ENGINEERING MATHEMATIC -III

Semester: III **Year: 2021-22**

Course	Code	Credits	Total Hours - 40 Hours/Week		Assessment		Exam Duration in Hours
			Lecture	Tutorial	SEE	CIE	
Engineering Mathematic -III	21MAT31	03	03	00	50	50	03

Course Objectives:

1) Introduce most commonly used analytical and numerical methods in the different engineering
2) fields.
3) Learn Laplace transform and Z-transforms to solve ODE and PDE's.
4) Understanding the statistical methods, numerical methods.
5) Solve the problem related to Interpolation.
6) To discuss the random variable and associated probability distributions.
7) Understand the vector space and associated results.
8) Understand the basic concepts of set theory, relations, functions and mathematical logic

Course outcomes:

	Course Outcomes	RBT LEVEL
C01	Apply the knowledge of Laplace transform from time domain to frequency domain. Knowing the property of Laplace transform and solving the problems on Signal and image processing which transforms differential equation into algebraic equation form and solving the problems also in inverse Laplace transform.	L1, L2, L3
C02	Knowing the random variable both discrete and continuous and their probability distribution, Mass density function and solving the problems on various engineering problems.	L1, L2, L3
C03	Apply the concept of correlation and regression lines for solving the problems and numerical techniques to solve engineering problems and fit a least squares curve to the given data.	L1, L2, L3
C04	Studying the Forward and Backward Finite differences and solve the problems on interpolation and finding the numerical integration by different methods.	L1, L2, L3
C05	Apply the knowledge of Z-transforms in solving the difference equation arising in the continuous and discrete time signals and digital processing, Apply the knowledge of vector space in digital communication/ Apply sampling distribution to solve engineering problems. / Apply the operations like union and intersection on discrete structures such as sets, relations and functions and construct mathematical arguments using logical connectives	L1, L2, L3
	Total number of lecture hours	40

Module-1

Laplace Transforms: Definition, Laplace transforms of Elementary functions, properties (without proof) periodic function, Unit step function, Unit impulse function.
Inverse Laplace Transforms: Definition, Convolution Theorem (without proof) and Finding Inverse Laplace transform by convolution Theorem. Solution of Linear Differential equations using Laplace Transforms and Applications (5 Assignment Problem).
Self-Study: Solution of first order simultaneous differential equation 08 Hours

Module-2

Probability Distribution: Random variables (discrete and continuous) probability mass/density functions. Binomial distribution, Poisson distribution. Exponential and Normal distributions. Problems. (5 Assignment Problem).

Self-Study: Definition of probability, addition and multiplication rule, Bay's theorem. 08 Hours

Module-3

Statistical Methods: Correlation-karl Pearson's co-efficient of correlation problems. Regression analysis lines of regression, Rank correlation (without proof)-problems.
Curve Fitting: Curve fitting by the method of least square. Fitting of the curves of the formy=ax+b,y=ax^2+bx+c & y=ae^bx.
Numerical Methods: Numerical solution of algebraic and transcendental equations by Regula-Falsi Method and Newton-Raphson method. (5 Assignment Problem).
Self-Study: Secent method, mean, mode, median, variance and standard deviation. 08 Hours

Module-4

Finite Difference: Forward and Backward differences, Newton's forward and backward interpolation formulae. Divided difference-Newton's divided difference formulae. Lagrange's-interpolation formula and inverse interpolation formula (all formula without proof) problems.
Numerical Integration: Simpsons(1/3)^rd,(3/8)^thrules, Weddle's rule (without proof) problems.
(5 Assignment Problem).
Self-Study: Numerical differentiation, Trapezoidal rule 08 Hours

Module-5

Sampling theory: Sampling, Sampling distributions, standard error, test of hypothesis for means and proportions, Type I and Type II errors, Level of significance, confidence limits for means, one tailed and two tailed tests, student's t-distribution, Chi - square distribution as a test of goodness of fit.
Tracing of curves: Cartesian form - Strophoid, Leminscate, Parametric form - Cycloid, Astroid, Polar form - Cardioid, Leminscate.
Self-Study : Types of samplings, Cartesian equations and their geometrical representation
08 Hours

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2		1				1			1
CO2	3	2	2		1				1			1
CO3	3	2	2		1				1			1
CO4	3	2	2		1				1			1
CO5	3	2	2		1				1			1

Text Books:

1. B.S. Grewal : Higher Engineering Mathematics, Khanna Publishers, 43rd Ed., 2015.
2. E. Kreyszig : Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed.(Reprint), 2016.

Reference books:

1. C.Ray Wylie, Louis C.Barrett : "Advanced Engineering Mathematics", 6th Edition,
2. McGraw-Hill Book Co., New York, 1995.
2. James Stewart : "Calculus –Early Transcendentals", Cengage Learning India Private Ltd., 2017.
3. B.V.Ramana : "Higher Engineering Mathematics" 11th Edition, Tata McGraw-Hill, 2010.
4. Srimanta Pal & Subobh C Bhunia:"Engineering Mathematics", Oxford University Press,3rd Reprint,2016.
5. Gupta C.B., Singh S.R. and Mukesh Kumar : "Engineering Mathematics for Semester I & II", Mc-Graw Hill Education (India) Pvt.Ltd., 2015.

Web links and Video Lectures:

1. http://nptel.ac.in/courses.php?disciplineID=111
2. http://www.class-central.com/subject/math
3. http://academicearth.org.

Scheme of Examination:

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question carries 20 marks.
4. There will be two full questions (with a maximum of four sub questions) from each module.
5. Each full question will have sub questions covering all the topics under a module.
6. The students will have to answer five full questions, selecting one full question from each module.

THERMODYNAMICS AND ENERGY CONVERSIONS

Semester: III **Year: 2021-22**

Course	Code	Credits	Total Hours - 48 Hours/Week		Assessment		Exam Duration in Hours
			Lecture	Tutorial	SEE	CIE	
Thermodynamics and Energy Conversions	21EG32	04	03	01	50	50	03

COURSE OBJECTIVES:

1) To introduce about basic concepts of Zeroth law, temperature scales and work and heat interaction.
2) To explicate the First and Second law of thermodynamics.
3) To illuminate the concepts of Entropy and Pure substances.
4) To elucidate the concepts of Gas power cycles and Vapour power cycles.
5) To study the basics of Refrigeration and Compressors.

