening, speaking and digital communication for professional and social interaction.
- To develop leadership, teamwork and public speaking for impactful presentations.
- To cultivate professional etiquette, cultural sensitivity and global awareness for diverse work environments.

Course Contents:

Listening Skills – Enhancing Comprehension and Interpretation

- Introduction to active listening strategies, focusing on listening for main ideas, details and inferences.
- Practice with a variety of audio-visual materials such as recorded lectures, podcasts, interviews, TED talks, speeches and debates.
- Listening tests based on different accents, dialects and speech patterns to improve listening comprehension in diverse settings.
- Exercises to differentiate between tone, mood and intent in spoken language to strengthen interpretative skills.
- Focus on active listening and emotional regulation during interactions.

Phonetics and Pronunciation – Mastering Sounds for Clarity

- Study of the International Phonetic Alphabet (IPA) for accurate word transcription and pronunciation.
- Practice with consonants, vowels, diphthongs, stress patterns and weak forms to ensure precise and clear speech.
- Syllable division and understanding of stress patterns to enhance fluency and speech rhythm.
- Focus on intonation, voice modulation and pitch for effective communication and expressiveness.
- Techniques to improve accent reduction and pronunciation for clearer, more confident speech.

Speaking Skills – Effective Expression and Interaction

- Focus on formal and standard speech practices in various contexts: academic, business and public communication. Exercises to enhance self-awareness, adaptability and resilience in challenging communication situations.
- Development of oral presentation skills with emphasis on structure, clarity and audience engagement.
- Training in group discussions, debates and impromptu speaking to build confidence and articulation.
- Mock interviews and role-playing exercises to prepare students for real-world professional situations.
- Techniques for effective communication in business settings, including business presentations and public speaking engagements.
- Practice in conveying ideas clearly, assertively and persuasively in both individual and group settings.

Vocabulary Enhancement – Building Lexical Resource

- Construction of new words through affixes, prefixes and suffixes to enhance word formation skills.
- Extensive practice with phrasal verbs, idioms and foreign phrases to build fluency in diverse communication settings.
- Introduction to jargon and specialized vocabulary related to organisational structures, industries and professional settings.
- Development of contextual vocabulary for accurate and appropriate word choices in different settings (formal vs. informal, professional vs. casual).

Digital and Virtual Communication – Handling Online Platforms

- Techniques for effective communication in virtual settings, including webinars, video conferencing and digital presentations.
- Introduction to virtual communication etiquette: body language, tone and engagement in online meetings and webinars.
- Practice with writing and responding to professional emails, creating formal online presentations and using digital tools for effective communication.
- Developing skills to manage cross-cultural communication in global digital platforms.
- Developing empathy and emotional intelligence in communication for effective relationship-building.

References:

1. Anjana Tiwari, *Communication Skills in English.* Khanna Book Publishing Co. (P) Ltd. Delhi, 2022.
2. Jones, Daniel. *The Pronunciation of English.* Cambridge University Press, 1956.
3. Hartman, James, et al. *English Pronouncing Dictionary.* Cambridge University Press, 2006.

4. Kumar, Kulbhushan. *Effective Communication Skills.* Revised ed., Khanna Publishing House, 2018.
5. O'Connor, J. D. *Better English Pronunciation.* Cambridge University Press, 1980.
6. Murray, Lindley. *An English Grammar: Comprehending Principles and Rules.* Wilson and Sons, 1908.
7. Maison, Margaret M. *Examine Your English.* Orient Longman, 1964.
8. Sethi, J., et al. *A Practice Course in English Pronunciation.* Prentice Hall, 2004.
9. Pfeiffer, William Sanborn, and T. V. S. Padmaja. *Technical Communication: A Practical Approach.* 6th ed., Pearson, 2007.
10. Bansal, R. K., and J. B. Harrison. *Spoken English: A Manual of Speech and Phonetics.* Orient Blackswan, 2013.
11. https://wordpowermadeeasy.files.wordpress.com/2007/12/gre_wordlist.pdf

Course Outcomes:

The students will be able to:

CO1	Apply active listening to understand key ideas, analyse speech patterns and interpret tone for effective communication, and master International Phonetic Alphabet, fine-tune pronunciation and enhance fluency, intonation and accent for confident speech.
CO2	Strengthen formal speech proficiency, improve presentations and build confidence through discussions, debates and role-plays; and expand vocabulary, develop fluency in idioms and phrasal verbs and refine word choice for effective formal and informal communication.
CO3	Excel virtual and cross-cultural communication, enhance non-verbal skills and adapt to diverse accents with personalised feedback; and cultivate emotional intelligence, resilience and adaptability for success in academic and professional settings.

Course Code	:	EEBS202
Course Title	:	Applied Physics
Number of Credits	:	3 (L:2, T:1, P:0)
Prerequisites	:	High School Physics Course
Course Category	:	BS

Course Objectives:

- Develop a strong foundational understanding of concepts of physics.
- Utilize theoretical concepts to solve real-world physics problems.
- Improve analytical, mathematical and problem-solving skills in physics.
- Analyse physical phenomena and interpret the results.
- Introduce practical applications of physics in engineering and technology.

Course Contents:

Unit– I Physical World, Units, and Measurements

Physical Quantities: Fundamental and derived units, Systems of units (FPS, CGS, SI). Dimensions: Dimensional formulae, principle of homogeneity, derivation of simple equations and correctness of physical equations.
Measurements: Least count, significant figures, error analysis and measuring instruments.

Unit– II Vectors and Mechanics

Scaler and vector quantities: Addition and subtraction of vectors, scaler and vector product, resolution of vector.
Conservation of momentum, Work and energy, kinetic and potential energy, work-energy theorem.

Unit– III Electromagnetism

Electric Field: Coulomb’s law, electrostatic field, Gauss's law, and its applications (charged sheet, sphere etc.), electrostatic potential.
Capacitance: parallel plate capacitor, series and parallel combinations, energy stored in capacitor.
Electric Current: Resistance, Kirchhoff’s laws and their applications.
Generation of Magnetic Field: Biot-Savart law, magnetic field due to current carrying straight wire and circular loop. Permanent magnets.
Effect of Magnetic Field: Force on current-carrying wires, torque on current-carrying loop.
Devices: Moving coil galvanometer and its conversion to ammeter and voltmeter.

Unit– IV Heat and Thermal properties:

Heat, modes of heat transfer, specific heat (C_p and C_v), Scales of temperature and thermometer, thermocouple and Seebeck effect. Thermal conductivity, thermal expansion, engineering applications.

Unit– V Waves and Optics

Simple Harmonic Motion: Time period, frequency, amplitude, transverse and longitudinal waves, superposition, principle of interference.
Reflection and Refraction: Total internal reflection and its application in fiber optics. Lens formula, magnification, optical instruments: simple microscope, compound microscope and astronomical telescope. LASER and applications.

References:

1. Physics Textbook for Class XI (Part 1 and Part 2) & XII (Part 1 and Part 2), NCERT.
2. David Halliday, Robert Resnick & Jearl Walker, Principles of Physics, John Wiley and Sons.
3. Vivek Talati & Vinod Kumar Yadav, Applied Physics-I (with Lab manual), Khanna Book Publishing Co. (P) Ltd.
4. Hussain Jeevakhan, Applied Physics-II (with lab manual), Khanna Book Publishing Co. (P) Ltd.
5. A Manual of Higher Secondary Physics Laboratory Kit, NCERT.
6. M. Mudassir Husain & M. Rafat, An Experience of Physics, Cadplan Publishers.
7. e-books/e-tools/learning physics software/YouTube videos/websites etc.

Course Outcomes:

The students will be able to:

CO1	Identify dimensions of physical quantities and correctness of physical equations, use accurate units, apply rules of errors propagation and significant figures.
CO2	Perform vector operations and analyse vectors to apply them in the problems related to principles of mechanics.
CO3	State key concepts of electrostatics, current electricity and electromagnetism and derive standard results and solve problems based on these concepts.
CO4	Demonstrate understanding of the concepts of heat and thermal properties and identify their applications in real world scenarios.
CO5	Recall the fundamental principles of simple harmonic motion and wave motion and describe the working of optical devices along with their applications.

Course Code	:	EEBS212
Course Title	:	Applied Physics Lab
Number of Credits	:	1 (L:0, T:0, P:2)
Prerequisites	:	High School Physics Course
Course Category	:	BS

Course Objectives:

- Value the importance of precise measurement and error analysis.
- Develop and enhance students' hands-on skills in measuring and recording of experiment data.
- Relate theoretical concepts of physics to real-world applications and engineering tasks.

List of Experiments:

1. To measure the volume of a cylinder using a Vernier caliper and calculate the associated uncertainty in the volume.
2. To measure the area of cross-section of a wire using a screw gauge and calculate the associated uncertainty in the area.
3. To determine radius of curvature of a spherical surface using spherometer.
4. To determine the spring constant of helical spring using dynamic method.
5. Verification of Ohm's law.
6. Conversion of galvanometer into Ammeter/Voltmeter of desired range.
7. To determine focal length of a convex lens.
8. To determine temperature of room and hot bath using thermometer and convert the value into different scales.

References:

1. M. Mudassir Husain & M. Rafat, An Experience of Physics, Cadplan Publishers.
2. A Manual of Higher Secondary Physics Laboratory Kit, NCERT.
3. Vivek Talati & Vinod Kumar Yadav, Applied Physics-I (with Lab manual), Khanna Book Publishing Co. (P) Ltd.
4. Hussain Jeevakhan, Applied Physics-II (with lab manual), Khanna Book Publishing Co. (P) Ltd.

Course Outcomes:

The students will be able to:

CO1	Demonstrate a systematic approach to performing experiments, reporting results with significant figures and calculating experimental errors.
CO2	Measure volume, area of cross-section, radius of curvature, temperature, spring constant and focal length using appropriate instruments or methods and calculate the associated uncertainties.
CO3	Create an ammeter or a voltmeter using galvanometer and identify the relationship between current and voltage.

Course Code	:	COES203
Course Title	:	IT Systems and Computer Programming
Number of Credits	:	2 (L: 2, T: 0, P: 0)
Prerequisites	:	Nil
Course Category	:	ES

Course Objectives:

- To understand the fundamentals of computers, information technology and data representation.
- To analyze computer system based on hardware, software, and different types of memories.
- To apply algorithms and flowchart for writing programs using C language.
- To understand C programming using arrays and functions.
- To apply structures and pointers for writing programs using C language.

Course Contents:

Unit– I Information Technology System and Data Representation

Digital computer systems, Characteristics, Digital vs. Analog computer systems, History, Computer generations, Types of computers and their classifications, Application of computer in various fields, Types of Personal Computers (PC), PC setup and Basic Input Output System; Working knowledge of PC software including Word Processor; Introduction to Information Technology (IT), Components of an IT system: Hardware, Software, Networks, Data, People, and Processes; Data representation: Number systems, radix, decimal, binary, octal, hexadecimal, conversion, and Complements: 1's complement, 2's complement, 9's complement, and 10's complement.

Unit– II Computer Hardware, Software, and Memories

Elements of computer hardware, CPU, I/O devices, storage and media used in PCs, Computer software: Types of software, System software, Application software, Introduction to Operating System (OS), Functions and types of OS, DOS commands, Memory system of a PC, Primary memory, Random access memory, Read only memory, Secondary memory, Types of secondary Storage, Access mechanism of storage devices.

Unit– III Elements of Algorithms and Programming in C

Computer languages, Generation of languages, Translators- Assemblers, Interpreters, Compilers, Algorithm, Pseudo-code, Flowcharts rules and symbols, Structured programming concepts, Introduction to 'C', importance of C, basic structure of a C program, constants, variables and data types, Operators and expressions, managing I/O operations, Control statement: 'IF' statement and its various forms, goto statement, for, while and do- while loops, Switch decision making statement.

Unit– IV Array and Functions

Introduction to array, array notation, storage and representation, manipulating array elements, using multidimensional arrays, Functions: Built-in and user defined functions and their applications; Use of built-in graphics functions to draw 2D objects.

Unit– V Structures and Pointers

Introduction to structures, Purpose, and usage of structures, declaring structures, assigning of structures, Pointers: Introduction, Address operator, and Basic programs using pointers, File handling, sequential and random-access files, Memory allocation, Command line parameters.

References:

1. Thareja R., "Computers Fundamentals and Programming in C," Oxford University Press 3rd Edition, 2023, ISBN-10: 9354977898
2. Kanetkar Y., "Let Us C: Authentic Guide to C Programming Language," BPB Publications, 20th Edition, 2024, ISBN-10: 9355515510
3. Ram B. and Kumar S., "Computer Fundamentals: Architecture and Organization," New Age International Private Limited, 6th Edition, 2020, ISBN-10: 9388818555
4. Balagurusamy E., "Computing Fundamentals and C Programming," McGraw Hill Education, 2nd Edition, 2017, ISBN-10: 9352604164

Course Outcomes:

At the end of this course, the students will be able to:

CO1	Explain about computer system, components of IT system and different ways of data representation
CO2	Differentiate among computer hardware, computer software, and memories
CO3	Write C programs based on algorithm and flowchart
CO4	Implement algorithms using array and functions of C programming language
CO5	Demonstrate the use of structures and pointers in C programming language

Course Code	:	COES213
Course Title	:	IT Systems and Computer Programming Lab
Number of Credits	:	2 (L: 0, T: 0, P: 4)
Corequisites	:	IT Systems and Computer Programming
Course Category	:	ES

Course Objectives:

- Understand the functionalities of various MS office tools such as Word, PowerPoint, and Excel, for document creation and presentations.
- Apply C programming concepts such as decision-making, loops, and arrays for problem-solving.
- Write C programs using functions, graphics, structures, and pointers to manipulate data and generate visual outputs.

List of Experiments / Programs:

1. Identify various word options dialog and make your resume to showcase your skills and experience.
2. Make a question paper of applied mathematics of your course using equation editor of word.
3. Make a power point presentation to discuss the importance of IT systems and computer programming.
4. Design a spreadsheet using Excel to convert Celsius to Fahrenheit and Fahrenheit to Celsius.
5. Write an algorithm and program in C to check whether a given number is even or odd.
6. Write an algorithm and program in C to input marks of five subjects, i.e., Physics, Applied Mathematics, Information Technology, Digital Electronics, and Workshop; and compute the percentage as well as grade according to the following conditions: If percentage >= 90%: Grade A; If percentage >= 80%: Grade B; If percentage >= 70%: Grade C; If percentage >= 60%: Grade D; If percentage >= 40%: Grade E; If percentage < 40%: Grade F (Failed). Modify this program using logical AND operator.
7. Draw a flowchart to print the multiplication table of a number entered by the users; also write a program for generating the multiplication table using different types of loops.
8. Write an algorithm and program in C to add "n" numbers using two- dimensional array.
9. Write a program in C using function to calculate the factorial of a given number.
10. Write a program in C to draw any two-dimensional object using built-in graphics functions.
11. Write a program in C using structure to store and display the information of a book.

12. Write a program in C using pointers to swap two numbers entered by the user.

Course Outcomes:

At the end of this course, the students will be able to:

CO1	Design professional documents, presentations, and spreadsheets using MS office tools.
CO2	Develop C programs using control structures, different types of loops, and arrays.
CO3	Implement various types of problems using functions, structures, pointers, and graphics.

Course Code:	:	ECES204
Course Title	:	Fundamentals of Electronics Engineering
Number of Credits	:	2 (L: 2, T: 0, P: 0)
Prerequisites	:	Semiconductor Physics
Course Category	:	ES

Course Objectives:

- To get the ideas about the applications of electronics engineering in different fields of life.
- To gain in-depth knowledge of p-n junction diode and its applications in electronic switching and rectifier circuits.
- To explore the idea of electronic filtration process by using various filter circuits.
- To gain knowledge about the zener diode and its application in voltage regulator.
- To get familiarized with bipolar junction transistor and its applications in electronic switching and amplifier circuits.