MODULE-1

Basic concepts, Zeroth law and temperature:

Thermodynamic definition and scope, Microscopic and Macroscopic approaches. Some practical applications of engineering thermodynamic Systems, Characteristics of system boundary and control surface, examples. Thermodynamic properties; definition and units, intensive, extensive properties, specific properties, pressure, specific volume Thermodynamic state, state point, state diagram, path and process, quasi-static process, cyclic and non-cyclic; processes; Thermodynamic equilibrium; definition, mechanical equilibrium; diathermic wall, thermal equilibrium, chemical equilibrium, Zeroth law of thermodynamics, Temperature; concepts, scales, international fixed points and measurement of temperature. Constant volume gas thermometer, constant pressure gas thermometer, mercury in glass thermometer.

Energy Interaction:

Mechanics, definition of work and its limitations. Thermodynamic definition of work; examples, sign convention. Displacement work; as a part of a system boundary, as a whole of a system boundary, expressions for displacement work in various processes through p-v diagrams. Shaft work; Electrical work. Other types of work. Heat; definition, units and sign convention. Problems. 10 Hours

MODULE-2

First Law of Thermodynamics:

Joules experiments, equivalence of heat and work. Statement of the First law of thermodynamics, extension of the First law to non - cyclic processes, energy, energy as a property, modes of energy, Extension of the First law to control volume; steady flow energy equation (SFEE), important applications.

Second Law of Thermodynamics:

limitations of first law of thermodynamics, Devices converting heat to work (Heat engine); Devices converting work to heat (Reversed Heat engine). Second law thermodynamics statements Kelvin - Planck statement and Clausius statement, Equivalence of the two statements; perpetual motion machine of second kind, Carnot cycle, Carnot principles. Numerical. 10 Hours

MODULE-3

Entropy:

Introduction, Clausius theorem, entropy a property of system, Clausius inequality, two reversible adiabatic path cannot intersect each other, Carnot's cycle on temperature-entropy diagram, change in entropy in an irreversible process, principle of increase of entropy, numerical.

Pure Substances:

P-V-T surface for a pure substance, P-T and P-V diagrams, triple point and critical points. Sub-cooled liquid, saturated liquid, mixture of saturated liquid and vapor, saturated vapor and superheated vapor states of pure substance with water as example. Enthalpy of change of phase, Dryness fraction, T-S and H-S diagrams of various processes. Steam tables and its use. Throttling calorimeter, separating and throttling calorimeter. 09 Hours

MODULE-4

Gas Power cycles:

Carnot, Stirling, Brayton, Otto, Diesel and Dual cycles, Numerical.

Vapour power cycles:

Simple steam cycle, Rankine cycle, actual vapour cycle processes, comparison of Carnot and Rankine cycle, reheat and regeneration cycle and numerical. 10 Hours

MODULE-5

Refrigeration:

Definition, refrigeration effect, co-efficient of performance, ton of refrigeration, applications, desirable properties of good refrigerants, Reversed heat engine cycle, vapour compression refrigeration system, vapour absorption refrigeration system, change in operating conditions on the performance of vapour compression and simple numerical.

Compressors:

Introduction, working of reciprocating air compressor, air compressor terminology, work done by compressor with and without clearance, isothermal efficiency, volumetric efficiency, multi stage compressor, condition for minimum work, numerical problems. 09 Hours

COURSE OUTCOMES

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

	COURSE OUTCOMES	**RBT LEVEL**
CO1	Comprehend basic concepts of Zeroth law, temperature scales and work and heat interaction.	**L1, L2, L3**
CO2	Practice the examples on First and Second law of thermodynamics and their applications.	**L1, L2, L3**
CO3	Comprehend the concepts of Entropy and Pure substances	**L1, L2, L3**

CO4	Analyse the Gas power cycles and Vapour power cycles.	**L1, L2, L3, L4**
CO5	Apply and analyse the basics of Refrigeration and Compressors.	**L1, L2, L3**
	Total Number Lecture Hours	**48**
	NOTE: All levels mentioned are as per Revised Bloom's Taxonomy	

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	02	01						01				01
CO2	02	01		02				01				01
CO3	02	01		02		01		01				01
CO4	02	02		01		01		01				01
CO5	02	02		01		01	01	01				01

TEXT BOOKS:

1) Rajput. R. K., "Thermal Engineering" S.Chand Publishers, 2000
2) Kothandaraman.C.P, Domkundwar. S,Domkundwar. A.V., "A course in thermal Engineering", Fifth Edition," Dhanpat Rai & sons, 2002

REFERENCES:

1) Basic and Applied Thermodynamics by P.K. Nag, MCGRAW HILL INDIA
2) Steam & Gas Turbine by R. Yadav, CPH Allahabad
3) Thermal Engg. By PL Ballaney, Khanna Publisher
4) Ganesan V." Internal Combustion Engines", Third Edition, Tata McGraw-Hill 2007
5) Thermodynamics: An Engineering Approach (SIE) By Yunus A. Cengel, Michael A. Boles, Mehmet Kanoglu , 2019 Publisher MCGRAW HILL INDIA.

SCHEME OF EXAMINATION:

Two questions to be set from each module. Students have to answer five full questions choosing at least one full question from each module.

MECHANICS OF MATERIALS

Semester: III **Year: 2021-22**

Course	Code	Credits	Total Hours - 48 Hours/Week		Assessment		Exam Duration in Hours
			Lecture	Tutorial	SEE	CIE	
Mechanics of Materials	21EG33	03	03		50	50	03

COURSE OBJECTIVES:

1) To understand the basic concepts of the stresses and strains for different materials and strength of structural elements.
2) To know the development of internal forces and resistance mechanism for one dimensional and two-dimensional structural elements.
3) To analyses and understand different internal forces and stresses induced due to representative loads on structural elements.
4) To analyses and understand principal stresses due to the combination of two-dimensional stresses on an element and failure mechanisms in materials.
5) To evaluate the behavior of torsional members, columns and struts.

MODULE-1

Stresses and Strains:

Introduction, Properties of materials, Stress, Strain and Hooke's law, Stress strain diagram for brittle and ductile materials, True stress and strain, Calculation of stresses in straight, Stepped and tapered sections.

Composite sections, Stresses due to temperature change, Shear stress and strain, Lateral strain and Poisson's ratio, Elastic constants and relations between them, numerical.

10 hours

MODULE-2

Analysis of Stress and Strain:

Introduction to three-dimensional state of stress, Stresses on inclined planes, Principal stresses and maximum shear stress.

Principal angles, Shear stresses on principal planes, Maximum shear stress, Mohr circle for plane stress conditions. 10 hours

MODULE-3

Shear Force and Bending Moment in Beams:

Introduction to types of beams, supports and loadings. Definition of bending moment and shear force, Sign conventions, relationship between load intensity, bending moment and shear force. Shear force and bending moment diagrams for statically determinate beams subjected to points load, uniformly distributed loads, uniformly varying loads, couple and their combinations.

10 hours

MODULE-4

Bending and Shear Stresses in Beams:

Introduction, pure bending theory, Assumptions, derivation of bending equation, modulus of rupture, section modulus, flexural rigidity. Expression for transverse shear stress in beams, Bending and shear stress distribution diagrams for circular, rectangular, 'I', and 'T' sections. Shear

Centre (only concept).

Thin and Thick Cylinders:

Introduction, Thin cylinders subjected to internal pressure; Hoop stresses, Longitudinal stress and change in volume. Thick cylinders subjected to both internal and external pressure; Lame's equation, radial and hoop stress distribution.

09 hours

MODULE-5

Torsion in Circular Shaft:

Introduction, pure torsion, Assumptions, derivation of torsion equation for circular shafts, torsional rigidity and polar modulus Power transmitted by a shaft, combined bending and torsion.

Theories of Failure:

Introduction, maximum principal stress theory (Rankine's theory), Maximum shearing stress theory (Tresca's theory), Strain energy theory (Beltrami and Haigh), and maximum strain theory (St. Venant's theory). 09 hours

COURSE OUTCOMES

At the end of this course, student should be able to

	COURSE OUTCOMES	**RBT LEVEL**
CO1	Understand simple, compound, thermal stresses and strains their relations and strain energy.	**L1, L2, L5**
CO2	Analyse structural members for stresses, strains and deformations.	**L1, L3**
CO3	Analyse the structural members subjected to bending and shear loads.	**L1, L5**
CO4	Comprehend the basic concept of analysis and design of members subjected to bending and understand the concept of cylinders.	**L2, L4**
CO5	Comprehend the basic concept of analysis and design of members subjected to torsion and thus understand failure concepts	**L2, L4**
	Total Number Lecture Hours	**48**
	NOTE: All levels mentioned are as per Revised Bloom's Taxonomy	

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	03	02				02		01				02
CO2	03	02				02		01				02
CO3	03	02				02		01				02
CO4	03	02				02		01				02
CO5	03	02				02		01				02

TEXT BOOKS:

1. B.S. Basavarajaiah, P.Mahadevappa "Strength of Materials" in SI Units, University Press (India) Pvt. Ltd., 3rd Edition, 2010

2. Ferdinand P. Beer, E. Russell Johnston and Jr.John T. DeWolf "Mechanics of Materials", Tata McGraw-Hill, Third Edition, SI Units.

REFERENCES:

1) D.H. Young, S.P. Timoshenko "Elements of Strength of Materials" East West Press Pvt. Ltd., 5th Edition (Reprint 2014)
2) R K Bansal, "A Textbook of Strength of Materials", 4th Edition, Laxmi Publications, 2010
3) S.S. Rattan "Strength of Materials" McGraw Hill Education (India) Pvt. Ltd., 2nd Edition (Sixth reprint 2013)
4) Fundamentals of Strength of Materials P N Chandramouli PHI Learning Pvt. Ltd 2013
5) Strength of Materials R K Rajput S. Chand and Company Pvt. Ltd 2014
6) Strength of Materials R. Subramanian Oxford 2005

SCHEME OF EXAMINATION:

Two questions to be set from each module. Students have to answer five full questions choosing at least one full question from each module.

MATERIALS SCIENCE FOR ENERGY ENGINEERING

Semester: III **Year: 2021-22**

Course	Code	Credits	Total Hours - 48 Hours/Week		Assessment		Exam Duration in Hours
			Lecture	Tutorial	SEE	CIE	
Material Science for Energy Engineering	21EG34	03	03		50	50	03

COURSE OBJECTIVES:

Upon successful completion of the course the students will be familiar with

1. Provide basic background to systematically approach for selection of materials for a wide range of products in engineering applications.
2. Introduce the concept of crystal structure, atomic planes and directions.
3. Introduce the concept of atomic packing, coordination, and symmetry elements.
4. Introduce imperfections in solids.
5. Introduce phase stabilities and phase diagrams.
6. Teach mechanism of phase transformations.
7. Introduce various heat treatment methods.

MODULE-1

Structure of Materials:

Introduction: Classification of materials, crystalline and non-crystalline solids, atomic bonding

Geometrical Crystallography: Symmetry elements: the operation of rotation, Proper and Improper rotation axes, Screw axes, Glide planes.

Crystal Structure: Crystal Lattice, Unit Cell, Planes and directions in a lattice, Planar Atomic Density, packing of atoms and packing fraction, Classification and Coordination of voids, Bragg's Law

Imperfections in Solids: Types of imperfections, Point defects: vacancies, interstitials, line defects, 2-D and 3D-defects, Concept of free volume in amorphous solids. 9 Hours

MODULE-2

Physical Metallurgy:

Alloy Systems: Classification of Solid solutions, Hume- Rothery Rules

Phase Diagrams: Gibbs Phase Rule, Solubility limit, phase equilibria and Phase Diagrams: Isomorphous systems, Invariant Binary Reactions, Lever Rule; important phase- diagrams, Iron-Carbon Diagram.

Diffusion: Diffusion-Fick's Laws, Role of imperfections in diffusion 9 Hours

MODULE-3

Nucleation and growth: Introduction to homogeneous and heterogeneous nucleation, critical radius for nucleation.

Plastic Deformation: Slip, Twinning; Recovery- Recrystallization-Grain Growth, Introduction to Strengthening mechanisms. Lever rule and phase diagram.

Heat treatment: Annealing, Normalizing, hardening, Tempering, Nitriding, Cyaniding, Induction Hardening and Flame Hardening, Recent advances in heat treat technology. TTT diagram,

microstructural effects brought about by these processes and their influence on mechanical properties 10 Hours

MODULE-4

Surface coating technologies: Introduction, coating materials, coating technologies, types of coating, advantages and disadvantages of surface coating.