Course Contents:

Unit– I PN Junction Diode

PN Junction diode, Depletion layer, Potential barrier, Behavior of P-N junction diode under forward and reverse bias, Cut-in voltage, Reverse saturation current, V-I characteristics, Breakdown phenomenon, Static and dynamic resistance and their calculations from diode characteristics, Dynamic resistance of the diode in terms of diode current, Diode ratings and specifications.

Unit– II Rectifiers and Filters

Rectifier circuits, Principle of operation and output waveforms of half wave rectifier, centre tapped and bridge type rectifier, Average value and RMS value of output voltage and load current, Performance analysis of rectifier circuits: ripple factor and rectification efficiency, Filter circuits, Shunt capacitor filter, Series inductor filter, L-type and pie type filter, Physical explanation of working of the shunt capacitor and series inductor filter and their suitability.

Unit– III Special Purpose Diodes

Zener diode: construction and operation, zener and avalanche breakdown mechanism, V-I characteristics, Zener ratings: zener voltage, minimum zener current, maximum zener current, maximum zener power dissipation and zener resistance, Application of Zener diode in voltage regulator circuit, Brief description with V-I characteristics and applications of varactor diode and light emitting diode.

Unit– IV Bipolar Junction Transistor

Concept of bipolar junction transistor as a two junction three terminal device, NPN and PNP transistor, Principle of operation of transistor, Transistor current relation, Different configurations: CB, CE, and CC, concept of leakage current and effect of temperature on it, input and output characteristics, Determination of input, output dynamic resistances and current amplification factor from the characteristics, Comparison of the three configurations.

Unit– V Amplifier and Biasing Circuits

Transistor as an amplifier in CE configuration, DC equivalent circuit, DC load line and operating point, Factors affecting operating point, Thermal runway condition of transistor, Effect of fixing operating point in cut off and saturation region, Different biasing circuits: Fixed biasing, collector to base biasing, potential divider biasing and emitter biasing circuit, Calculation of operating point for these biasing circuits, Merits and demerits.

References:

1. N. N. Bhargava, D. C. Kulshrestha, S. C. Gupta, Basic Electronics and Linear Circuits, Tata McGraw-Hill Publishing Company Limited, New Delhi.
2. V. K. Mehta, Rohit Mehta, Principles of Electronics, S. Chand and Company, New Delhi.
3. Albert Malvino, David Paul, Electronics Principles, McGraw Hill Education, New Delhi.
4. R. S. Sedha, A Text Book of Applied Electronics, S. Chand and Company, New Delhi.
5. David Bell, Fundamental of Electronic Devices and Circuits, Oxford University Press.

Course Outcomes:

At the end of the course, the student will be able to:

CO1	Explain the construction, working and characteristics of p-n junction diodes.
CO2	Gain knowledge about the rectifier and filter circuits in converting ac signal into smooth dc signal.
CO3	Develop the ability to understand the application of zener diode in voltage regulator circuit.
CO4	Gain in-depth knowledge about the construction, working and characteristics of bipolar junction transistor.
CO5	To understand the applications of bipolar junction transistor in switching and amplification.

Course Code	:	ECES214
Course Title	:	Fundamentals of Electronics Engineering Lab
Number of Credits	:	1 (L: 0, T: 0, P: 2)
Prerequisites	:	Fundamentals of Electronics Engineering Theory
Course Category	:	ES

Course Objectives:

- To develop understanding of characteristics of p-n junction, zener and light emitting diode in different biasing conditions.
- To analyze the performance of various rectifiers without and with different filter circuits.
- To plot input and output characteristics curves for common base and common emitter bipolar junction transistor.

List of Experiments:

1. To draw V-I characteristics of p-n junction diode and to calculate its static and dynamic resistances in forward and reverse bias conditions.
2. To draw V-I characteristics of zener diode and to calculate its static and dynamic resistances in forward and reverse bias conditions.
3. To draw V-I characteristics of light emitting diode and to calculate its static and dynamic resistances in forward and reverse bias conditions.
4. To calculate ripple factor for half wave rectifier without filter and with filters.
5. To calculate ripple factor for centre-tap full wave rectifier without filter and with filters.
6. To calculate ripple factor for bridge type full wave rectifier without filter and with filters.
7. To draw input characteristics for common base transistor and to calculate its static and dynamic resistances.
8. To draw output characteristics for common base transistor and to calculate its static and dynamic resistances.
9. To draw input characteristics for common emitter transistor and to calculate its static and dynamic resistances.
10. To draw output characteristics for common emitter transistor and to calculate its static and dynamic resistances.

Course Outcomes:

At the end of the course, the student will be able to:

CO1	To calculate static and dynamic resistance of various semiconductor diodes in forward and reverse bias conditions.
CO2	To measure and calculate the ripple factor produced by various rectifiers without and with different filter circuits.
CO3	To compute static and dynamic input and output resistances of bipolar junction transistor.

Course Code	:	EEBS205
Course Title	:	Applied Mathematics-II
Number of Credits	:	3 (L:2, T:1, P:0)
Prerequisites	:	Nil
Course Category	:	BS

Course Objectives:

- Develop mathematical foundations.
- Explore advanced problem-solving techniques.
- Understand and apply geometrical and analytical Concepts.
- Develop the ability to solve first- and second-order differential equations.
- Enhance computational skills in vectors.

Course Contents:

Unit– I Differential Calculus

Concept of limits and continuity (without problems), Four standard limits: $\lim_{n\to a}\frac{x^n-a^n}{x-a}$, $\lim_{x\to 0}\frac{\sin x}{x}$, $\lim_{x\to 0}\frac{a^x-1}{x}$, and $\lim_{x\to 0}(1+x)^{\frac{1}{x}}$. Differentiation of functions by first principle, Differentiation of sum, difference, product and quotient of two functions, Differentiation of function of a function (Chain rule), Differentiation of trigonometric and inverse trigonometric functions, Logarithmic differentiation, Higher order derivatives (or successive differentiation).

Unit– II Integral Calculus

Integration as inverse operation of differentiation, Simple integration by substitution**,** by parts and by partial fractions. Use of $\int_0^{\frac{\pi}{2}}\sin^m x\cos^n x\,dx$ for solving problems, where *m* and *n* are positive integers. Evaluation of definite integral. Properties of definite integral, area bounded by a curve between two ordinates and *x*-axis.

Unit– III Co-ordinate Geometry of Two Dimensions

Definition of locus with problems, Equations of straight lines in various forms. Angle between two lines, Perpendicular distance formula, Study of properties of Circle, Parabola, Ellipse and Hyperbola.

Unit– IV Ordinary Differential Equations

Ordinary differential equation, Order and degree of differential equations, Solution of differential equations of first order and first degree, Variable separable, Homogeneous and

Linear differential equations, Complementary function and Perticular integral of linear differential equations of 2nd order with constant coefficient.

Unit– V Vectors

Scalars and vectors, addition and subtraction of vectors and their simple applications, multiplication of a vector by a scalar, Scalar and vector product of two vectors and their simple applications. Scalar product of three vectors and its geometrical interpretation.

References:

1. H.K. Dass, Rama Verma & Rajnish Verma, Mathematics for Polytechnics, CBS Publishers.
2. R.D. Sharma, Applied Mathematics, DhanPat Rai Publications.
3. Deepak Singh, Mathematics-I, Khanna Book Publishing Co. (P) Ltd.
4. Garima Singh, Mathematics-II, Khanna Book Publishing Co. (P) Ltd.

Course Outcomes:

The students will be able to:

CO1	Use the concept of limits and differentiation to find derivatives of functions, including applications of sum, difference, product, quotient, chain rule, and differentiation of trigonometric, inverse trigonometric, and logarithmic functions.
CO2	Apply integration techniques such as substitution, integration by parts, and partial fractions to evaluate integrals, and understand the properties of definite integrals for finding areas and solving related problems.
CO3	Analyze and solve problems related to the equations of straight lines, conic sections, and loci, and apply the properties of geometric shapes like circles, parabolas, ellipses, and hyperbolas.
CO4	Formulate and solve ordinary differential equations of first and second order, including separable, homogeneous, and linear equations, and find complementary functions and particular integrals.
CO5	Understand and perform operations on vectors, including addition, subtraction, scalar multiplication, scalar and vector products, and apply these operations in geometric contexts and real-world applications.

Course Code:	:	MEES216
Course Title	:	Engineering Graphics
Number of Credits	:	2 (L: 0, T: 0, P: 4)
Prerequisites	:	NIL
Course Category	:	ES

Course Objectives:

- To understand the language of graphics which is used to express ideas, convey instructions while carrying out engineering jobs.
- To develop drafting and sketching skills, to know the applications of drawing equipment and get familiarize with Indian Standards related to engineering drawings.
- To develop skills to visualize actual object and to draw, read various engineering curves, projections, dimensioning styles, and understand common symbols used in engineering.

Course Contents:

Introduction to Engineering Drawing

Drawing Instruments and supporting materials, Sizes and layout of standard drawing sheets, Sizes of drawing boards, Method to use them with applications.

Lines

Convention of lines and their applications, Different types of lines in engineering drawing as per BIS Specifications, Practice of vertical, horizontal and inclined lines.

Lettering

Free hand and instrumental lettering (Alphabet and numerals) – upper case (Capital Letter), single stroke, vertical and inclined at 75 degrees, series of 5,8,12 mm of free hand and instrumental lettering of height 25 to 35 mm in the ratio of 7:4.

Dimensioning Techniques

Necessity of dimensioning, Dimensioning techniques as per BIS (Board of Indian standard) SP-46:2003 – types and applications of chain, parallel and coordinate dimensioning. Dimensioning of overall sizes, circles, threaded holes, chamfered surfaces, angles, tapered surfaces, holes, equally spaced on P.C.D., counter sunk holes, counter bored holes, cylindrical parts, narrow spaces and gaps, radii, curves and arches.

Scales

Scales and their need and importance, type of scales, Representative Fractions – reduced, enlarged and full-size scales; Engineering Scales such as plain, diagonal scale and Vernier scale.

Geometrical Constructions

Construction of ellipse, parabola and hyperbola by eccentricity method and other methods, cycloids, epicycloids and hypocycloids, regular polygons, involute.

Projections

Introduction to projections. Basic concepts of projection techniques, projection of points and lines. Projection of Points in different quadrant, Projection of Straight Line (First angle and Third angle) Line parallel to both the planes, Line perpendicular to any one of the reference planes, Line inclined to any one of the reference planes.

Common Symbols and Conventions used in Engineering

Important Terms used in Building Drawing, Civil Engineering sanitary fitting symbols, Electrical fitting symbols for domestic interior installations.

S. No.	Practical Exercises
1	Draw horizontal, Vertical, 30-degree, 45 degrees, 60- and 75-degrees lines, different types of lines, dimensioning styles using Tee and Set squares/ drafter.
2	Letter writing single stroke and double stoke
3	Drawing of scales: plain, diagonal and vernier
4	Draw ellipse, parabola, and hyperbola by eccentricity method
5	Draw ellipse by arcs of a circle, oblong and concentric circle methods
6	Draw parabola and hyperbola using other methods
7	Draw regular polygons and involute
8	Draw various figures on projections of points
9	Draw some problems on projection of lines
10	Common symbols and conventions used in Engineering

References:

1. Bhatt, N. D. Engineering Drawing. Charotar Publishing House, Anand, Gujrat
2. P S Gill, Engineering Drawing, SK Kataria and sons. Delhi.
3. Bureau of Indian Standards. Engineering Drawing Practice for Schools and Colleges IS: Sp-46. BIS. Government of India, Third Reprint, October 1998
4. Jain & Gautam, Engineering Graphics & Design, Khanna Publishing House, New Delhi
5. Siddiquee, Arshad N. , Khan, Zahid A. , Ahmad, Mukhtar Engineering Drawing With A Primer On Autocad, PHI Learning Pvt. Ltd.
6. Jolhe, D. A. Engineering Drawing. Tata McGraw Hill Edu. New Delhi, 2010.
7. Dhawan, R. K. Engineering Drawing. S. Chand and Company, New Delhi.
8. Shah, P. J. Engineering Drawing. S. Chand and Company, New Delhi, 2008.
9. Kulkarni, D. M.; Rastogi, A. P.; Sarkar, A. K. Engineering Graphics with AutoCAD. PHI Learning Private Limited-New Delhi (2010).
10. Jeyapoovan, T. Essentials of Engineering Drawing and Graphics using AutoCAD. Vikas Publishing House Pvt. Ltd, Noida, 2011.

Course Outcomes:

The student will be able to:

CO1	Draw lines and letter writing in single and double stroke.
CO2	Select and construct appropriate drawing scales, use drawing equipment's, and understand Indian Standards of engineering drawing.
CO3	Construct the various curves, draw views of given object and understand engineering convention used in drawing.

Course Code	:	EEAU200
Course Title	:	Environmental Science
Number of Credits	:	0 (non-credit) (L: 2, T: 0, P: 0)
Prerequisites	:	High School Science
Course Category	:	AU

Course Objectives:

Technicians working in industries or elsewhere essentially require the knowledge of environmental science so as to enable them to work and produce most efficient, economical and eco-friendly finished products.

- Solve various engineering problems applying ecosystem to produce eco – friendly products.
- Use relevant air and noise control method to solve domestic and industrial problems.
- Use relevant water and soil control method to solve domestic and industrial problems.
- To recognize relevant energy sources required for domestic and industrial applications.
- Solve local solid and e-waste problems.

Course Contents:

Unit– I Ecosystem

Structure of ecosystem, Biotic & Abiotic components Food chain and food web Aquatic (Lentic and Lotic) and terrestrial ecosystem Carbon, Nitrogen, Sulphur, Phosphorus cycle.
Global warming -Causes, effects, process, Green House Effect, Ozone depletion

Unit– II Air and Noise Pollution

Definition of pollution and pollutant, Natural and manmade sources of air pollution (Refrigerants, I.C., Boiler)

Air Pollutants: Types, Particulate Pollutants: Effects and control (Bag filter, Cyclone separator, Electrostatic Precipitator)

Gaseous Pollution Control: Absorber, Catalytic Converter, Effects of air pollution due to Refrigerants, I.C., Boiler
Noise pollution: sources of pollution, measurement of pollution level, Effects of Noise pollution, Noise pollution (Regulation and Control) Rules, 2000

Unit– III Water and Soil Pollution

Sources of water pollution, Types of water pollutants, Characteristics of water pollutants Turbidity, pH, total suspended solids, total solids BOD and COD: Definition, calculation

Waste Water Treatment: Primary methods: sedimentation, froth floatation, Secondary methods: Activated sludge treatment, Trickling filter, Bioreactor, Tertiary Method: Membrane separation technology, RO (reverse osmosis).
Causes, Effects and Preventive measures of Soil Pollution: Causes-Excessive use of Fertilizers, Pesticides and Insecticides, Irrigation, E-Waste.

Unit– IV Renewable Sources of Energy

Solar Energy: Basics of Solar energy. Flat plate collector (Liquid & Air). Theory of flat plate collector. Importance of coating. Advanced collector. Solar pond. Solar water heater, solar dryer. Solar stills.
Biomass: Overview of biomass as energy source. Thermal characteristics of biomass as fuel. Anaerobic digestion. Biogas production mechanism. Utilization and storage of biogas.
Wind energy: Current status and future prospects of wind energy. Wind energy in India. Environmental benefits and problem of wind energy.
New Energy Sources: Need of new sources. Different types new energy sources. Applications of (Hydrogen energy, Ocean energy resources, Tidal energy conversion.) Concept, origin and power plants of geothermal energy.

Unit– V Solid Waste Management, ISO 14000 & Environmental Management

Solid waste generation- Sources and characteristics of: Municipal solid waste, E- waste, biomedical waste.
Metallic wastes and Non-Metallic wastes (lubricants, plastics, rubber) from industries.
Collection and disposal: MSW (3R, principles, energy recovery, sanitary landfill), Hazardous waste.
Air quality act 2004, air pollution control act 1981 and water pollution and control act1996.
Structure and role of Central and state pollution control board.
Concept of Carbon Credit, Carbon Footprint. Environmental management in fabrication industry. ISO14000: Implementation in industries, Benefits.

References:

1. S.C. Sharma & M.P. Poonia, Environmental Studies, Khanna Publishing House,NewDelh
2. Arceivala, Soli Asolekar, Shyam, Waste Water Treatment for Pollution Control and Reuse, Mc-Graw illiam, Cohen, Lisa, Environmental Engineering Science, Willy, New York, 2000, ISBN 10: 0471144940.
3. Rao, M. N. Rao, H.V.N, Air Pollution, Tata Mc-Graw Hill Publication, New delhi, 1988, ISBN: 0-07-451871-8.
4. Aldo Vieira, Da Rosa, Fundamentals of renewable energy processes, Academic Press Oxford, UK; 2013. ISBN: 9780123978257.
5. Patvardhan, A.D, Industrial Solid Waste, Teri Press, New Delhi, 2013, ISBN:978-81-

7993-502-6

6. Metcalf & Eddy, Waste Water Engineering, Mc-Graw Hill, New York, 2013, ISBN: 077441206.

Course Outcomes:

At the end of the course, the student will be able to:

CO1	Understand the ecosystem and terminology and solve various engineering problems applying ecosystem knowledge to produce eco – friendly products.
CO2	Explain the suitable air, extent of noise pollution, and control measures and acts
CO3	Observe the water and soil pollution, and control measures and acts
CO4	Distiguish different renewable energy resources and efficient process of harvesting.
CO5	Understand solid Waste Management, ISO 14000 & Environmental Management.

Course Code:	:	EEPC301
Course Title	:	Electrical Measurements & Measuring Instruments
Number of Credits	:	3 (L: 2, T: 1, P: 0)
Prerequisites	:	Fundamentals of Electrical Engineering
Course Category	:	PC

Course Objectives:

- To understand the concepts and different methods of electrical measurements.
- To understand the working principle, types & construction of electrical instruments.
- To use relevant measuring instrument for particular electrical applications.
- To extend the range of ammeters and voltmeters using techniques such as shunts, multipliers, current transformers (CT), and potential transformers (PT).
- To understand the concepts of bridge circuits for measurement of resistance, inductance, capacitance and frequency.

Course Contents:

Unit– I Fundamentals of Electrical Measurements

Important terms (accuracy, precision, resolution, sensitivity), Types of errors and their calculations, Calibration and its need, Classification of measuring instruments, Essential requirements of indicating instruments.

Unit– II Measurement of Voltage and Current

Principle of operation, construction and working of moving coil and moving iron instruments, Electrostatic instruments, Multiplying factor and extension of range of instruments, Current transformer & potential transformer.

Unit– III Measurement of Electrical Power & Energy

Construction and working of electrodynamometer type wattmeter, Measurement of three phase power, Construction and working of single phase energy meter, errors and their compensation.

Unit– IV Measurement of Resistance

Measurement of low resistance (ammeter voltmeter method, Kelvin's double bridge), Measurement of medium resistance (substitution method, Wheatstone bridge method), Measurement of high resistance (deflection method, loss of charge method), Multimeter.

Unit– V AC Bridges

Basic principle of AC Bridges, Quality factor, Measurement of inductance (Hay's bridge, Maxwell's bridge, Anderson's bridge), Measurement of capacitance and frequency (Wien's bridge and Schering's bridge). Frequency meter.

References:

1. K. Sawhney, Electrical and Electronic Measurement & Instrumentation, Dhanpat Rai and Sons, New Delhi.
2. V. N. Mittle, Basic Electrical Engineering, Tata McGraw Hill, New Delhi.
3. H.S. Kalsi, Electronic Instrumentation, Tata McGraw Hill.
4. W.D. Cooper, Modern Electronic Instrumentation and Measuring Techniques, Prentice Hall India.
5. E.W. Golding, Electrical Measurements and Measuring Instruments, Reem Publications Pvt. Ltd

Course Outcomes:

At the end of the course, the student will be able to:

CO1	Learn the concepts of electrical measurements and instruments, and know the definition and significance of various terms used in measurements.
CO2	Understand the construction and working of instruments to measure various electrical quantities such as voltage and current, power and energy.
CO3	Extension of range of the instruments for measurement of higher value parameters using methods such as, shunts, multipliers, current and potential transformer.
CO4	Know the ranges of low, medium and high resistances and various methods of their measurements and also able to choose a specific method for particular range.
CO5	Use different bridge circuits for various applications such as measurement of inductance, capacitance and frequency.

Course Code:	:	EEPC311
Course Title	:	Electrical Measurements & Measuring Instruments Lab
Number of Credits	:	1(L: 0, T: 0, P: 2)
Prerequisites	:	Electrical Measurements & Measuring Instruments
Course Category	:	PC

Course Objectives:

- To familiarize students with the calibration of electrical measurement instruments like energy meters.
- To extend the measurement range of ammeters and voltmeters using techniques such as shunts, multipliers, current transformers (CT), and potential transformers (PT).
- To measure electrical parameters like resistance, inductance, and capacitance using bridge circuits.

List of Experiments:

1. To calibrate the single phase Energy meter.
2. To extend the range of ammeter and voltmeter using (i) shunt and multiplier (ii) CT and PT.
3. To measure the low resistance using Kelvin's bridge.
4. To measure the inductance using Hay's bridge.
5. To measure the inductance using Maxwell's bridge.
6. To measure the inductance using Anderson's bridge.
7. To measure the capacitance and frequency using Wien's bridge.

Course Outcomes:

At the end of the course, the student will be able to:

CO1	Calibrate energy meter to ensure accurate measurements.
CO2	Apply techniques to extend the measurement range of ammeters and voltmeters for high-current and high-voltage applications.
CO3	Measure resistance, inductance, capacitance and frequency using bridge circuits and analyze the results.

Course Code:	:	ECPC302
Course Title	:	Digital Electronics & Microprocessors
Number of Credits	:	3 (L: 2, T: 1, P: 0)
Prerequisites	:	Fundamentals of Electronics Engineering
Course Category	:	PC

Course Objectives:

- To introduce students to the fundamentals of digital electronics including number systems, binary codes and the advantages of digital systems over analog systems.
- To develop an understanding of logic gates, Boolean algebra and simplification techniques for designing efficient digital circuits.
- To enable students to design and analyze combinational circuits such as adder, subtractor, multiplexer and encoder.
- To familiarize students with sequential circuits including flip-flops, counters, shift registers and their real-world applications.
- To provide foundational knowledge of microprocessor systems focusing on the architecture and pin diagram.

Course Contents:

Unit– I Number Systems and Logic Gates

Difference between analog and digital signals, Types of number systems (Radix, Symbols): Binary, octal, decimal and hexadecimal, Representation of binary number system: 1's and 2's complements, BCD code, Excess-3 code and Gray code, Concept of logic gates: Graphical symbols, algebraic forms and truth tables, Basic logic gates: AND, OR and NOT, Universal gates: NAND and NOR: Graphical symbols, algebraic forms, truth tables and realization of logic gates using NAND and NOR gates, Ex-OR and Ex-NOR gates: Graphical symbols, algebraic forms and truth tables.

Unit– II Boolean Algebra

Boolean algebra relations: Commutative laws, associative laws, distributive laws, AND laws, OR laws, Double inversion law, De Morgan's theorem, Simplifications of Boolean expressions using Boolean laws and theorem, Karnaugh map (K-map): Sum of product in terms of Minterms, Product of sum in terms of Maxterms, Karnaugh map construction and properties, Minimization of the Boolean function using K-map.

Unit– III Combinational Logic Circuits

Introduction to combinational circuits, Arithmetic circuits: Half adder, full adder, half subtractor and full subtractor, Multiplexers (MUX) and Demultiplexers (DEMUX), Encoders and decoders.

Unit– IV Sequential Logic Circuits

Introduction to sequential circuits, SR flip-flop, JK flip-flop, D flip-flop and T flip-flop, Counters: Synchronous and asynchronous, Applications of counters, Shift registers, Shift register operations: Serial in – serial out, serial in – parallel out, parallel in – serial out and parallel in – parallel out.

Unit– V Microprocessors

Evolution of microprocessors, Functional bock diagram and pin diagram of 8085 microprocessor, Accumulator, Program Counter, Instruction Register and Instruction Decoder, Arithmetic Logic Unit, General Purpose Registers, Status Registers, Stack Pointer, Index Register, Timing and Control circuitry of 8085 microprocessor, Features of 8086 microprocessor and its comparison with 8085.

References:

1. M. Morris Mano, Digital Design, Pearson Education, India.
2. R. P. Jain, Modern Digital Electronics, McGraw Hill Publication, New Delhi.
3. Ramesh S. Gaonkar, Microprocessor Architecture, Programming and Application with 8085, New Age International Publication, New Delhi.
4. Thomas L. Floyd, Digital Electronics, Pearson Publication, India.
5. M. Morris Mano, Digital Logic and Computer Design, Pearson Education India.

Course Outcomes:

At the end of the course, the student will be able to:

CO1	Explain the difference between analog and digital signals and use of different number systems.
CO2	Design and simplify logical expressions using Boolean algebra and K-map techniques to create efficient digital systems.
CO3	Develop combinational logic circuits such as adders, subtractors, multiplexers and encoders and implement them practically.
CO4	Understand and design sequential circuits including flip-flops, counters and shit registers and apply them in real-world scenarios.
CO5	Describe the architecture and operation of the microprocessors.

Course Code:	:	ECPC312
Course Title	:	Digital Electronics & Microprocessors Lab
Number of Credits	:	1 (L: 0, T: 0, P: 2)
Prerequisites	:	Digital Electronics & Microprocessors Theory
Course Category	:	PC

Course Objectives:

- To gain knowledge of fundamental logic gates.
- To design and implement combinational circuits as adders and subtractors.
- To gain hand-on experience with digital integrated circuits.

List of Experiments:

1. To verify the truth tables of basic logic gates (AND, OR and NOT).
2. To verify the truth tables of universal gates (NAND and NOR.
3. To design and verify the truth tables of basic logic gates by using NAND gate.
4. To design and verify the truth tables of basic logic gates by using NOR gates.
5. To design and verify the truth tables of Ex-OR gate by using NAND gates.
6. To design and verify the truth tables of Ex-NOR gate by using NOR gates.
7. To design and verify the circuit and truth table of Half Adder.
8. To design and verify the circuit and truth table of Full Adder.
9. To design and verify the circuit and truth table of Half Subtractor.
10. To design and verify the circuit and truth table of Full Subtractor.

Course Outcomes:

At the end of the course, the student will be able to:

CO1	Verify the truth tables of all basic and universal gates.
CO2	Design adder and subtractor circuits using logic gates and verify their functioning.
CO3	Design circuits using digital ICs and verify their working.

Course Code:	:	EEPC303
Course Title	:	Electrical Circuits And Analysis
Number of Credits	:	3 (L: 2, T: 1, P: 0)
Prerequisites	:	Fundamentals of Electrical Engineering
Course Category	:	PC

Course Objectives:

- To understand network terminology and basic circuit elements.
- To analyse DC and AC circuits using KCL, KVL, and phasor algebra.
- To apply concepts of single-phase and three-phase AC circuits.
- To solve numerical problems related to AC circuits and network analysis.
- To apply network theorems to simplify and analyse complex circuits.

Course Contents:

Unit– I Network Terminology

Basic circuit element, dependent and independent sources, KCL & KVL, its application in solving D.C. circuits, Mesh and Nodal Analysis.

Unit– II AC Fundamentals

Generation of alternating Voltage and Current, important terminology: Peak value, RMS value, Average value of current and voltage, Form Factor & Peak Factor, phase and phase difference, addition of alternating quantities, AC circuit containing pure resistance, pure inductance, pure capacitance. Numerical problems

Unit– III Single Phase AC Circuits

RL, RC and RLC series and parallel circuit, impedance triangle, phasor algebra, rectangular and polar conversion, addition, subtraction, division and multiplication, different methods for solving series and parallel circuits, series and parallel resonance, numerical problems.

Unit– IV Polyphase Circuits

Concept of generation of 3-phase voltage, advantage of 3-phase over 1-phase, Star-Delta connection (relationship between phase and line values of current & voltage), Expression for power measurement by 2-Wattmeter Method & 3-Wattmeter Method, numerical problems.

Unit– V Network Theorems

Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem and their applications, Star-Delta Conversion, Numerical Problems.

References:

1. Basic Electrical Engineering by V.K Mehta & Rohit Mehta, S Chand Publication.
2. Fundamentals of Electrical Engineering, Ashfaq Husain & Haroon Ashfaq, Dhanpat Rai & Co.
3. Basic Electrical Engineering by C L Wadhwa, New Age International Publishers.
4. Ashfaq Husain, Networks & Systems, Khanna Book Publishing, New Delhi.
5. Gupta, B.R; Singhal, Vandana;, Fundamentals of Electrical Network, S.Chand and Co., New Delhi, ISBN : 978-81-219-2318-7
6. Saxena, S.B Lal; Dasgupta, K; Fundamentals of Electrical Engineering, Cambridge University

Course outcomes:

At the end of the course, the student will be able to:

CO1	Analyse DC and AC circuits using fundamental laws.
CO2	Apply phasor algebra to solve single-phase AC circuits.
CO3	Understand three-phase AC circuits and power measurement.
CO4	Apply network theorems to simplify complex circuits.
CO5	Solve numerical problems related to circuit analysis.

Course Code:	:	EEPC313
Course Title	:	Electrical Circuits And Analysis Lab
Number of Credits	:	1 (L: 0, T: 0, P: 2)
Prerequisites	:	Electrical Circuits And Analysis
Course Category	:	PC

Course Objectives:

This course aims to help students acquire industry-recognized competencies through various teaching and learning experiences.

- Familiarizing students with the measurement and analysis of active, reactive, and apparent power, as well as power factor, in R-L, R-C, and R-L-C AC series circuits using a voltmeter, ammeter, and wattmeter, and teaching them to draw the impedance triangle.
- Developing skills in applying mesh and node analysis for determining currents in electrical networks.
- Providing practical knowledge of circuit theorems like Superposition, Thevenin's, Norton's, and Maximum Power Transfer theorem for electrical circuit analysis.

List of Experiments:

1. Use voltmeter, ammeter, wattmeter to determine active, reactive and apparent power consumed in given R-L series circuit. Draw its Impedance Triangle and determine the power factor.
2. Use voltmeter, ammeter to determine active, reactive and apparent power consumed in given R-C series circuit. Draw its Impedance Triangle and determine the power factor.
3. Use voltmeter, ammeter, wattmeter to determine active, reactive and apparent power consumed in given R-L-C series circuit. Draw its Impedance Triangle and determine the power factor.
4. Use voltmeter, ammeter to determine current through the given branch of an electric network by applying mesh analysis.
5. Use voltmeter, ammeter to determine current through the given branch of an electric network by applying nodal analysis.
6. To determine equivalent circuit parameter in a given circuit by applying superposition theorem.
7. To determine equivalent circuit parameter in a given circuit by applying Thevenin's theorem.

8. To determine equivalent circuit parameter in a given circuit by applying Norton's theorem.
9. To determine equivalent circuit parameter in a given circuit by applying Maximum Power Transfer theorem.

Course Outcomes:

Upon successful completion of this course, students will be able to:

CO1	Determine active, reactive, and apparent power in ac series circuits, calculate the power factor, and draw impedance triangles.
CO2	Students will effectively apply mesh and nodal analysis to calculate currents in electrical networks.
CO3	Students will apply Superposition, Thevenin's, Norton's and Maximum Power Transfer theorems to find equivalent circuit parameters and simplify complex circuits.