Powder metallurgy: Introduction, Powder Production Techniques: Different Mechanical and Chemical methods, Characterization of powders (Particle Size & Shape Distribution), Powder Shaping: Particle Packing Modifications, Lubricants & Binders, Powder Compaction & Process, Sintering and Application of Powder Metallurgy. 10 Hours

MODULE-5

Nanomaterials Applied in Solar Cells: Nano, micro, and poly crystalline and amorphous Si for solar cells, Nano-micro-Si-composite structure, various techniques of Si deposition. Nanostructured Materials for High Efficiency Perovskite Solar Cells, Dielectric Nanomaterials for Silicon Solar Cells, Nanostructured Cathode Buffer Layers for Inverted Polymer Solar Cells - Discotic Liquid Crystals for Self-organizing Photovoltaics. 10 Hours

COURSE OUTCOMES

At the end of this course, student should be able to

	COURSE OUTCOMES	**RBT LEVEL**
CO1	Understand the atomic arrangement in crystalline materials and describe the periodic arrangement of atoms in terms of unit cell parameters.	**L1**
CO2	Understand the importance of phase diagrams and the phase transformations.	**L1, L3**
CO3	Know various heat treatment methods for controlling the microstructure.	**L1, L2, L3**
CO4	Correlate between material properties with component design and identify various kinds of defects.	**L3**
CO5	Apply the method of materials selection, material data and knowledge sources for computer-aided selection of material	**L1, L3**
	Total Number Lecture Hours	**48**
	NOTE: All levels mentioned are as per Revised Bloom's Taxonomy	

CO-PO Mapping

CO \ PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2				2	1	1	1				1
CO2	2				2	1	1	1				1
CO3	2				2	1	1	1				1
CO4	2				2	1	1	1				1
CO5	2				2	1	1	1				1

TEXT BOOKS:

1. Ashby, M.F. (2010), Materials Selection in Mechanical Design, 4th Edition, Butterworth-Heinemann.
2. Azaroff, L.V., (2001) Introduction to solids, 1st Edition, McGraw Hill Book Company.
3. Avner, S.H., (2017), Introduction to Physical Metallurgy, 2nd Edition, McGraw Hill Education.
4. Powder Metallurgy Technology, Cambridge International Science Publishing,2002.

REFERENCES:

1. Jones, D.R.H., and Ashby,M.F., (2011), Engineering Materials 1: An Introduction to Properties, Application and Design, 4th Edition, Butterworth-Heinemann.
2. Jones, D.R.H., and Ashby,M.F., (2012), Engineering Materials 2: An Introduction to Microstructure and Processing, 4th Edition, Butterworth-Heinemann.
3. Callister Jr, W.D., Rethwisch, D.G., (2018), Materials Science and Engineering: An Introduction, 10th Edition, Hoboken, NJ: Wiley.
4. Abbaschian, R., Abbaschian, L., Reed-Hill, R. E., (2009), Physical Metallurgy Principles, 4t Edition, Cengate Learning.
5. P. C. Angelo and R. Subramanian: Powder Metallurgy- Science, Technology and Applications, PHI, New Delhi,2008

SCHEME OF EXAMINATION:

Two questions to be set from each module. Students have to answer five full questions choosing at least one full question from each module.

FLUID MECHANICS

Semester: III **Year: 2021-22**

Course	Code	Credits	Total Hours - 48 Hours/Week		Assessment		Exam Duration in Hours
			Lecture	Tutorial	SEE	CIE	
Fluid Mechanics	**21EG35**	**02**	**02**		**50**	**50**	**03**

COURSE OBJECTIVES:

1. To understand the basic principles and fundamental concepts of fluid mechanics.
2. To make the students to understand the concept and apply the various laws solving the fluid engineering problems.
3. To make the students familiar with measurements and visualisation of fluid flow types, kinematics, dynamics and its analysis.
4. To understand the concept flow of liquids through pipes and different sections and the dimensional quantities.

MODULE-1

Basics concepts and definitions: Introduction, Properties of fluids-mass density, weight density, specific volume, specific gravity, viscosity, surface tension, capillarity, compressibility and bulk modulus**.**

Fluid pressure at a point, Pascal's Law, Pressure Variation in Fluid at rest, Types of fluids, Absolute, Gauge, Atmosphere and Vacuum Pressure, simple numerical. 10 Hours

MODULE-2

Pressure measurement: Simple Manometers (Piezometers, U-tube Manometers and Single Column Manometers), differential manometers (U-tube and Inverted U-Tube differential manometers)

Fluid Statics: Introduction, Hydrostatic forces on submerged horizontal plane, vertical plane and inclined plane to determine total pressure and centre of pressure in static fluid, Definition of Buoyance, Centre of Buoyance, Meta Centre, Meta centric Height and simple numerical. 10 Hours

MODULE-3

Fluid Kinematics: Introduction, Method of describing fluid motion, Types of flows - steady, unsteady, uniform, non-uniform, laminar, turbulent, one, two and three dimensional, compressible, incompressible, rotational, irrational flow, Continuity Equation, Continuity Equation in Three Dimensions.

Velocity and Acceleration, velocity components, convective and local acceleration, velocity potential and stream function and types of motion. 10 Hours

MODULE-4

Fluid Dynamics; Introduction, Forces acting on fluid in motion. Euler's equation of motion along a streamline, Integration of Euler's equation to obtain Bernoulli's equation, Assumptions and limitations of Bernoulli's equation, simple numerical

Fluid Flow Measurements: Introduction to Navier-Stokes equation, Application of Bernoulli's theorem such as venturi-meter, orifice meter and pitot tube, Simple numerical. 09 Hours

MODULE-5

Notches and weirs: Introduction, classification, rectangular notch, triangular Notch, Trapezoidal notch (Simple Numerical).

Dimensional Analysis: Introduction, dimensions of physical quantities, dimensional homogeneity, Rayleigh's method, Buckingham Pi-theorem, similitudes- Types of similarities, Forces acting in moving fluid, dimensionless numbers, Simple Numerical. 09 Hours

COURSE OUTCOMES

At the end of this course, student should be able to

	COURSE OUTCOMES	**RBT LEVEL**
CO1	To analyse a variety of practical fluid flow and measuring devices and utilize fluid mechanics principles in design.	**L1, L2**
CO2	To understand the concept of measurements of fluid, and study of fluid at static or rest.	**L1, L2**
CO3	To visualise different types of fluid flow, and compare them based on kinematic flow descriptions.	**L2. L3**
CO4	To understand how mass and momentum is conserved based on Bernoulli's & Newton's laws and its applications.	**L1, L2**
CO5	To understand the concept of dimensional quantities, study of notches, wire and its application	**L2, L3**
	Total Number Lecture Hours	**48**
	NOTE: All levels mentioned are as per Revised Bloom's Taxonomy	

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2		1								1
CO2	3	2		1		1						1
CO3	2	1		1		2						1
CO4	2	1		1		2						1
CO5	2	1		1								1

TEXTBOOKS:

1. A Text Book of Fluid Mechanis And Hydraulic Machines Dr R.K Bansal Laxmi Publishers
2. Fluid Mechanics F M White McGraw Hill Publications Eighth edition. 2016
3. Fluid Mechanics (SI Units) Yunus A. Cengel John M.Cimbala TataMcGraw Hill 3rd Ed.,2014.