Course Code:	:	EEPC304
Course Title	:	Electric Power Transmission and Distribution
Number of Credits	:	3 (L: 2, T: 1, P: 0)
Prerequisites	:	Basic Electrical Engineering
Course Category	:	PC

Course Objectives:

The aim of this course is to enable students to develop the industry-recognized competencies through a variety of teaching and learning experiences.

- To gain a clear understanding of transmission lines, their components, and the factors that influence their design.
- To gain knowledge of the key parameters influencing transmission lines such as resistance, inductance, capacitance, and conductance.
- To learn about the different types of transmission lines and how to calculate and interpret their parameters, and understand how these factors impact the performance and efficiency of power transmission
- To acquire a thorough understanding of the principles and components involved in the distribution of electrical energy.
- To understand the basics of High Voltage Direct Current (HVDC) and Extra High Voltage Alternating Current (EHVAC) transmission systems.

Course Contents:

Unit – I Electrical Supply System

Single line diagrams with components of the electric supply transmission and distribution systems. Classification of transmission lines, Comparison of AC/DC transmission systems. Main components of transmission line i.e. tower, conductors, and overhead line insulators. Potential distribution over suspension insulator string, string efficiency and methods of improving string efficiency, sag calculation of equal supports, Characteristics of high voltage for power transmission and its advantages, Kelvin's law.

Unit– II Transmission Line Parameters

Identification of Line parameters, R, L, C & G, Calculation of line parameters, Skin and Proximity effect, Corona, Corona losses and other effects.

Unit – III Transmission Line Performance

Parameters of performance of transmission lines, Efficiency and regulation of line, performance of 1-phase short transmission line, Effect of load power factor on performance, and Phasor diagram for different power factor, Medium transmission lines- Nominal **T** & **π-**

models, A, B, C & D parameters of short and medium lines. Elementary idea of long transmission line, Ferranti effect.

Unit– IV Distribution of Electrical Energy

Introduction, Classification of distribution system, A.C distribution, Connection schemes of distribution system, Requirements of Distribution systems, Design consideration, A.C. distribution calculation, Methods of solving A.C. 1-phase & 3-phase connected (balanced) distribution system, Underground cables, Introduction and requirements, Classification of cables, cable conductors, cable construction, cable insulation, Metallic sheathing and mechanical protection, Comparison with Overhead lines, Cable laying.

Unit– V HVDC and EHVAC Transmission

Introduction to High Voltage DC (HVDC) Transmission Line**,** Component of an HVDC transmission system, D C systems, applications of HVDC systems, limitations of A C transmission, economic comparison, advantages and limitation of HVDC transmission, classification of HVDC links. Basics of Extra High Voltage AC (EHVAC) transmission line. Lines in India, Single Line diagram (layout) of 33/11KV Sub-Station, 11KV/400V sub-station, Symbols and functions of their components.

References:

1. Mehta, V.K., Principles of Power System, S. Chand and Co., New Delhi.
2. Ashfaq Husain, Electrical Power Systems, C B S Publishers & Distributors Pvt. Ltd
3. Wadhwa C. L., Electrical Power Systems, New Academic Science Limited, UK.
4. Ned Mohan, Electrical Power System: A First Course, Wiley India Pvt. Ltd. New Delhi.
5. D. P. Kothari, I. J. Nagrath, Power System Engineering, McGraw-Hill, India.

Course Outcomes:
By the end of this course, students will be able to:

CO1	Understand and describe Transmission line fundamentals. Also gain an understanding of conductors and power cables, including their types and properties.
CO2	Calculate and analyse line parameters of transmission lines and their impact on power transmission.
CO3	Assess the performance of transmission lines under various operating conditions, including voltage drop, power losses, and efficiency.
CO4	Design and evaluate electrical distribution systems.
CO5	Understand the key components, working principles, and benefits of HVDC (High Voltage Direct Current) and EHVAC (Extra High Voltage Alternating Current) systems.

Course Code:	:	EEPC314
Course Title	:	Electric Power Transmission and Distribution Lab
Number of Credits	:	1 (L: 0, T: 0, P: 2)
Prerequisites	:	Electric Power Transmission and Distribution
Course Category	:	PC

Course Objectives:

This course aims to help students acquire industry-recognized competencies through various teaching and learning experiences.

- Providing students with a thorough understanding of transmission line networks, including their components, performance parameters, and design.
- Offering hands-on experience in studying electrical distribution systems and substations, enhancing skills in analyzing and designing transmission and distribution networks.
- Introducing students to electrical transmission systems like HVDC and EHVAC, focusing on their principles and applications.

Course contents:

Following are the suggested student-related co-curricular activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a. Prepare a report based on transmission line network in Delhi.
b. Collect the information on components of transmission line.
c. Evaluate transmission line performance parameters of a given line.
d. Library/ Internet survey of electrical high voltage line and HVDC lines.
e. Visit to 33/11 KV and 11KV/400V Distribution Substation and write a report.

Also, one micro-project can be assigned to the student. A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

a. Prepare a model showing:

i. Single line diagram of electric supply system.
ii. Single line diagram of a given distribution system.
iii. Short line and medium transmission line.
iv. Write a report on the same by giving the details of lines in Maharashtra State.

b. Collect different samples of Overhead Conductors, Underground Cables, Line supports and Line Insulators.

c. Prepare a power point presentation:

i. Extra High Voltage AC Transmission line.
ii. High Voltage DC Transmission line.
iii. Flexible AC Transmission line.
iv. New trends in wireless transmission of electrical power.

d. Collect information on:

i. A.C Distribution System adjacent to your institute.
ii. Draw a layout diagram of 11KV/400 V substation in your campus/ adjacent substation.

Course Outcomes:

Upon successful completion of this course, students will be able to:

CO1	Students will analyse transmission line performance and understand key components in power transmission.
CO2	Students will design and interpret single-line diagrams for transmission and distribution systems.
CO3	Students will understand the operation and applications of HVDC and EHVAC systems in power system.

Course Code:	:	EEPC307
Course Title	:	Generation of Electrical Energy
Number of Credits	:	2 (L: 2, T: 0, P: 0)
Prerequisites	:	Fundamentals of Electrical Engineering
Course Category	:	PC

Course Objectives:

- To understand the basics of coal thermal power plants, including site selection, components, and operation.
- To learn about the classification, site selection, components, and operation of hydro power plants.
- To familiarize with nuclear fuels, nuclear power plants, and other power plants like diesel and gas power plants.
- To introduce the recent developments in renewable energy sources, including solar, wind, tidal, and MHD generation.
- To understand power plant economics, including load curves, costs, and factors affecting power plant performance.

Course Contents:

Unit– I Coal Fired Thermal Power Plant

Introduction to various sources of energy, Power scenario in India, Selection of site for coal thermal power station, Schematic diagram of coal thermal power station, Components of coal thermal power station and their operation, Numerical Problems.

Unit– II Hydro Power Plant

Classification of hydro power plants, choice of site for hydro power plant, Schematic arrangement of hydro power plant, Components of hydro power plants and their operation, selection of turbines, Numerical Problems.

Unit– III Nuclear and other Thermal Power Plant

Nuclear fuels –fusion and fission action, Site selection and components of Nuclear Power Plant, Brief description and schematic diagrams of various nuclear reactors, Schematic diagrams and operation of Diesel Power Plant and Gas Power Plant, Numerical Problems.

Unit– IV Introduction to Renewable Energy

Introduction to recent developments in renewable energy, solar power, wind power, tidal power and MHD generation.

Unit– V Load Analysis

Load Curves: daily, monthly and yearly, connected load, Average load, Peak load (Maximum demand), Load factor, Demand factor, Diversity factor, Plant factor and Plant use factor, Fixed, semi fixed and running costs, annual costs, Interest and Depreciation, Numerical Problems.

References:

1. Generation and Economic Considerations by J. B. Gupta, S K Kataria and Sons.
2. Non-Conventional Energy Sources by S. Hasan Saeed & D. K. Sharma, S.K. Kataria & Sons
3. Electrical Power Generation & Protection by M. L. Anand, Sangam Books Ltd.
4. Mehta V. K, Rohit Mehta, Principles of Power System, S. Chand and Co., New Delhi.

Course Outcomes:

At the end of the course, the student will be able to:

CO1	Understand the fundamental concepts and principles of power plants, including their types, components, and operations.
CO2	Evaluate the technical, economic, and environmental aspects of different power plants, including their advantages and disadvantages.
CO3	Use mathematical and analytical techniques to solve problems related to power plant performance, efficiency, and cost.
CO4	Assess the suitability of different power plants for various applications, considering factors such as energy demand, resource availability, and environmental impact.
CO5	Develop critical thinking and decision-making about power plant selection, operation, and maintenance, based on technical, economic, and environmental considerations.

Course Code:	:	EESI316
Course Title	:	Summer Internship-I
Number of Credits	:	2 (L: 0, T: 0, P: 0)
Prerequisites	:	NIL
Course Category	:	SI

The Course includes at least four-week summer internship mandatory for students. The students are supposed to have practical understanding and training in a suitable industry or organization. The students are required to apply their classroom learning for identification of problem. They are required prepare reports and present the output. Summer Internship-I should be undertaken in an industry/Govt. or Pvt. Certified Agencies which are in social sector/ Govt. Skill Centres/Institutes/Schemes.

Course Objectives:

- To provide industrial exposure to student that will help students to gain real life experience.
- To engage students with experienced professionals that can help them further in their careers.
- To provide industrial exposure to student to the real time.
- To enable the students to work on short industry projects and gain the skill of preparing report, describing its results and findings.
- To identify the gap between existing knowledge and industry expectations.

Course Code:	:	EEPC401
Course Title	:	Electrical Machines-I
Number of Credits	:	3 (L: 2, T: 1, P: 0)
Prerequisites	:	Basic Electrical Engineering and Network Analysis
Course Category	:	PC

Course Objectives:

- To know the principles, operation and constructional parts of electrical machines.
- To know about DC generators with their performance, industrial use and other applications.
- To know about DC motors with their domestic, industrial and other fields of applications.
- To know the principle with constructional parts of different transformers.
- To understand the special purpose transformers with their use.

Course Contents:

Unit– I DC Generators

DC generator, principle of operation, constructional details and types. EMF equation, electrical equivalent circuits, armature reaction and commutation problem with its remedy. Characteristics, losses, efficiency, voltage regulation and applications of different DC generators.

Unit– II DC Motors

DC motors, principle of operation, constructional details and types. Back e.m.f. and its significance, electrical equivalent circuits and characteristics, Shaft torque, losses, efficiency. Starting and starters with speed control of different dc motors. Brushless DC Motor with construction, working and fields of applications.

Unit– III Single-Phase Transformer

Principle and types with constructional details, CRGO, CRNGO, HRGO, amorphous cores. EMF equation different ratios, transformer rating, transformer with No-load and On-load phasor diagrams, leakage reactance, equivalent circuit, equivalent resistance, reactance and impedance with drops. Losses and reduction of losses, OCT & SCT tests, voltage regulation and efficiency, condition for maximum efficiency. Polarity test and all-day efficiency.

Unit– IV Three Phase Transformers

Three-phase transformer, construction with accessories and cooling. ON Load & Off load Tap Changer (Brief idea) Bank of three, single-phase transformers. Main connections, 3-phase to 2- phase conversion (Scott Connection), Selection criteria for selecting distribution transformer and power transformer, amorphous core type distribution transformer, Need of parallel operation of three phase transformers, Conditions for parallel operation. Polarity test and phasing out test on 3-phase transformer.

Unit– V Special Purpose Transformers

Construction, working and applications of 1-phase and 3-phase auto-transformers. Construction, working and applications of instrument transformers. Introduction of solation transformer. Single phase welding transformer and pulse transformer with their construction and applications. Overheating due to non-linear loads and harmonics.

References:

1. Electrical Machines by SK Bhattacharya, Tata Mc Graw Hill, New Delhi.
2. Electric Machines by Ashfaq Husain, Dhanpat Rai & Co., New Delhi.
3. Electrical Machines by SK Sahdev, Unique International Publications, Jalandhar.
4. B.L. Theraja, Electrical Technology Vol-II (AC and DC machines), S. Chand and Co. Ltd., New Delhi.
5. Electrical Engineering by JB Gupta, SK Kataria & sons, New Delhi.
6. V. K. Mehta and Rohit Mehta, Principles of Electrical Machines, S. Chand and Co. Ltd., New Delhi.

Course Outcomes:

At the end of the course, the student will be able to:

CO1	Learn about various DC generators with their performances and different fields of applications.
CO2	Learn about various DC motors with their performances and different fields of applications.
CO3	Learn about the single-phase transformer with its behavior and uses.
CO4	Learn about the 3-phase transformer with its behavior and uses.
CO5	Learn about the auto-transformers (1-ph & 3-ph), special purpose transformers with their fields of applications.

Course Code:	:	EEPC411
Course Title	:	Electrical Machines-I Lab
Number of Credits	:	1 (L: 0, T: 0, P: 2)
Prerequisites	:	Electrical Machines-I
Course Category	:	PC

Course Objectives:
The aim of the course is to enable the students to acquire industry-oriented competency through teaching and learning experiences:

- Use of DC generators/motors with their selection for different applications.
- Starting, speed regulation and speed control of different dc motors.
- Performance study and use of single-phase/three-phase and auto-transformers.

List of Experiments:

1. To perform open circuit and short circuit tests on a 1-phase transformer.
2. To determine: (i) equivalent circuit (ii) the regulation and (iii) efficiency of a transformer using data obtained from OCT and SCT tests.
3. To determine the efficiency and regulation of single-phase transformer at different loads and different power factors.
4. To measure the three-phase power using two watt-meter method in a star/delta connected balanced inductive load and determine the load power factor from wattmeter readings.
5. To perform polarity test on a single-phase transformer.
6. Connect the auto-transformer in step-up and step-down modes noting the input/output voltage readings.
7. To draw the internal and external characteristics of DC shunt generators and determine its voltage regulation.
8. To perform brake test on DC series motor.
9. To control the speed of DC shunt motor by different methods.
10. Reverse the direction of rotation of the DC shunt motor.

Course outcomes:
On completion of the course, the students will be able to:

CO1	Learn about the different ratios, tests, losses, efficiency and voltage regulation of single-phase/three-phase transformer.
CO2	Learn about measurement of single-phase/ three-phase active, reactive and apparent powers.
CO3	Learn about DC shunt/series generators and generators with performance and their selection.

Course Code:	:	EEPC402
Course Title	:	Power Electronics
Number of Credits	:	3 (L: 2, T: 1, P: 0)
Prerequisites	:	Fundamentals of Electronics Engineering
Course Category	:	PC

Course Objectives:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- To introduce students to power electronic devices, their operation, and applications.
- To study the triggering circuits for thyristor family devices and their operations.
- To understand the principles, operation, and applications of controlled rectifiers for AC to DC conversion.
- To study the design and analysis of DC-DC converters (choppers), and Cycloconverters
- To study the design and analysis of inverters.

Course Contents:

Unit– I Power Electronic Devices

Introduction of power electronics, Ideal switch, power diode, SCR, Diac, Triac, GTO, BJT, IGBT, MOSFET, thyristor rating, di/dt and dv/dt limitations, snubber circuits. Concept of single electron transistor (SET) - aspects of Nano- technology.

Unit– II Thyristor Family Devices & Triggering Circuits

SCR: construction, two transistor analogy, types, working and characteristics. SCR mounting and cooling, Triggering circuits of Thyristor, Commutation of Thyristor, Series and Parallel operation of Thyristors.

Unit– III Controlled Rectifiers

Introduction to Rectifiers and its applications, Single phase half wave-controlled rectifier with R-L load, Single phase full wave-controlled rectifier with R-L load, fully controlled full wave rectifier, 3-phase full wave half-controlled bridge rectifier, 3-phase full wave fully controlled bridge rectifier.

Unit– IV Choppers/ DC-DC Converters

Basic principle of D.C. Chopper, step up and step-down choppers TRC and CLC method, buck, and boost converters, Types of Chopper circuits, chopper related problems. Introduction to Cycloconverters, working principle and applications.

Unit– V Inverters

Working of inverter, classification of inverters, series and parallel Inverter, Analysis of single phase half wave and full wave bridge inverter, 3-phase inverter, Voltage source inverter, Current source inverter, control and harmonic reduction.

References:

1. Ramamoorty M., An Introduction to Thyristors and their applications, East-West Press Pvt. Ltd., New Delhi.
2. Rashid Muhammad, Power Electronics Circuits Devices and Applications, Pearson Education India, Noida.
3. Sugandhi, Rajendra Kumar and Sugandhi, Krishna Kumar, Thyristors: Theory and Applications, New Age International (P) ltd. Publishers, New Delhi.
4. Bhattacharya, S.K., Fundamentals of Power Electronics, Vikas Publishing House Pvt. Ltd. Noida.
5. Jain & Alok , Power Electronics and its Applications, Penram International Publishing (India) Pvt. Ltd, Mumbai.
6. Singh, M. D. and Khanchandani, K.B., Power Electronics, Tata McGraw Hill Publishing Co. Ltd, New Delhi.
7. Bimbhra P.S., Power Electronics, Khanna Publishing; 7th edition, 2022, New Delhi.

Course Outcomes:

Upon successful completion of this course, students will be able to:

CO1	Identify and describe power electronic devices and their applications.
CO2	Design and analyse triggering circuits for thyristor family devices.
CO3	Analyse and design controlled rectifiers for AC to DC conversion.
CO4	Ability to understand the working of DC-DC converters (choppers) and its applications.
CO5	Understand the operation, functioning, and applications of inverters.

Course Code:	:	EEPC412
Course Title	:	Power Electronics Lab
Number of Credits	:	1 (L: 0, T: 0, P: 2)
Prerequisites	:	Power Electronics
Course Category	:	PC

Course Objectives:

This course aims to help students acquire industry-recognized competencies through various teaching and learning experiences.

- Imparting a detailed understanding of the voltage-current (V-I) characteristics of semiconductor devices through experimental analysis.
- Exploring the principles and effects of R and RC triggering circuits on the firing angle control of SCRs.
- Enhancing students' ability to model and simulate the controlled rectifiers, with a focus on firing angle control and its impact on load voltage.

List of Experiments:

1. To study and plot the V-I characteristics of SCR.
2. To study and plot the V-I characteristics of MOSFET.
3. To study and plot the V-I characteristics of IGBT.
4. To study and plot the V-I characteristics of TRIAC.
5. To study and plot the V-I characteristics of DIAC.
6. To study and plot the V-I characteristics of UJT.
7. To study and plot the V-I characteristics of PUT.
8. To test the variation of R, C in R and RC triggering circuits onfiring angle of SCR.
9. To use CRO to observe the output waveform of half wave-controlled rectifier with resistive load and determine the load voltage.
10. To simulate different firing angle on SCILAB software.

Course Outcomes:

Upon successful completion of this course, students will be able to:

CO1	Experimentally analyze and plot the V-I characteristics of key semiconductor devices, gaining an understanding of their operational behavior.
CO2	Demonstrate the ability to evaluate the effects of R and C values in triggering circuits on the firing angle of SCRs.
CO3	Demonstrate proficiency in modeling and simulating half-wave controlled rectifiers with SCILAB.

Course Code:	:	EEPE403
Course Title	:	Switchgear and Protection
Number of Credits	:	3 (L: 2, T: 1, P: 0)
Prerequisites	:	Fundamentals of Electrical Engineering and Electric Power Transmission and Distribution
Course Category	:	PE

Course Objectives:

The objective of the course "Switchgear and Protection" is to provide students with a comprehensive understanding of the principles, working, and applications of electrical protection systems and switchgear in power systems.

- To understand the principles of protection systems, fault analysis, and the basic concepts of switchgear and protection systems
- To gain knowledge of circuit interruption devices and their applications.
- To learn the operation and selection of protective relays.
- To study system protection techniques for enhancing power system reliability.
- To understand surge protection methods and system grounding practices.

Course contents:

Unit– I Basics of Protection System and Fault Analysis

Necessity, functions of protective system, different types of switchgear equipment, protection zones, Primary and backup protection, essential qualities of protection, normal and abnormal conditions, faults in a power system and their cause, Symmetrical and Unsymmetrical fault calculations, need of current limiting reactors and their arrangements, Per-unit system,

Unit– II Circuit Interruption Devices

Isolators: basic terms, types, construction and working, Fuses: basic terms, types, construction and working, Circuit Breaker: Arc formation process, methods of arc extinction (High resistance and Low resistance), Arc voltage, Recovery voltage, Re-striking voltage, RRRV. Classification of circuit breakers, Construction and working of modern circuit breakers, Circuit breaker ratings, related problems, MCB, RCCB, ACB and ELCB, brief idea of GIS.

Unit– III Protective Relays

Protective Relays, fundamental requirements of relaying. Classification, principle of working, construction and operation of Electromagnetic attraction and induction type relay. Induction type overcurrent relay, Induction type reverse power relay, Induction type directional overcurrent relay, overcurrent protective schemes, earth fault relay, distance relays, Static relays and relaying circuitry.

Unit– IV System Protection

Classification of Protective Schemes, Principle of differential protection, Principle of distance protection, R-X diagram, Translay system, Principle of carrier protection, Merz-Price schemes for protection of electrical machines (Transformer and Alternator), Buchholz Relay, protection of Bus-bars, Transmission Lines and motors.

Unit– V Surge Protection and System Grounding

Surges, Protection against surges, Modern surge diverters, Purpose of neutral grounding, Methods of neutral grounding- Resonant, Solid and Impedance grounding, Earthing transformer, Earthing of all non-current carrying metallic parts, Introduction to lightning.

References:

1. Mehta V. K, Rohit Mehta, Principles of Power System, S. Chand and Co., New Delhi.
2. Singh, R. P., Switchgear and Power System Protection, PHI Learning, New Delhi.
3. Gupta. J. B., Switchgear and Protection, S. K. Kataria and Sons, New Delhi.
4. Ram Badri; Vishwakarma D. N., Power System Protection and Switchgear, McGraw-Hill, New Delhi.
5. Wadhwa C. L., Electrical Power Systems, New Academic Science Limited, UK.
6. Rao. Sunil S., Switchgear and Protection, Khanna Publishers, New Delhi.

Course Outcomes:

Upon successful completion of this course, students will be able to:

CO1	Analyse faults in electrical systems and understand protection fundamentals.
CO2	Understand and select appropriate circuit interruption devices.
CO3	Apply different protective relays to safeguard electrical systems.
CO4	Implement protection coordination strategies for system stability.
CO5	Design and apply surge protection and grounding techniques for safety.

Course Code:	:	EEPE413
Course Title	:	Switchgear and Protection Lab
Number of Credits	:	1 (L: 0, T: 0, P: 2)
Prerequisites	:	Switchgear and Protection
Course Category	:	PE

Course Objectives:

This course aims to help students acquire industry-recognized competencies through various teaching and learning experiences:

- Provide students with practical experience in testing and analysing various electrical protection devices, including HRC fuses, MCBs, MCCBs, ELCBs, and protection relays.
- Equip students with the knowledge and skills to study the construction, working principles, and performance of protection relays, including overcurrent, directional, and transformer differential relays.
- Students will study solid-state time delay relays, test single phasing preventers, simulate transmission line fault protection on a simulation kit, and implement neutral earthing at different locations for system safety.

List of Experiments:

1. Test HRC fuse by performing the load test.
2. Test MCB by performing the load test
3. Dismantle MCCB/ELCB and identify various parts.
4. To study the construction and working principle of induction type non-directional over current relay and plot the curve between time and current at different current settings (CS) and time multiplier setting (TMS).
5. To study the construction and working principle of the induction type directional over current relay.
6. To study the protection of electrical equipment by relays in conjunction with circuit breakers.
7. To study the performance of solid-state time delay relay.
8. To study the construction and working principle of the transformer differential relay.
9. Test the working of the single phasing preventer using a three-phase induction motor.
10. Simulate transmission line protection by using the impedance relay/over current relay for various faults (On transmission line protection simulation Kit).
11. Perform neutral earthing at different substations / locations.

Course Outcomes:

Upon successful completion of this course, students will be able to:

CO1	Demonstrate the ability to test and evaluate electrical protection devices, such as HRC fuses, MCBs, and MCCBs, through load testing and fault simulations.
CO2	Understand the construction, operation, and application of various protection relays, including overcurrent, directional, and differential types, and analyse their performance under different settings.
CO3	Analyze the performance of solid-state time delay relays, test single phasing preventers, simulate fault protection in transmission lines using a simulation kit, and implement neutral earthing at different locations to ensure system safety.

Course Code:	:	EEPE404
Course Title	:	Electrical Instrumentation
Number of Credits	:	3 (L: 2, T: 1, P: 0)
Prerequisites	:	Electrical Measurements & Measuring Instruments
Course Category	:	PE

Course Objectives:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- To know the importance of electrical instrumentation for measurement of non-electrical quantities.
- To understand the concepts of resistive transducers for measurement of nonelectrical parameters such as strain and temperature etc.
- To understand the concepts of inductive and capacitive transducers for measurement of nonelectrical parameters such as displacement and pressure etc.
- To understand the concepts of optoelectronic transducers for sensing light intensity as nonelectrical parameters.
- To know about the digital transducers and learn the data acquisition system and data transmission.

Course Contents:

Unit– I Introduction

Basic purpose of instrumentation, Basic block diagram (transduction, signal conditioning, signal presentation) and their function, Advantages of electrical instrumentation, Primary sensing elements, Electrical transducer, its classification and advantages.

Unit– II Resistive Transducers

Concepts of resistive transducers, Constructional features, working and applications of potentiometers, strain gauges, resistance**,** thermistor, thermocouple.

Unit– III Inductive and Capacitive transducers

Concepts of inductive transducers, Constructional features, working and applications of variable reluctance transducer, linear variable differential transformer, Concepts of capacitive transducer and its applications, Piezoelectric transducers, Hall effect transducers.

Unit– IV Optoelectronic transducers

Concepts of optoelectronic transducers, Constructional features, working and applications of photovoltaic cell, photoconductive cell, photodiode, phototransistor, Digital transducers for measurement of linear and angular displacements.

Unit– V Signal Conditioning and Telemetry

Basic Concept of signal conditioning System, OPAMP and its pin diagram, Use of op-amp as inverting, non- inverting mode, adder, subtractor, divider, multiplier, integrator and differentiator, Telemetry & data acquisition.

References:

1. Sawhney, A.K. Electrical and Electronic Measurement and Instrumentation, Dhanpat Rai and Co.
2. Rangan, C.S. G. R. Sharma. and V. S. V. Mani, Instrumentation devices and system, Pen ram International Publishing India Pvt.
3. S.K. Singh, Industrial instrumentation and control, Tata McGraw-Hill.
4. H.S Kalsi, Electronic Instrumentation, Tata McGraw Hill.

Course Outcomes:

At the end of the course, the student will be able to:

CO1	Learn the concepts of electrical instrumentation and related terminologies.
CO2	Learn the basics of primary sensing devices and electrical transducers for measurement of physical quantities, classification and their applications.
CO3	Understand the concepts of resistive, inductive and capacitive transducers and their applications for measurement of various nonelectrical quantities like pressure, strain, displacement, temperature etc.
CO4	Acquire the knowledge of optoelectronic transducers for sensing the light energy and understand the significance of digital transducers and their types.
CO5	Understand the use of signal conditioning and the use of OPAMP circuits for various applications, data acquisition and telemetry to properly acquire the data.

Course Code:	:	EEPE414
Course Title	:	Electrical Instrumentation Lab
Number of Credits	:	1(L: 0, T: 0, P: 2)
Prerequisites	:	Electrical Instrumentation
Course Category	:	PE

Course Objectives:

- To develop an in-depth understanding of strain measurement and utilizing strain gauge and cantilever assembly to assess force and strain in various applications.
- To enable students to effectively measure displacement and temperature using transducers such as LVDT, thermocouples, RTD, and thermistor, while also understanding their operational principles.
- To impart knowledge on determining the sensitivity and performance characteristics of measurement systems, such as the strain gauge and LVDT.

List of Experiments:

1. To measure force and strain using Strain guage and cantilever assembly.
2. To determine the sensitivity of Strain guage and cantilever assembly.
3. To measure the displacement using LVDT and draw the curve between displacement and output voltage.
4. To determine the sensitivity of LVDT.
5. To measure the temperature using Thermocouple.
6. To measure the temperature using RTD and Thermistor.
7. Measurement of the velocity of air.
8. Measurement of Humidity and moisture using capacitive transducer.

Course Outcomes:

CO1	Upon completion, students will be able to accurately measure force and strain using strain gauges and cantilever assembly and determine their sensitivity through experimental analysis.
CO2	Students will gain the ability to measure and analyze displacement using LVDT systems and establish the correlation between displacement and output voltage, as well as determine the system's sensitivity.
CO3	Students will acquire proficiency in measuring temperature using thermocouples, RTDs, and thermistors, and will be able to evaluate the accuracy of sensors for practical applications, including the measurement of air velocity.

Course Code:	:	EEPC405
Course Title	:	Building Electrification
Number of Credits	:	2 (L: 2, T: 0, P: 0)
Prerequisites	:	Knowledge of Electric Circuitry
Course Category	:	PC

Course Objectives:

- To interpret electrical symbols and diagrams.
- To design and install electrical circuits.
- To select and apply electrical accessories.
- To plan and estimate electrical installations.
- To commission and test electrical installations.

Course Contents:

Unit– I Electrical Symbols and Simple Light and Alarm Circuits

Electrical symbols used in electrical installation, Schematic and wiring diagrams, light and fan point controlled by individual switches, fluorescent tube controlled by one-way switch, one lamp controlled by two switches (staircase circuit) three lamps controlled by four switches (Corridor light circuit).

Unit– II Electrical Accessories

Classification of electrical accessories, Switch and their types, Holders and their types, Socket outlets and plugs- two pin, three-pin, multi pin sockets, two-pin and three-pin plug, Iron connector, adaptor, ceiling rose, distribution box, neutral link and busbar.

Unit– III Alarm Circuits without and with Relays

One bell controlled by one push button, two ordinary bells (for day and night) used at a doctor's residence, bell response circuit using one bell and one relay, bell response circuit of an office (of three rooms). A Light circuit which automatically gets connected to DC supply in case of power failure.

Unit– IV Electrical Installation of Small Residential Buildings

Internal Distribution system, Single-phase Light and Power Sub-Circuit, Systems of wiring, Installation plan, Multiline and Single line wiring diagrams, Design and Estimation of electrical installation of small residential buildings, list of material required along with cost

by doing market survey, Description of various tests to test the wiring installation before commissioning.

Unit– V Electrical Installation of Commercial Buildings

Internal Distribution system, Busbar chamber, Mains, installation plan, Single-Line wiring diagram, Design and Estimation of electrical installation of large commercial buildings, list of material required along with cost by doing market survey, commissioning of electrical installation, Introduction to Intelligent Lightning system.

References:

1. Electrical Design Estimating and Costing, by K. B. Raina & S. K. Bhattacharya, New Age International Publishers.
2. Course in Electrical Installation Estimating & Costing by Gupta J. B. Kataria, S. K., & Sons.
3. Electrical Wiring Estimating 3. & Costing by S. L. Uppal, Khanna Publishers.
4. Electrical Estimating and Costing, Singh, Surjit, Dhanpat Rai and Co. New Delhi,

Course Outcomes:

At the end of the course, the student will be able to:

CO1	Analyse simple electrical circuits and identify their components and functions.
CO2	Design and develop electrical installation plans for residential and commercial buildings.
CO3	Install, test, and commission electrical systems, ensuring safety and efficiency.
CO4	Select and apply appropriate electrical accessories, including switches, holders, and socket outlets.
CO5	Troubleshoot and resolve common electrical issues in residential and commercial electrical installations.