REFERENCE:

1. Fluid Mechanics, Oijush.K.Kundu, IRAM COCHEN, ELSEVIER, 3rd Ed. 2005.
2. Fluid Mechanics and hydraulics, Dr.Jagadishlal: Metropolitan Book Co-Ltd., 1997.
3. Fluid Mechanics, John F. Douglas, Janul and M.Gasiosek and john A.Swaffield, Pearson Education Asia, 5th ed., 2006.
4. Fluid Mechanics and Fluid Power Engineering, Kumar.D.S, Kataria and Sons, 2004
5. Fluid Mechanics -. Merle C. Potter, Elaine P.Scott. Cengage learning.

SCHEME OF EXAMINATION:

Two questions to be set from each module. Students have to answer five full questions choosing at least one full question from each module.

Fluid Mechanics Lab

Semester: III **Year: 2021-22**

Course	Code	Credits	Total Hours - 24 Hours /Week		Assessment		Exam Duration in hrs
			Lecture	Practical	SEE	CIE	
Fluid Mechanics Lab	**21EGL36**	**01**	**00**	**02**	**50**	**50**	**03**

COURSE OBJECTIVES:

Upon Completion of this subject, the students can able to have hands on experience in flow measurements using different devices and also perform calculation related to losses in pipes and also perform characteristic study of pumps, turbines etc.

LIST OF EXPERIMENTS:

PART-A

1) Study of taps, valves, pipe fittings, gauges, pitot tubes, water meters and current meters.
2) Calibration of Pressure gauges
3) Determination of metacentric height and radius of gyration of floating bodies.
4) Verification of Bernoulli's theorem
5) Reynolds experiment

PART-B

6) Determination of the Coefficient of discharge of given Venturi meter
7) Determination of the Coefficient of discharge of given Orifice meter.
8) Determination of the Coefficient of discharge of given V-Notch 600, and 900.
9) Determination of the Coefficient of discharge of given V-Notch rectangular notch
10) Determination of friction factor for a given set of pipes.
    a) Major loss.
    b) Minor loss.

COURES OUTCOMES:

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

	COURSE OUTCOMES	**RBT LEVEL**
CO1	Comprehend the types of valves, taps, pipe fitting and gauges.	**L1, L2**
CO2	Understand the measurement of pressure gauge and to measure metacentric height of floating body.	**L1, L2**
CO3	Understand the concept of Bernoulli's and Reynolds number.	**L2. L3**
CO4	To understand the different flow measurement equipment's and their procedures.	**L1, L2**
CO5	Able to develop the skill of experimentation techniques for the study of flow phenomena in channels/pipes.	**L2, L3**
	Total Number Lecture Hours	**48**
	NOTE: All levels mentioned are as per Revised Bloom's Taxonomy	

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1						1	1			1
CO2	2	1						1	1			1
CO3	2	1						1	1			1
CO4	2	1						1	1			1
CO5	2	1						1	1			1

Conduct of Practical Examination:

1) All laboratory experiments are to be included for practical examination.
2) Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.
3) Students can pick one experiment from the questions lot prepared by the examiners.
4) Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

Scheme of Examination:

ONE question from par –A: 20 Marks
ONE question from part –B: 20Marks
Viva -Voice: : 10 Marks
Total: : 50 Marks

ENERGY CONVERSION LAB - 1

Semester: III **Year: 2021-22**

Course	Code	Credits	Total Hours - 24 Hours /Week		Assessment		Exam Duration in hrs
			Lecture	Practical	SEE	CIE	
Energy Conversion Lab -1	**21EGL37**	**01**	**00**	**02**	**50**	**50**	**03**

OBJECTIVES:

Upon successful completion of this laboratory, the students should be able to have hands on experience in

1) Determination of Fire and flash point of various fuels.
2) Determination of viscosity of various fuels.
3) Determination of cloud and pour point of various fuels.
4) Determination of carbon residue of various fuels.
5) Determination of density, calorific value of various fuels.
6) Determination of area of irregular shapes.

LIST OF EXPERIMENTS:

PART-A

1. Determination of Flash and Fire point of lubricating oil using Abel Pensky and Marten's (closed) Apparatus.
2. Determination of Flash and Fire point of lubricating oil using Cleveland's (Open Cup) Apparatus.
3. Determination of Calorific value of solid and liquid fuels using Bomb Calorimeter.
4. Determination of Calorific value of gaseous fuels using Boy's gas calorimeter.
5. Determination of Viscosity of a lubricating oil using Redwoods Viscometers.

PART-B

1. Determination of Viscosity of a lubricating oil using Say Bolt Viscometers
2. Determine the carbon residue of the given sample of lubricating oil/ fuels.
3. Determination of cloud point and pour point of the given lubricant.
4. Determination of density of given fluid.
5. Determination of dropping point of a grease.

COURSE OUTCOMES

At the end of this course, student should be able to:

	COURSE OUTCOMES	RBT LEVEL
CO1	Perform experiments to determine the flash point, fire point of fuels and oils.	**L3**
CO2	Perform experiments to determine calorific value of solid, liquid and gaseous fuels.	**L3**
CO3	Perform experiments to determine viscosity of various oils.	**L3**
CO4	Perform experiments to determine carbon residue and density of fuels.	**L3**
CO5	Perform experiments to determine cloud and pour point of lubricants.	**L3**
CO6	Perform experiments to determine area of irregular surfaces using planimeter	**L3**

	Total Number Lecture Hours	**24**
	NOTE: All levels mentioned are as per Revised Bloom's Taxonomy	

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1					1	1				1
CO2	1	1					1	1				1
CO3	1	1					1	1				1
CO4	1	1					1	1				1
CO5	1	1					1	1				1
CO6	1	1					1	1				1

Scheme of Examination:

ONE question from par –A: 20 Marks
ONE question from part –B: 20Marks
Viva -Voice: : 10 Marks
Total: : 50 Marks

MATERIAL SCIENCE & TESTING LAB - 1

Semester: III **Year: 2021-22**

Course	Code	Credits	Total Hours - 24 Hours /Week		Assessment		Exam Duration in hrs
			Lecture	Practical	SEE	CIE	
Material Science & Testing Lab-1	21EGL38	01	00	02	50	50	03

OBJECTIVES:

1. To learn the concept of the preparation of samples to perform characterization such as microstructure, volume fraction of phases and grain size.
2. Calculate the various Mechanical properties of material such as tension, flexural, compression strength and hardness.
3. To learn materials failure modes and the differential loads causing failure.
4. To learn the concept of improving the mechanical properties of materials by differential method like heat treatment, surface treatment etc.