Course Code	:	EEPR416
Course Title	:	Minor Project
Number of Credits	:	2 (L:0, T:0; P:4)
Prerequisites	:	NIL
Course Category	:	PR

Course Objectives:

- Understand the method of applying engineering knowledge to solve specific problems.
- Apply engineering and management principles while executing the project.
- Identify and solve complex engineering problems using professionally prescribed standards and demonstrate good verbal presentation and technical report writing skills.

Guidelines:

1. Project will have to be done by a group in their area of interest.
2. Each group has to select a contemporary topic that will use the technical knowledge of their program of specialization.
3. Allocation of the guides preferably in accordance with the expertise of the faculty.
4. The student will be assigned a faculty guide who would be the supervisor of the student.
5. The number of projects that a faculty can guide would be limited to two groups.
6. The project can be carried out on-campus or in an industry or an organization with prior approval from the principal through head of section.
7. The project shall be completed and submitted at least one month before the last teaching day.
8. The project should be presented by students using power point once before submission of project.

Course Outcomes:

After going through this course, the students will be able to:

CO 1	Conceptualize, design and implement solutions for specific problems.
CO 2	Communicate the solutions through presentations and technical reports.
CO 3	Apply project and resource managements skills, professional ethics, societal concerns.

Course Code	:	EEAU400
Course Title	:	Essence of Indian Knowledge and Tradition
Number of Credits	:	0 (L:2, T:0; P:0)
Prerequisites	:	NIL
Course Category	:	AU

Course Contents:

1. Basic Structure of Indian Knowledge System:
   (i) वेद, (ii) उन्नवेद (आयुवेद, धनुवेद, गन्धवेद , स्थान्नत्य आदद) (iii) वेदथाथांग (शिक्था, कलन्न, ननरुत , व् थाकरण , ज्योनतष छथांद), (iv) उन्नथाइग (धर्म शथास्न , र्ीर्थाथांसथा, न्नुरथाण, तकशरथास्न).
2. Modern Science and Indian Knowledge System
3. Yoga and Holistic Health care
4. Case Studies.

References:

1. Sivaramakrishna, Cultural Heritage of India-Course Material, Bharatiya Vidya Bhavan, Mumbai, 5th Edition, 2014
2. Swami Jitatmanand, Modern Physics and Vedant, Bharatiya Vidya Bhavan
3. Fritzof Capra, The wave of Life
4. Fritzof Capra, Tao of Physics
5. V N Jha, arkasangraha of Annam Bhatta, Inernational, Chinmay Foundation, Velliarnad, Amaku,am, RN Jha, Science of Consciousness Psychotherapy and Yoga Practices, Vidyanidhi Prakasham, Delhi, 2016

Course Code:	:	EEPC501
Course Title	:	Electrical Machines-II
Number of Credits	:	3 (L: 2, T: 1, P: 0)
Prerequisites	:	Electrical Machines-I
Course Category	:	PC

Course Objectives:

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

- To know Three-phase induction motors and predict their performances.
- To know synchronous machines and predict their performances.
- To know different 1-phase induction motors with their performance and selection.
- To know 1-phase synchronous motors with their performance and applications.
- To know commutator motors, their selection for different applications.

Course Contents:

Unit– I Three Phase Induction Motor

Working principle, production of rotating magnetic field, synchronous speed, rotor speed and slip. Construction of 3-phase SCIM and SRIM. Rotor frequency, emf, power factor at starting and running condition. Torque-slip (speed) characteristics. Motor torques and their relations. Four quadrant operation, power flow diagram. Starters and types. Speed control using different methods. Motor selection for different applications. Maintenance of three phase induction motor.

Unit– II Single phase Induction Motors

Types of 1-phase motors, double field revolving theory, construction, working and use of different motors with their torque-speed characteristics. Motor selection as per the load torque-speed requirements. Maintenance of single-phase induction motors.

Unit– III Three Phase Alternator

Principle of working, moving and stationary armatures. Constructional details, single layer and double layer windings, E.M.F. equation with different factors. Alternator loading, armature reaction for various power factors. Armature resistance, leakage reactance and synchronous impedance. Voltage regulation and determination with maintenance of alternators.

Unit– IV Three-Phase Synchronous Motor

Principle of working, operation, staring procedure, significance of load angle and motor torques. Synchronous motor on load with constant excitation, effect of excitation with constant load, related numerical ability. V-curves and inverted V-curves, hunting and phase swinging in the motor. Losses in synchronous motor with efficiency and its applications.

Unit– V Fractional Horse Power (FHP) Motors

Construction and working of synchronous reluctance motor, switched reluctance motor, BLDC motor, PMS motors, stepper motors, AC and DC servomotors with T-S characteristics and their applications.

References:

1. P. S. Bimbhra, Electric Machines, Khanna Book Publishing Co., New Delhi.
2. I. J. Nagrath and D. P. Kothari, Electrical Machines, McGraw Hill Education. New Delhi.
3. Electric Machines, Ashfaq Husain and Haroon Ashfaq, Dhanpat Rai & Co., New Delhi.
4. S. K. Bhattacharya, Electrical Machines, McGraw Hill Education, New Delhi.
5. B.L. Theraja, Electrical Technology Vol-II, S. Chand and Co. Ltd., New Delhi.
6. S. K. Sen, Special Purpose Electrical Machines, Khanna Publishers, New Delhi.

Course Outcomes:

On completion of the course, the students will be able to:

CO1	Learn about 3-phase induction motors with their performances and different fields of applications.
CO2	Learn about various 1-phase induction motors with their performances and different fields of applications.
CO3	Learn about the 3-phase alternator its behavior and performance.
CO4	Learn about the 3-phase synchronous motor with its behavior and use.
CO5	Learn about the Fractional Horse Power (FHP/FKW) Motors with their fields of applications.

Course Code:	:	EEPC511
Course Title	:	Electrical Machines-II Lab
Number of Credits	:	1 (L: 0, T: 0, P: 2)
Prerequisites	:	Electrical Machines-II
Course Category	:	PC

Course Objectives:

The aim of the course is to enable the students to acquire industry-oriented competency through teaching and learning practices:

- To attain proficiency in 3-phase induction motor with its performance and use.
- To attain proficiency in 3-phase Synchronous motor with its performance and use.
- To attain proficiency in FHP motors and their selection for different fields of applications.

List of Experiments:

1. To connect and run the three-phase squirrel cage induction motor in both directions using
   the DOL and auto-transformer starters.
2. To conduct the No-load and Blocked-rotor tests on given 3-ph squirrel cage induction motor and determine the equivalent circuit parameters.
3. To control the speed of the given three phase squirrel cage/slip ring induction motor using auto-transformer.
4. To measure the open circuit voltage ratio of the three-phase slip ring induction motor.
5. To draw the speed-voltage (AC & DC) characteristics for universal motor.
6. To determine the starting torque verses full-load torque ratio of a 3-phase SCIM.
7. Speed control and reversing the direction of stepper motor.
8. To draw the speed-load characteristics of chopper-controlled DC shunt motor in open -loop and closed-loop modes.
9. To draw the magnetization characteristics for 3-phase alternator.
10. To draw the load characteristics of a 3-phase alternator.

Course outcomes:

On completion of the course, the students will be able to:

CO1	Learn about 1-phase and 3-phase induction motors with performance and use.
CO2	Learn about the performance and behavior of DC shunt motor, universal motor and other special purpose motors.
CO3	Learn about performance of 3-phase alternators used in different applications.

Course Code	:	EEPC502
Course Title	:	Electrical Testing and Commissioning
Number of Credits	:	3 (L: 2, T: 1, P: 0)
Prerequisites	:	Knowledge of building Electrification and Electric Machines
Course Category	:	PC

Course Objectives:

- To understand electrical safety and insulation principles.
- To learn installation and erection procedures for electrical machinery.
- To understand testing and commissioning methods for electrical equipment.
- To develop skills in troubleshooting electrical equipment faults.
- To understand maintenance procedures for electrical machines.

Course Contents:

Unit – I Electrical Safety and Insulation

Electrical safety in industry/power stations/ substations at the time of operation/ control/maintenance. Fire detection alarm, fire-fighting equipment, Factors affecting life of insulating materials, classifications of insulating materials as per IS:1271-1958. Measuring insulation resistance by different methods such as i) Polarization, ii) Dielectric absorption, iii) Megger, Reconditioning of insulation, Insulating oil - properties of insulating oil, causes of deterioration of oil, testing of transformer oil as per IS 1866-1961.

Unit – II Installation and Erection

Concept of foundation for installation of machinery. Requirements of foundation for static and rotating electrical machinery, Concept of leveling and aligning, Procedure for leveling and aligning, Alignment of direct coupled drive, Effects of misalignment, Installation of transformer as per I.S.-1886-1967 and procedure of installation of transformer, Requirements of installation of pole mounted transformer, Requirements of installation of rotating electrical machines as per I.S. 900-1965, Devices and tools required for loading, unloading, lifting, and carrying heavy equipment and precautions to be taken while handling them.

Unit– III Testing and Commissioning

Concept of testing, Objectives of testing, Roles of I.S.S. in testing of electrical equipment, Types of tests and concepts, Routine tests, type tests, supplementary test, special tests, Methods of testing - Direct/Indirect/Regenerative testing, Tolerances for the various items for equipment –transformer, induction motor, dc motor, Synchronous machines, Commissioning,

Tests before Commissioning for transformer, Induction motor, Alternator, Testing of transformer as per I.S.1886- 1967 and I.S.2026- 1962, Testing of three-phase induction motor as per I.S.325 -1970, Testing of single-phase induction motor as per I.S.990-1965, Testing of synchronous machines as per ISS, Testing of D.C. machines.

Unit– IV Troubleshooting Plans

Internal and external causes for failure / abnormal operation of equipment, List of mechanical faults, electrical faults and magnetic faults in the electrical equipment, remedies, applications, Use of tools like bearing puller filler gauges, dial indicator, spirit level, megger, earth tester, and growler, Common troubles in electrical equipments and machines, Preparation of trouble shooting charts for D.C. Machines, AC Machines and transformers.

Unit– V Maintenance

Concept of maintenance, types of maintenance, Routine, preventive and breakdown maintenance. Causes of failure of electrical machines, Preventive maintenance-procedure or developing maintenance schedules for electrical machines, Factors affecting preventive maintenance schedules, Concept of TPM, Pillars of TPM, Identification of different types of faults developed such as mechanical/ electrical/ magnetic faults Maintenance schedules of the distribution transformer as per I.S.1886-1967, Single phase and three phase Induction motors as per I.S.900-1965 and Batteries as per I.S.S.

References:

1. Deshpande. M. V. PHI Learning Pvt. Ltd., 2010, Design and Testing of Electrical Machines.
2. Rao, B V S Asia Club House, First Reprint, 2011, Operation and Maintenance of Electrical Equipment, Vol-I.
3. Rosenberg. Mc GRAW-HILL, 1st Edition, May 2003, Maintenance and Repairs.
4. Sharotri, S.K. Glencoe/ McGraw-Hill; 2nd Edition, June 1969; Preventive Maintenance of Electrical Apparatus.

Course outcomes:

At the end of the course, the student will be able to:

CO1	Follow safety procedures with respect to earthing and insulation of electrical equipment.
CO2	Select proper tools, equipment, for installation, testing, maintenance of electrical machines and transformers.
CO3	Test and commission electrical equipment in accordance with IS codes.
CO4	Make plans for troubleshooting electrical machines.
CO5	Undertake regular preventive and breakdown maintenance.

Course Code	:	EEPC512
Course Title	:	Electrical Testing and Commissioning Lab
Number of Credits	:	1 (L: 0, T: 0, P: 2)
Prerequisites	:	Electrical Testing and Commissioning
Course Category	:	PC

Course Objectives:

- To determine breakdown strength and perform insulation resistance test.
- To analyze and troubleshoot the electrical machines.
- To evaluate performance and efficiency of electrical machines.

List of Experiments:

1. Determine breakdown strength of transformer oil.
2. Perform insulation resistance test on any one motor/transformer.
3. Prepare trouble shooting charts for electrical machines such as Transformer, D.C. machines, Induction motor, and Synchronous machines.
4. Measure impedance voltage and load losses of three-phase transformer.
5. Find regulation and efficiency of single-phase transformer by direct loading and back-to-back connection method and compare the results.
6. Perform reduced voltage running up test on three-phase Induction motor as per I.S.325 -1967.
7. Measure No Load losses and No Load current of a transformer as per I.S.
8. Perform no load test on single phase Induction motor for the measurements of No Load current, power input, and speed at rated voltage as per I.S.
9. Perform temperature rise test on single-phase transformer.
10. Find efficiency of M.G. set.

Course outcomes:

At the end of the course, the student will be able to:

CO1	Determine breakdown strength and perform insulation resistance test on electrical machines.
CO2	Analyse and troubleshoot the electrical machines.
CO3	Evaluate performance of electrical machines in accordance with IS codes

Course Code:	:	EEPE503
Course Title	:	Control System Engineering
Number of Credits	:	3 (L: 2, T: 1, P: 0)
Prerequisites	:	Knowledge of Applied Mathematics
Course Category	:	PE

Course Objectives:

- To analyse control systems and their components.
- To apply Laplace transform techniques to solve problems.
- To model and analyze electrical systems using transfer functions.
- To evaluate time response and stability of control systems.
- To develop problem-solving skills in control system design and analysis.

Course Contents:

Unit– I Fundamental Elements and Components

Introduction to control system: Types, Open loop and Closed loop system, Basic elements of feedback control systems, Position control system, Effect of feedback.

Unit– II Introduction to Laplace Transform

Laplace transform: General Laplace transform of algebraic and other functions, Partial fraction expansion, Inverse Laplace transform, Application of Laplace transform in solving second order differential equations, Initial and final value theorems.

Unit– III Transfer Function & Modeling of Electrical Systems

Block diagram representation, Reduction techniques, Signal flow graph, Mason's gain formula, Transfer function, Transfer function of electrical system.

Unit– IV Time Response Analysis

Standard signals, Steady state and transient response, Input test signals, Step signal, Ramp signal, Impulse signal and Parabolic signal, Transient response of control system, Rise time, Maximum overshoot, Peak time, Settling time, Steady state error.

Unit– V Stability Analysis

Stability concept, Necessary conditions for stability, Hurwitz's stability criterion, Root locus plot, General rules for constructing root loci, Examples.

References:

1. Automatic Control System by Hasan Saeed, S.K.Kataria & Sons.
2. Modern Control Engineering by K. Ogata, PHI.
3. Control Systems Engineering by I. J. Nagrath, New Age International Pvt Ltd.

Course Outcomes:

At the end of the course, the student will be able to:

CO1	Understand the fundamental concepts of control systems, including open-loop and closed-loop systems.
CO2	Use mathematical models and techniques to analyze the behavior of control systems.
CO3	Use Laplace transform and transfer functions to model and analyze electrical systems.
CO4	Assess the time response and stability of control systems using various criteria.
CO5	Apply control system analysis techniques to solve real-world problems.

Course Code:	:	EEPE513
Course Title	:	Control System Engineering Lab
Number of Credits	:	1 (L: 0, T: 0, P: 2)
Prerequisites	:	Control System Engineering
Course Category	:	PE

Course Objectives:

- Understand and apply MATLAB for analyzing transfer functions by performing series, parallel, and feedback operations.
- Analyze the behavior of dynamic systems by computing and visualizing poles, zeros, and system responses (step, impulse, and ramp) for first- and second-order systems.
- Utilize MATLAB tools to visualize control system stability and performance through root locus and response plotting for different system parameters.