PART-A

1. Preparation of specimen for metallographic examination of different engineering materials. To report microstructure of Plain Carbon Steel, Tool steel, Gray CI, SG Iron. Brass, Bronze and Composites.
2. Brinell Hardness test on metals.
3. Rockwell Hardness test on metals.
4. Vickers's Hardness test on metals.

PART-B

1. Tensile, shear and compression tests of metallic and wooden materials specimens using universal testing machine
2. Bending test on wooden specimen
3. Torsion test on steel bar
4. Izod and Charpy test on mild steel specimen
5. Fatigue test

COURSE OUTCOMES

At the end of this course, student should be able to:

	COURSE OUTCOMES	RBT LEVEL
CO1	Demonstrate the application of metallography and material science.	L1
CO2	Select the standard experiments to determine the mechanical properties of different materials using hardness test by different apparatus.	L3
CO3	Select the standard experiments to determine tensile, shear and compression tests of various material using UTM.	L3
CO4	Determine the mechanical properties of different materials using torsion test on steel bar.	L3
CO5	Determine the mechanical properties of fatigue test.	L3

	Total Number Lecture Hours	**24**
	NOTE: All levels mentioned are as per Revised Bloom's Taxonomy	

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3		2		2		1				2
CO2	3	3		2		2		1				2
CO3	3	3		2		2		1				2
CO4	3	3		2		2		1				2
CO5	3	3		2		2		1				2

Scheme of Examination:

ONE question from par –A: 15 Marks
ONE question from part –B: 25Marks
Viva -Voice: : 10 Marks
Total: : 50 Marks

PROJECT-3

Semester: III **Year: 2021-22**

Course	Code	Credits	Total Hours - 32 Hours /Week		Assessment		Exam Duration in hrs
			Lecture	Project	SEE	CIE	
Project-3	21PROJ39	01	00	02	50	50	03

OBJECTIVES:

To Introduce fundamental concepts and analysis techniques in engineering to students across all disciplines.

Mini-Project Work:

Based on the ability/abilities of the students and recommendations of the mentor, a single discipline or a multidisciplinary Mini-Project can be assigned to an individual student or to a group having not more than 4 students.

COURSE OUTCOMES

At the end of this course, student should be able to:

	COURSE OUTCOMES	RBT LEVEL
CO1	Comprehend how to identify issues related to environment, society and industry.	L1, L3
CO2	Able to prepare the model and report on society, environment and industry related projects.	L2
	Total Number Lecture Hours	**32**
	NOTE: All levels mentioned are as per Revised Bloom's Taxonomy	

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2		1	2	2	1	2	1	1	1
CO2	2	2	2		1	2	2	1	2	1	1	1

Scheme of Examination:

Write-up : 15 Marks
Demonstration : 25Marks
Viva -Voice: : 10 Marks
Total: : 50 Marks

KANNADA KALI-III/
AYDU KATEGALU

Semester: III **Year: 2021-22**

Course	Code	Credits	Total Hours - 24 Hours /Week		Assessment		Exam Duration in hrs
			Lecture	Tutorial	SEE	CIE	
Kannada kali-III /Aydu Kategalu	21KANKK310/ 20KANAK310	01	01	00	50	50	03

OBJECTIVES:

OUTCOMES:

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

WORKSHOP PRACTICE ON REFRIGERATION & AIR CONDITIONING

Semester: III **Year: 2021-22**

Course	Code	Credits	Total Hours - 32 Hours /Week		Assessment		Exam Duration in hrs
			Lecture	Practical	SEE	CIE	
Workshop Practice on Refrigeration & Air Conditioning	21AEC301	01	00	01	50	50	03

OBJECTIVES: The main objectives are to

1) Identify hazards and safety procedures following safety precautions.
2) Identify RAC tools and equipment and recognise different parts of RAC system.
3) Perform copper tube cutting, flaring, swaging and brazing.
4) Test mechanical & electrical components.
5) Perform leak test, vacuuming, gas charging, wiring & installation of refrigerator.
6) Understand the function of compressor, condenser, expansion valve and evaporator.

RAC Work:

Identify the RAC tools and equipment, Identify the condensing and cooling unit, Copper pipe cutting, bending, swaging, flaring and brazing as per requirements and test pressure, Leak testing of RAC unit use dry nitrogen, Evacuation the unit and test vacuum level, Gas charging unit, Wirings, Install, run and check the performance, Trace and test compressor / motor terminals, Start the compressor Direct / without relay, Start the compressor with relay, Flushing, cleaning of condenser, Evaporator coils, Joining of condensers, Evaporator capillary fitter drier by brazing, Braze the major mechanical components, Test Pressure, Test electrical components and safety cut outs, Make wiring, run the machine and check performance, Assembly and Dis-assembly of Air-Conditioner.

COURSE OUTCOMES

At the end of this course, student should be able to:

	COURSE OUTCOMES	RBT LEVEL
CO1	Comprehend safety hazards, precautions, RAC Tools, Copper tube cutting and Brazing.	L1
CO2	Understand mechanical, electrical, leak test, charging and installation of refrigerator.	L1
	Total Number Lecture Hours	**32**
	NOTE: All levels mentioned are as per Revised Bloom's Taxonomy	

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2		1	2	2	1	2	1	1	1
CO2	2	2	2		1	2	2	1	2	1	1	1

Scheme of Examination:

Write-up	: 15 Marks
Demonstration	: 25Marks
Viva -Voice:	: 10 Marks
Total:	: 50 Marks

ADDITIONAL MATHEMATICS-1

Semester: III **Year: 2021-22**

Course	Code	Credits	Total Hours - 24 Hours /Week		Assessment		Exam Duration in hrs
			Lecture	Practical	SEE	CIE	
Additional Mathematics-1	21MATDIP31	00	03	00	50	50	03

OBJECTIVES:

OUTCOMES:

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

ENGINEERING MATHEMATICS-IV

Semester: IV **Year: 2021-22**

Course	Code	Credits	Total Hours - 40 Hours/Week		Assessment		Exam Duration in Hours
			Lecture	Tutorial	SEE	CIE	
Engineering Mathematics-IV	21MAT41	03	03	00	50	50	03

COURSE OBJECTIVES:

This course will enable students to:

1. Learn Fourier series and Fourier transforms.
2. Conversant with numerical methods to solve ordinary differential equations.
3. Know then complex combers, Analytic function and associated results and problems.
4. Understand Joint probability distribution and stochastic processes arising in science and engineering.
5. Understand the definition of sequence, series and its importance.
6. Discuss the elementary concepts of graph theory.
7. Know the finite difference method and use in solving partial differential equation.