List of Experiments:

1. Using MATLAB, represent a transfer function and perform series, parallel and feedback operations.
2. Using MATLAB, compute the poles and zeros of a transfer function and plot them on pole zero map.
3. Using MATLAB, compute the step response of first order system.
4. Using MATLAB, compute the ramp response of first order system.
5. Using MATLAB, compute the impulse response of first order system.
6. Using MATLAB, compute the impulse response for a second order system with different damping ratios.
7. Using MATLAB, compute the step response for a second order system with different damping ratios.
8. Using MATLAB, sketch the root locus for a given transfer function.

Course outcomes:

At the end of the course, the student will be able to:

CO1	**Represent and manipulate transfer functions** using MATLAB for various system operations, including series, parallel, and feedback configurations.
CO2	**Analyze system dynamics** by computing and plotting poles and zeros, and evaluating step, impulse, and ramp responses for both first and second-order systems.
CO3	**Analyze system stability** through root locus plots and understanding the impact of damping ratios on second-order system behavior.

Course Code:	:	EEPE504
Course Title	:	Utilization and Traction
Number of Credits	:	2 (L: 2, T: 0, P: 0)
Prerequisites	:	Electric Machines and Power Electronics
Course Category	:	PE

Course Objectives:

- To introduce the light concept with different lighting schemes for indoor, outdoor and other requirements.
- To study the different types electrical lamps for indoor and outdoor applications.
- To introduce heat principles, heating methods and heating furnaces.
- To introduce welding process, welding techniques for different requirements.
- To understand electro-deposition, applications, electric drives, electric braking and electric traction.

Course Contents:

Unit– I Illumination

Nature of light, terms, Laws of illumination. Illumination due to one and many point sources. Design of lighting schemes, number and location of sources. Street lighting and flood lighting. Construction, working and circuits for different lamps, use and relative merits or demerits.

Unit– II Electric Heating and Welding

Advantages of electric heating. Resistance heating, types. Properties and design of heating elements. Induction and arc heating with types, furnaces and types, dielectric heating. Electric welding and its types. Different welding equipment and circuits with use.

Unit– III Electrochemical Processes, Refrigeration and Air-conditioning

Electrolysis and its applications. Laws of electrolysis. Electro-plating, equipment and process of electroplating. Introduction to refrigeration and air-conditioning, types and applications with electrical circuits.

Unit– IV Electric Drives

Advantages of electric drives, types of mechanical loads. Motors for electric drives, electrical characteristics of different drive motors. Electric braking, types and use. Selection of electric drives for specific purposes**.**

Unit– V Electric Traction

Advantages and economical aspects of electric traction. Supply systems and supply voltages. Methods of feeding current collection of overhead structure. Speed-time curves, maximum distance, power and energy calculations, specific energy consumptions and efficiency.

References:

1. H. Pratap, An Art and Science of Utilization of Electrical Energy Dhanpat Rai & Co.
2. B. L. Theraja, A K Theraja Electrical Technology, vol.-IV, S. Chand LTD.
3. Utilization of Electrical Power and Electric Traction, J.B. Gupta, S.K. Kataria & Sons.
4. Utilization of Electrical Power, R.K. Rajput, Laxmi Publications.

Course Outcomes:

On completion of the course students will be able to:

CO1	Know the light concept, laws of illumination, design and selection of different types of lamps for lighting purposes.
CO2	Know the working of various types of electric heating and welding techniques and their applications.
CO3	Know the laws of electrolysis, applications along the knowledge of refrigeration & air-conditioning.
CO4	Know about types of motors for electric drives, characteristics, speed control, braking techniques and their applications.
CO5	Know the traction system, equipment, current collection, calculation of speed, specific energy consumption and concept of neutral section and speed- time curve etc.

Course Code:	:	EEOE505
Course Title	:	Renewable Energy Technologies
Number of Credits	:	3 (L: 2, T: 1, P: 0)
Prerequisites	:	Energy Resources, Semiconductor physics, Power Electronics, Electric Machines,
Course Category	:	OE

Course Objectives:

- To understand the global energy scenario and renewable energy's role.
- To analyze solar, wind, bio-energy, and other renewable energy sources.
- To apply technical knowledge of renewable energy systems.
- To evaluate environmental and economic benefits of renewable energy.
- To design innovative renewable energy solutions.

Course Contents:

Unit– I Introduction

World Energy Use; Reserves of Energy Resources; Environmental Aspects of Energy Utilisation; Renewable Energy Scenario in India and around the World; Potentials; Achievements / Applications; Economics of renewable energy systems.

Unit– II Solar energy

Solar Radiation; Measurements of Solar Radiation; Flat Plate and Concentrating Collectors; Solar direct Thermal Applications; Solar thermal Power Generation, Fundamentals of Solar Photo Voltaic Conversion, solar PV Configurations.

Unit– III Wind Energy

Wind Data and Energy Estimation; Types of Wind Energy Systems; Performance; Site Selection; Details of Wind Turbine Generator; Safety and Environmental Aspects.

Unit– IV Bio-Energy

Biomass direct combustion; Biomass gasifiers; Biogas plants; Digesters; Ethanol production; Bio diesel; Cogeneration; Biomass Applications.

Unit– V Other Renewable Energy Sources

Tidal energy; Wave Energy; Open and Closed OTEC Cycles; Small Hydro-Geothermal Energy; Hydrogen and Storage; Fuel Cell Systems; Hybrid Systems.

References:

1. O.P. Gupta, Energy Technology, Khanna Publishing House, Delhi (ed. 2018).
2. B. H Khan, Non-Conventional Energy Resources, McGraw Hill Education India Private Limited; Third edition, 2017.
3. Solar Energy, Sukhatme. S.P., Tata McGraw Hill Publishing Company Ltd., New Delhi, 1997.
4. Renewable Energy, Power for a Sustainable Future, Godfrey Boyle, Oxford University Press, U.K., 1996.
5. Fundamental of Renewable Energy Sources, GN Tiwari and MK Ghoshal, Narosa, New Delhi, 2007.
6. Renewable Energy Resources, JW Twidell and AD Weir, ELBS, 2006.

Course Outcomes:

At the end of the course, the student will be able to:

CO1	Understand renewable energy systems and technologies.
CO2	Develop technical skills in designing and evaluating renewable energy systems.
CO3	Apply critical thinking and problem-solving skills.
CO4	Recognize environmental benefits and implications.
CO5	Develop professional competence in the renewable energy sector.

Course Code:	:	EESI516
Course Title	:	Summer Internship-II
Number of Credits	:	2 (L: 0, T: 0, P: 2)
Prerequisites	:	NIL
Course Category	:	SI

Four-week summer internship is mandatory for students. The students are supposed to have practical understanding and training in a suitable industry or organization.

Summer Internship II should be undertaken in an industry only. It should be based on real/ live problems of the Industry/Govt./NGO/ MSME/Rural Sector or an innovative idea having the potential of a Startup

Course Objectives:

- To provide industrial exposure to student that will help students to gain real life experience
- To engage students with experienced professionals that can help them further in their careers
- To provide industrial exposure to student to the real time
- To enable the students to work on short industry projects and gain the skill of preparing report, describing its results and findings
- To identify the gap between existing knowledge and industry expectations

Course Code	:	EEPR517
Course Title	:	Major Project-I
Number of Credits	:	1 (L:0, T:0; P:2)
Prerequisites	:	NIL
Course Category	:	PR

Course Objectives:

- Understand the method of applying engineering knowledge to solve specific problems.
- Apply engineering and management principles while executing the project.
- Identify and solve complex engineering problems using professionally prescribed standards and demonstrate good verbal presentation and technical report writing skills.

Guidelines:

1. Project will have to be done by a group in their area of interest.
2. Each group has to select a contemporary topic that will use the technical knowledge of their program of specialization.
3. Allocation of the guides preferably in accordance with the expertise of the faculty.
4. The student will be assigned a faculty guide who would be the supervisor of the student.
5. The major project-1 required:
   - To specify project topics.
   - To complete introduction, literature review.
   - To specify methodology completely.
   - The line diagram and requirements of parts and materials should be specified in case of fabrication project.

Course Outcomes:

After going through this course, the students will be able to:

CO1	Conceptualize, design and implement solutions for specific problems.
CO2	Communicate the solutions through presentations and technical reports
CO3	Apply project and resource managements skills, professional ethics, societal concerns

Course Code:	:	EEPC601
Course Title	:	Electrical Energy Management
Number of Credits	:	3 (L: 2, T: 1, P: 0)
Prerequisites	:	Knowledge of Generation, Transmission, Distribution and Utilization of Electrical Energy
Course Category	:	PC

Course Objectives:

- To understand energy management fundamentals.
- To analyse energy conservation techniques.
- To apply economic operation principles to power systems.
- To conduct energy audits and analyse energy consumption.
- To evaluate environmental impact and develop sustainable energy solutions.

Course Contents:

Unit– I Introduction to Energy Management

Introduction, Energy crisis, Environmental aspects, Introduction to Alternative sources of Energy, Energy Efficiency, and Energy scenario in India.

Unit– II Energy Conservation

Introduction, Energy conservation in domestic sector, Energy conservation in HVAC systems, Thermal insulation and Energy efficiency, Standby power, Energy conservation at macro level, Demand side management, Energy pricing, Energy efficient motors and basic specifications, other energy efficient devices in electrical systems.

Unit– III Economic operation of Power systems

Introduction, Unit Commitment, Incremental fuel cost, Economic dispatch neglecting Transmission Losses, Transmission loss as a function of plat generation, General loss formula, Optimum load dispatch considering transmission losses.

Unit– IV Energy Audit

Definition, Need for energy audit, Types of audit, Procedures to follow, Data and Information analysis, Energy consumption, Finding of audit, Action plans, Bench marking energy performance, Energy audit instruments, Report writing.

Unit– V Energy and Environment

Energy Economy interaction, Energy-Environment interaction, Global Warming, CO_2 emissions, Ozone layer, Sustainable energy action plan, Environmental Impact assessment.

References:

1. Energy Management by Umesh Rathore, S.K. Kataria & Sons.
2. Energy Management and Conservation by K.V. Sarma, I K International Publishing House.
3. Energy Engineering and Management by Amlan Chakrabarti, PHI.
4. Handbook of Energy Audit by Sonal Desai, McGraw Hill India
5. Electrical power Systems by Ashfaq Hussain, CBS Publishers

Course Outcomes:

At the end of the course, the student will be able to:

CO1	Design and implement energy-efficient systems and technologies.
CO2	Conduct comprehensive energy audits to identify energy-saving opportunities.
CO3	Optimize power system operations for efficient and reliable energy supply.
CO4	Develop and evaluate sustainable energy solutions for environmental sustainability.
CO5	Analyze and interpret energy consumption patterns to inform energy management decisions.

Course Code:	:	EEPE602
Course Title	:	Electric Vehicle
Number of Credits	:	3 (L: 2, T: 1, P: 0)
Prerequisites	:	Knowledge of Electric Machines, Power Electronics and Electric Drives.
Course Category	:	PE

Course objectives:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- To understand the basics of electric vehicle, history and its components.
- To analyse the dynamics of electric vehicles, including the forces involved in vehicle motion, vehicle performance, and the importance of energy consumption optimization.
- To gain knowledge of electric machines used in Electric Vehicles (EVs) and Hybrid Electric Vehicles (HEVs).
- To understand the fundamental principles of converters used in Electric Vehicles (EVs) and Hybrid Electric Vehicles (HEVs), along with the control mechanisms involved in their operation.
- To understand the different types of batteries used in EVs and HEVs, including their characteristics, and the impact of battery technology on vehicle performance.

Course contents:

Unit– I Introduction to Electric Vehicles

Evolution of Electric vehicles, Advanced Electric drive vehicle technology, Vehicles-Electric vehicles (EV), Hybrid Electric drive (HEV), Plug in Electric vehicle (PIEV), Components used Hybrid Electric Vehicle, Economic and environmental impacts of Electric hybrid vehicle, Parameters affecting Environmental and economic analysis, Comparative study of vehicles for economic, environmental aspects

Unit– II Dynamics of Electric vehicles

General description of vehicle movement, analyse various mechanical factors affecting movement of electric vehicle, classification of vehicle power plant, need of gear box, Basic architecture of hybrid drive trains, types of HEVs, Energy saving potential of hybrid drive trains HEV Configurations-Series, parallel, Series-parallel, complex.

Unit– III Electric Machines for EV and HEVs

Electric Machines used in EVs and HEVs, Classification of electrical motors used for EV applications: Induction Motor, Permanent magnet motor, switched reluctance motor, Construction, working and control of permanent magnet motor and switched reluctance motor, Characteristics and applications of above motors, overview, Schematics of hybrid drive train, control architecture,

Unit– IV Power Electronics Converters (DC-AC/DC-DC) for EV and HEVs

EV and EHV configuration based on power electronics, Converter requirement for on board charger, battery pack, auxiliary battery, Introduction to DC to DC converter in EV and HVE, DC to AC converter. Control system for EVs and HEVs, Electronic control unit ECU, Regenerative braking in EVs

Unit– V Batteries

Overview of batteries, Battery Parameters, Types of batteries, various type of battery charging, Comparison of batteries with respect to specific energy, specific power, cycle life, cost, alternative novel energy sources-solar photovoltaic cells, fuel cells, super capacitors, flywheels.

References:

1. A.K. Babu, Electric & Hybrid Vehicles, Khanna Publishing House, New Delhi (Ed. 2018)
2. Fuhs, A. E. Hybrid Vehicles and the Future of Personal Transportation, CRC Press,
3. Gianfranco, Electric and Hybrid Vehicles: Power Sources, Models, Sustainability, Infrastructure And The Market, Pistoia Consultant, Rome, Italy,
4. Ehsani, M. Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press
5. Husain, I. Electric and Hybrid Electric Vehicles, CRC Press
6. Chan C. C. and K. T. Chau, Modern Electric Vehicle Technology, Oxford Science Publication,
7. Rashid, M. H. Power Electronics: Circuits, Devices and Applications, 3rd edition, Pearson,
8. Krishnan, R. Electric motor drives: modelling, analysis, and control, Prentice Hall
9. Krause, O. P., C. Wasynczuk, S. D. Sudhoff, Analysis of electric machinery, IEEE Press

Course Outcomes:

Upon successful completion of this course, students will be able to:

CO1	Identify and describe the key components and working of Electric Vehicles (EVs), including their structure, types, and impact on the environment.

CO2	Analyse the dynamic performance of electric vehicles.
CO3	Select and design appropriate electric machines for use in EVs and HEVs, with an understanding of their performance metrics and control systems.
CO4	Develop proficiency in designing and implementing power electronics converters (DC-AC, DC-DC) for use in the powertrain of Electric and Hybrid Electric Vehicles to optimize energy efficiency.
CO5	Understand and evaluate the characteristics of batteries used in EVs and HEVs to enhance the vehicle's overall performance and range.

Course Code:	:	EEPE612
Course Title	:	Electric Vehicle Lab
Number of Credits	:	2 (L: 0, T: 0, P: 4)
Prerequisites	:	Electric Vehicle
Course Category	:	PE

Course Objectives:

This course aims to help students acquire industry-recognized competencies through various teaching and learning experiences.

- Providing students with knowledge of the components and systems of Electric and Hybrid Electric Vehicles (EVs and HEVs).
- Developing practical skills in diagnosing, installing, and maintaining critical EV/HEV components, including batteries, inverters, and converters.
- Enabling students to conduct economic and environmental analysis, and create test procedures for EV equipment, with a focus on safety standards.