MODULE-1

Fourier Series: Periodic functions, Dirichlet's condition, Fourier Series of periodic functions with period 2π and with arbitrary period 2c. Fourier series of even and odd functions Half range Fourier Series, practical harmonic analysis (5 Assignment Problem).

Self-Study: Sequence and series of a function, convergent series. 08 Hours

MODULE-2

Joint probability distribution: Joint Probability distribution for two discrete random variables, expectation, covariance, correlation coefficient.

Stochastic process: Stochastic processes, probability vector, stochastic matrices, fixed points, regular stochastic matrices, Markov chains, higher transition probability-simple problems.
(5 Assignment Problem).

Self-Study: Joint probability distribution for continuous random variable 08 Hours

MODULE-3

Numerical Methods: Numerical solution of ordinary differential equations of first order and first degree, Taylor's series method, modified Euler's-method Runge Kutta method of fourth order. Milne's and Adams- Bashforth predictor and corrector methods (No derivations of formulae). (5 Assignment Problem).

Self-Study: Picards method 08 Hours

MODULE-4

Numerical Methods: Numerical solution of second order ordinary differential equations, Runge-Kutta Method and Milne's Method, Numerical solution of P.D.E: Numerical solution of Heat equation, Wave equation, problems. (5 Assignment Problem).

Self-Study: Picard's method, Numerical solution of Laplace's equation 08 Hours

MODULE-5

Special Functions: Series solution of Bessel's differential equation leading to Jn (x)-Bessel's function of first kind. Basic properties and orthogonality. Series solution of Legendre's differential equation leading to Pn (x)-Legendre polynomials. Rodrigue's formula, problems

Self-Study: Frobenius method 08 Hours

COURSE OUTCOMES

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

	COURSE OUTCOMES	**RBT LEVEL**
CO1	Define the Periodic function and find the Fourier series and half range series expansion of different functions in different intervals and studying Practical Harmonic functions, Know the use of periodic signals and Fourier series to analyze circuits	**L1, L2, L3**
CO2	Learn to solve the problems on Joint probability distribution for two discrete random variables. Knowing the concept of stochastic processes, probability vector, Probability matrix and studying the examples on Markov's chains in discrete time.	**L1, L2, L3**
CO3	Solving the first order first degree ordinary differential equations arising in flow problems using single step and multistep numerical methods.	**L1, L2, L3**
CO4	Use to solve second order ordinary and partial differential equations arising in heat and wave equations by numerical methods.	**L1, L2, L3,**
CO5	Apply the knowledge of Fourier transform to solve engineering problems. Understand the analyticity, potential fields, residues and poles of complex potentials in field theory, electromagnetic theory and studying Bilinear transformation. / Obtain the series solution of ordinary differential equations and studying special functions. / Develop the model using advanced concept of graph for real world applications.	**L1, L2, L3**
	Total Number Lecture Hours	**43**
	NOTE: All levels mentioned are as per Revised Bloom's Taxonomy	

CO-PO Mapping

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2		1				1			1
CO2	3	2			1				1			1
CO3	3	2	2		1				1			1
CO4	3	2	2		1				1			1
CO5	3	2	2		1				1			1

Text Books:

1. B.S. Grewal : Higher Engineering Mathematics, Khanna Publishers, 43rd Ed., 2015.
2. E. Kreyszig : Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed.(Reprint), 2016.

Reference books:

1. C.Ray Wylie, Louis C.Barrett : "Advanced Engineering Mathematics", 6th Edition,
2. McGraw-Hill Book Co., New York, 1995.
2. James Stewart : "Calculus –Early Transcendentals", Cengage Learning India Private Ltd., 2017.
3. B.V.Ramana : "Higher Engineering Mathematics" 11th Edition, Tata McGraw-Hill, 2010.
4. Srimanta Pal & Subobh C Bhunia:"Engineering Mathematics", Oxford University Press,3rd Reprint,2016.
5. Gupta C.B., Singh S.R. and Mukesh Kumar : "Engineering Mathematics for Semester I & II", Mc-Graw Hill Education (India) Pvt.Ltd., 2015.

Web links and Video Lectures:

1. http://nptel.ac.in/courses.php?disciplineID=111
2. http://www.class-central.com/subject/math
3. http://academicearth.org.

SCHEME OF EXAMINATION:

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question carries 20 marks.
4. There will be two full questions (with a maximum of four sub questions) from each module.
5. Each full question will have sub questions covering all the topics under a module.
6. The students will have to answer five full questions, selecting one full question from each module.

ELECTRICAL MECHINES

Semester: IV **Year: 2021-22**

Course	Code	Credits	Total Hours - 48 Hours/Week		Assessment		Exam Duration in Hours
			Lecture	Tutorial	SEE	CIE	
Electrical Machines	21EG42	03	03	00	50	50	03

COURSE OBJECTIVES:

This course will enable the students:

1) To understand the concepts of transformers and their analysis and suggest a suitable three phase transformer connections for a particular application.
2) To explain the required conditions for the parallel operation of transformers.
3) To study different tests to be conducted for the assessment of the performance characteristics of DC motors.
4) To understand the different tests on DC motor.
5) To Explain the construction and operation of Synchronous generators and to evaluate their performance.
6) To study the constructional features of Motors and select a suitable drive for specific application.
7) To study the constructional features and speed control of Three Phase induction Motors.

MODULE-1

Single phase Transformers: Operation of practical transformer under no-load and on-load conditions with Phasor diagrams. Open circuit and short circuit tests, calculation of equivalent circuit parameters and predetermination of efficiency-commercial and all-day efficiency. Voltage regulation and its significance.

Three-phase Transformers: Introduction, Constructional features of three-phase transformers. Choice between single unit three-phase transformer and a bank of three single-phase transformers. Transformer connection for three phase operation– star/star, delta/delta, star/delta, zigzag/star and V/V, comparative features. Phase conversion-Scott connection for three-phase to two-phase conversion. Labelling of three-phase transformer terminals, vector groups. 10 Hours

MODULE-2

Transformers (Continuation): Polarity test, Sumpner's test, separation of hysteresis and eddy current losses.

Parallel Operation of Transformers: Necessity of Parallel operation, conditions for parallel operation – Single phase and three phase transformers. Load sharing in case of similar and dissimilar transformers.

D.C. Machines: Working principle of D.C. Machine as a generator and a motor. Types and constructional features. Types of armature windings, Emf equation of generator, relation between induced emf and terminal voltage with an enumeration of brush contact drop and drop due to armature reaction. Illustrative examples, neglecting armature reaction. 10 Hours

MODULE-3

D.C. Machines (Continuation): Operation of D.C. motor, Back emf and its significance, torque equation. Types of D.C. motors, characteristics and applications. Necessity of a starter for D.C. motor. Illustrative examples on back emf and torque.