List of Experiments:

1. Develop block diagram of Electric vehicle and identify parts.
2. Case study- Compare minimum four vehicles for economic and environmental analysis.
3. Develop schematic diagram of hybrid electric vehicle and identify the components.
4. Prepare report on Plug in Electric vehicle by visiting a charging station
5. Inspect and install inverter of given lead acid battery.
6. Prepare a report on batteries used from market survey.
7. Collect specifications of converters and inverters used for Electric vehicles.
8. Diagnose, repair and maintain battery used in electric vehicle.
9. Prepare test procedure for equipment used in Electric vehicle
10. List safety procedures and schedule for handling HEVs and EVs.

Course Outcomes:

Upon successful completion of this course, students will be able to:

CO1	Students will be able to create block and schematic diagrams for EVs and HEVs and identify their key components.
CO2	Students will be able to perform economic and environmental comparisons of different EVs and conduct market surveys on EV components.
CO3	Students will familiarize with installing, maintaining, and testing EV/HEV components, while adhering to safety protocols.

Course Code	:	EEHS603
Course Title	:	Entrepreneurship and Start-Ups
Number of Credits	:	3 (L:2, T:1, P:0)
Prerequisites	:	NIL
Course Category	:	HS

Course Objectives:

- To acquiring Entrepreneurial spirit, and resourcefulness.
- To understanding the concept and process of entrepreneurship - its contribution and role in the growth and development of individual and the nation.
- To acquiring entrepreneurial quality, competency and motivation
- To eliminate unproductive activities under the control of the Management, Supervisor, worker and the Design of Products and Processes.
- To use the Charts to record the Activities of the people, materials and Equipment to find alternative methods which minimize waste and to implement the best method.

Course Contents:

Unit– I Introduction to Entrepreneurship and Start-Ups

Definitions, Traits of an entrepreneur, Intrapreneurship, Qualities to becomes entrepreneur, Motivation, Types of Business Structures, Similarities/differences between entrepreneurs and managers, Small Scale of industries, Business Ideas and their implementation, Business Plan.

Unit– II Idea to Start-Up

Market Survey, Project report, Market Analysis – Identifying the target market, Competition evaluation and Strategy Development, Marketing and accounting, Risk analysis, Communication of Ideas to potential investors – Investor Pitch, Patenting and Licenses, exit strategies for entrepreneurs, bankruptcy, and succession and harvesting strategy.

Unit– III Principles of Management

Definition of Management, Administration Organization, F.W. Taylor's and Henry Fayol's Principles of Management, Functions of Manager, Types of Organization: Line, Staff, and committee type, Directing, Leadership; Styles of Leadership; Qualities of a good leader; Motivation, Positive and Negative Motivation, Modern Management Techniques, Management Information Systems, Objectives and Importance.

Unit– IV Production Planning and Control

Introduction, Major functions of Production Planning and Control, Methods of forecasting, Concept of Critical Path Method (CPM), Types of Production: Mass Production, Batch Production and Job Order Production, Principles of Product and Process Planning, Quality Control: Definition, Objectives, Sampling Inspection, Benefits of ISO to the organization, Concept of ISO 9001:2008, Quality Management System, Registration/Certification.

Unit– V Financial Management

Financial Institutions, Financing methods available for start-ups in India, Fixed and Working Capital; Resources of Capital; Shares Preference and Equity Shares; Debentures; Public Deposits; Factory Costing: Direct Cost; Indirect Cost; Factory Overhead; Selling Price of a product; Profit.

References:

1. S.C. Sharma, Industrial Engineering & Management, Khanna Book Publishing Co. (P) Ltd., Delhi
2. O.P. Khanna, Industrial Engineering and Management, Revised Edition, Dhanpat Rai Publications (P) Ltd., New Delhi – 110002.
3. Steve Blank and Bob Dorf, K & S Ranch, The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company.
4. Eric Ries, The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses, Penguin UK.
5. Heinz Weihrich, Harold Koontz, Management, A global perspective, 10th Edition, McGraw Hill International Edition 1994.
6. M. Mahajan, Industrial Engineering and Production Management, Dhanpat Rai & Co.

Course Outcomes:

At the end of the course, the student will be able to

CO1	Understanding the concept and process of entrepreneurship.
CO2	Understand the ideas of start-up, finance and protection.
CO3	Explain the production planning and quality control, and its functions.
CO4	Understand the basic principles, approaches and functions of management and identify concepts to specific situations.
CO5	List and explain the different financial sources and methods of inventory management.

Course Code	:	COOE605
Course Title	:	Artificial Intelligence
Number of Credits	:	3 (L:2, T:1, P:0)
Prerequisites	:	IT System and Computer Programming
Course Category	:	OE

Course Objectives:

- To understand basics of artificial intelligence and intelligent agents.
- To apply propositional logic for representing knowledge to achieve a goal.
- To analyze the real-world problems using first-order logic.
- To evaluate different types of machine learning algorithms.
- To apply algorithms and knowledge that allow computer to learn from data and make predictions.

Course Contents:

Unit– I Intelligent Agents and Problem Solving

Introduction to Artificial Intelligence (AI), Foundations and history of AI, Agents and environments, Concept of rationality, Nature of environments, and Structure of agents, Problem-solving agents, Toy and real-world problem, Searching for solutions, Uninformed search strategies, and informed (Heuristic) search strategies, and Heuristic functions.

Unit– II Logical Agents

Knowledge-based agents, The Wumpus world problem, Logic, Propositional logic, Propositional Theorem Proving, Effective propositional model checking, and Agents based on propositional logic.

Unit– III First-Order Logic

Representation, Syntax and semantics of first-order logic (FOL), Using FOL, Knowledge engineering in FOL, Inferences in FOL: Propositional vs First-order inference, unification and lifting, Forward chaining, Backward chaining, and Resolution.

Unit– IV Learning

Forms of learning, Supervised and unsupervised learning, Learning decision trees: The decision tree representation, expressiveness of decision trees, Inducing decision trees from examples, Theory of learning, Regression and classification with linear models, Artificial Neural Networks (ANN), Support Vector Machine (SVM), Ensemble learning, and Practical machine learning (ML): Handwritten digit recognition and House price prediction.

Unit– V Knowledge in Learning

Logical formulation of learning: Examples and hypotheses, Current-best-hypothesis search and least commitment search; Knowledge in learning, Explanation-based learning, Inductive logic programming: An example, Top-down inductive learning methods, Inductive learning with inverse deduction, Introduction to reinforcement learning.

References:

1. Russell S. J. and Norvig P., "Artificial Intelligence-A Modern Approach", Pearson, 4th Edition, 2022.
2. Padhy N. P., "Artificial Intelligence and Intelligent Systems", Oxford University Press, 1st Edition.
3. Goel L., "Artificial Intelligence: Concepts and Applications", Wiley, 2021.
4. Deisenroth M. P., Faisal A. A., and Ong C. S., "Mathematics for Machine Learning", Cambridge University Press, 1st Edition, 2020.

Course Outcomes:

At the end of this course, the students will be able to:

CO1	Describe the basics of AI and different types of searching
CO2	Solve the problems related to propositional logic
CO3	Represent knowledge using first-order logic in AI-based systems
CO4	Differentiate among different forms of learning, decision trees, ANN, and SVM
CO5	Demonstrate knowledge in learning

Course Code:	:	EEPC611
Course Title	:	Electrical Workshop Lab
Number of Credits	:	2 (L: 0, T: 0, P: 4)
Prerequisites	:	Building Electrification, Electrical Testing and Commissioning
Course Category	:	PC

Course Objectives:

This course aims to help students acquire industry-recognized competencies through various teaching and learning experiences.

- Teaching students how to identify various types of electrical wires and prepare different electrical joints.
- Enabling students to design and implement staircase and corridor wiring systems for controlling lamps from multiple locations.
- Providing practical experience in constructing and testing electrical circuits, including series and parallel testing boards, while understanding various wiring installations.

List of Experiments:

1. Identification of single core (ST), Twin core (TC), three core(3C), four core(4C), copper and aluminium PVC, VIR & weather proof (WP) cable and prepare Britannia T joint and married joint.
2. To control one lamp load from two different places (i.e. staircase wiring system).
3. To control two lamps from three different places (i.e. corridor wiring system).
4. Prepare series testing board.
5. Prepare parallel testing board board with A.M. & V.M.
6. Prepare combination of series and parallel testing board
7. To study the various types of wiring (e.g. cleat wiring, batten wiring, casing caping wiring, conduit type wiring).
8. To study and test the internal connections of a fluorescent tube and measure its power factor.
9. Connection of Distribution Board with Energy Meter, Main Switch, Fuse & Distribution Box.
10. Test wiring installation using megger.

Course Outcomes:

Upon successful completion of this course, students will be able to:

CO1	Students will identify and classify electrical wires and create different types of electrical joints.
CO2	Students will design and implement staircase and corridor wiring systems for multi-location lamp control.
CO3	Students will construct and test series, parallel, and combination circuits, and understand wiring methods and installations.

Course Code	:	EESE616
Course Title	:	Seminar
Number of Credits	:	1 (L:0, T:0; P:2)
Prerequisites	:	NIL
Course Category	:	SE

A seminar course at the diploma engineering level covers a wide range of topics within the Electrical Engineering field, with an emphasis on analysis, design, and presentation. The seminar aims to enhance students' understanding of various aspects of Electrical Engineering by choosing topics relevant to their academic interests and of professional value to industry organizations. Each teacher is expected to supervise 8-10 students.

Guidelines for Seminar for Diploma in Electrical Engineering:

1. Objective of the Seminar:

- Enhancing the technical and communication skills of students.
- Providing students with the opportunity to explore and present on contemporary topics in electrical engineering.
- Encouraging critical thinking, research, and in-depth understanding of emerging technologies in the electrical engineering domain.

2. Selection of Topics:

- Topics should be relevant to the current trends and advancements in electrical engineering, such as renewable energy systems, smart grids, power systems, power electronics, electric drives and machines, automation, and robotics etc.
- Topics should focus on practical applications, innovations, or research findings in electrical engineering.
- Ensure the topic is manageable within the scope of the seminar duration and accessible to the seminar audience.

3. Preparation for the Seminar:

- **Study and Research work:**
  Students should engage in comprehensive study and research work, utilizing reliable sources such as books, journals, research papers, and online databases.
- **Presentation Materials:**
  Prepare clear and well-structured presentation slides (e.g., PowerPoint) with visual aids (graphs, charts, diagrams) to enhance understanding.

- **Practice:**
  Students should practice delivering the seminar, focusing on clarity, confidence, and time management.
- **References:**
  Cite all the sources used in the research, ensuring the credibility and authenticity of the information presented.
- information presented.

4. Format of the Seminar:

- **Introduction:**
  Briefly introduce the topic, its importance, and the objectives of the seminar.
- **Main Content:**
  Present the core concepts, methodologies, and findings in a logical and concise manner.
- **Case Studies/Examples:**
  Include relevant case studies, real-world examples, or demonstrations that illustrate the practical applications of the topic.
- **Conclusion:**
  Summarize the key points discussed and provide insights into future trends or research directions in the area of focus.
- **Q&A Session:** After the presentation, open the floor for questions and discussions. Students should be prepared to answer questions and engage with the audience.
- Ability to handle questions and engage in discussions effectively.

6. Duration:

- The seminar should last between **15 to 20 minutes** for the presentation, followed by **5 to 10 minutes** for questions and answers.

7. Report Submission:

- Students must submit a seminar report presented during the seminar.
- The report should include introduction, results, and conclusions.
- The report should also include references to all sources of information used in the research.

8. Ethical Considerations:

- All work should be original and properly referenced to avoid plagiarism.
- Students should ensure the use of credible and authentic sources of information.

Course Code	:	EEPR617
Course Title	:	Major Project-II
Number of Credits	:	3 (L:0, T:0; P:6)
Prerequisites	:	NIL
Course Category	:	PR

Course Objectives:

- Understand the method of applying engineering knowledge to solve specific problems.
- Apply engineering and management principles while executing the project.
- Identify and solve complex engineering problems using professionally prescribed standards and demonstrate good verbal presentation and technical report writing skills.

Guidelines:

1. Project will have to be done by a group in their area of interest.
2. Each group has to select a contemporary topic that will use the technical knowledge of their program of specialization.
3. Allocation of the guides preferably in accordance with the expertise of the faculty.
4. The student will be assigned a faculty guide who would be the supervisor of the student.
5. The number of projects that a faculty can guide would be limited to two groups.
6. The project can be carried out on-campus or in an industry or an organization with prior approval from the principal through head of section.
7. The project shall be completed and submitted at least one month before the last teaching day.
8. The project should be presented by students using power point once before submission of project.

Course Outcomes:

After going through this course, the students will be able to:

CO1	Conceptualize, design and implement solutions for specific problems.
CO2	Communicate the solutions through presentations and technical reports.
CO3	Apply project and resource managements skills, professional ethics, societal concerns.

Course Code	:	EEAU600
Course Title	:	Indian Constitution
Number of Credits	:	0 (L:2, T:0; P:0)
Prerequisites	:	NIL
Course Category	:	AU

Course Contents:

Unit– I The Constitution - Introduction

The History of the Making of the Indian Constitution, Preamble and the Basic Structure, and its interpretation, Fundamental Rights and Duties and their interpretation, State Policy Principles

Unit– II Union Government

Structure of the Indian Union, President – Role and Power, Prime Minister and Council of Ministers, Lok Sabha and Rajya Sabha

Unit– III State Government

Governor – Role and Power, Chief Minister and Council of Ministers, State Secretariat

Unit– IV Local Administration

District Administration, Municipal Corporation, Zila Panchayat

Unit– V Election Commission

Role and Functioning, Chief Election Commissioner, State Election Commission

References:

1. Rajeev Bhargava, Ethics and Politics of the Indian Constitution, Oxford University Press, New Delhi, 2008.
2. B.L. Fadia, The Constitution of India, Sahitya Bhawan; New edition (2017).
3. DD Basu, Introduction to the Constitution of India, Lexis Nexis; Twenty-Third 2018 edition.

Suggested Software/Learning Websites:

a. https://www.constitution.org/cons/india/const.htm
b. http://www.legislative.gov.in/constitution-of-india
c. https://www.sci.gov.in/constitution
d. https://www.toppr.com/guides/civics/the-indian-constitution/the-constitution-of-india

APPENDIX-I

LIST OF PROGRAMME ELECTIVE COURSES

S. No.	Course	Course Code
1	Communication Technologies	EEPE###
2	Control System Engineering	EEPE###
3	Electric Vehicles	EEPE###
4	Electrical Estimation and Contracting	EEPE###
5	Electrical Instrumentation	EEPE###
6	Illumination Practices	EEPE###
7	Solar Power Technologies	EEPE###
8	Switchgear and Protection	EEPE###
9	Utilization and Traction	EEPE###
10	Wind Power Technologies	EEPE###

###: Three-digit numeric code

APPENDIX-II

LIST OF OPEN ELECTIVE COURSES

S. No.	Course	Course Code
1	Cyber Security	**OE###
2	Internet of Things	**OE###
3	Soft Computing Techniques	**OE###
4	Web Designing and Multimedia Technology	**OE###
5	Smart systems	**OE###
6	Artificial Intelligence	**OE###
7	Renewable Energy Technologies	**OE###
8	Disaster Management	**OE###
9	Robotics	**OE###
10	Mechatronics	**OE###

**: Branch code offering the course
###: Three-digit numeric code

APPENDIX-III

EXIT POLICY

By implementing the guidelines of **NEP-2020**, if any student fails to continue with the diploma engineering course of 3-year duration after passing 2nd year of the enrolled discipline of the course due to any reason/s, he/she may be awarded with a certificate in the respective discipline of engineering.

S. No.	Year	Weightage	Maximum Marks
1	First	25 Percent	500
2	Second	75 Percent	1500
		GRAND TOTAL	**2000**

APPENDIX-IV

FINAL RESULT PREPARATION

S. No.	Year	Weightage	Maximum Marks
1	First	25 Percent	500
2	Second	75 Percent	1500
3	Third	100 Percent	2000
		GRAND TOTAL	**4000**