Testing of dc motors: Direct & indirect methods of testing of DC motors-Brake test, Swinburne's test, Retardation test, Hopkinson's test, Field's test, merits and demerits of tests. 10 Hours

MODULE-4

Three Phase Synchronous Generators: Principle of operation, Types and constructional features, Advantages of rotating field type alternator, Synchronous speed, Frequency of generated voltage, Emf equation. Concept of winding factor (excluding the derivation of distribution and pitch factors). Illustrative examples on emf equation. 09 Hours

MODULE-5

Three Phase Induction Motors: Principle of operation, Concept and production of rotating magnetic field, Synchronous speed, rotor speed, Slip, Frequency of the rotor induced emf, Types and Constructional features. Slip and its significance. Applications of squirrel - cage and slip – ring motors. Illustrative examples on slip calculations..

Starting and speed Control of Three-phase Induction Motors: Need for starter. Direct on line, Star-Delta and autotransformer starting. Rotor resistance starting. Speed control by voltage, frequency, and rotor resistance methods. 09 Hours

COURSE OUTCOMES

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

	COURSE OUTCOMES	**RBT LEVEL**
CO1	Explain the construction, operation and performance of single phase and three phase transformers.	**L1, L2, L3**
CO2	Explain the use of auto transformer, tap changing and tertiary winding transformer and need of operating transformers in parallel and explain the working principle of D.C. Machine as a generator	**L1, L2, L3**
CO3	Analyze and assess the performance characteristics of DC motors by conducting suitable tests and control the speed by suitable method.	**L1, L2, L3, L4**
CO4	Explain the construction and operation of Synchronous generators.	**L1, L2, L3, L4**
CO5	Explain the constructional features of Three Phase induction Motors and assess their performance. And control the speed of three-phase Induction Motor by a suitable method.	**L1, L2, L3**
	Total Number Lecture Hours	**48**
	NOTE: All levels mentioned are as per Revised Bloom's Taxonomy	

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	2	2								2
CO2	2	1	1									2
CO3	2	1	1									1
CO4	2	1	2		2	2	2					2
CO5	2	1	2	2	2	2	2					3

TEXT BOOKS:

1) Electrical Technology AC & DC Machines, B.L. Thereja and A. K. Thereja S. CHAND Publications Reprint 2014.
2) Electric Machines D. P. Kothari, et al McGraw Hill 4th Edition, 2011
3) Performance and Design of A.C. Machines M. G. Say CBS Publishers 3rd Edition, 2002
4) Electrical machinery, P.S Bhimbra, Khanna Publishers

REFERENCES:

1) Principles of Electric Machines P.C.Sen Wiley 2nd Edition, 2013
2) Electric Machines MulukuntlaS.Sarma,at el Cengage 1st Edition, 2009
3) Performance & Design of Alternating Current machines, M. G. Say, CBS publishers,3rd Edition,2002.
4) The Performance & Design of DC machines A.E Clayton &N.N.Hancock CBS Publication,3rd Edition,2004.
5) Electrical Machines,Ashfaq Hussain, Dhanpat Rai Publications.

SCHEME OF EXAMINATION:

Two questions to be set from each module. Students have to answer five full questions choosing at least one full question from each module.

RENEWABLE ENERGY TECHNOLOGIES

Semester: IV **Year: 2021-22**

Course	Code	Credits	Total Hours - 48 Hours/Week		Assessment		Exam Duration in Hours
			Lecture	Tutorial	SEE	CIE	
Renewable Energy Technologies	**21EG43**	**03**	**03**	**00**	**50**	**50**	**03**

COURSE OBJECTIVES:

1) To discuss causes of energy scarcity and its solution, energy resources and availability of renewable energy.
2) To explain solar geometry and solar thermal applications.
3) To discuss benefits of hydrogen energy, production of hydrogen energy.
4) To discuss wind turbines, wind resources, site selection for wind turbine.
5) To discuss geothermal systems, and geothermal based electric power generation
6) To discuss waste recovery management systems.
7) To discuss biogas, its composition, production, benefits.
8) To discuss tidal energy and wave energy resources.

MODULE-1

Introduction: Causes of Energy Scarcity, Solution to Energy Scarcity, Factors Affecting Energy Resource Development, Energy Resources and Classification, Renewable Energy – Worldwide Renewable Energy Availability, Renewable Energy in India.

Energy from Sun: Sun- earth Geometric Relationship, Layer of the Sun, Earth – Sun Angles and their relationships, Solar Energy Reaching the Earth's Surface, Solar Thermal Energy Applications. 10 Hours

MODULE-2

Solar Thermal Energy Collectors: Types of Solar Collectors, Configurations of Certain Practical Solar Thermal Collectors, Material Aspects of Solar Collectors, Concentrating Collectors, Parabolic Dish – Stirling Engine System, Working of Stirling or Brayton Heat Engine.

Solar Collector Systems into Building Services, Solar Water Heating Systems, Passive Solar Water Heating Systems, Applications of Solar Water Heating Systems, Active Solar Space Cooling, Solar Air Heating, Solar Dryers, Crop Drying, Space Cooing, Solar Cookers, Solar Pond. 10 Hours

MODULE-3

Hydrogen Energy: Benefits of Hydrogen Energy, Hydrogen Production Technologies, Hydrogen Energy Storage, Use of Hydrogen Energy, Advantages and Disadvantages of Hydrogen Energy, Problems Associated with Hydrogen Energy. Wind Energy: Windmills, Wind Turbines, Wind Resources, Wind Turbine Site Selection.

Geothermal Energy: Geothermal Systems, Classifications, Geothermal Resource Utilization, Resource Exploration, Geothermal Based Electric Power Generation, Associated Problems, environmental Effects. 10 Hours

MODULE-4

Biogas Energy: Introduction, Biogas and its Composition, Anaerobic Digestion, Biogas Production, Benefits of Biogas, Factors Affecting the Selection of a Particular Model of a Biogas Plant, Biogas Plant Feeds and their Characteristics.

Tidal Energy: Introduction, Tidal Energy Resource, Tidal Energy Availability, Tidal Power Generation in India, Leading Country in Tidal Power Plant Installation, Energy Availability in Tides, Tidal Power Basin, Turbines for Tidal Power, Advantages and Disadvantages of Tidal Power, Problems Faced in Exploiting Tidal Energy. 10 Hours

MODULE-5

Ocean Thermal Energy: Introduction, Principles of Ocean Thermal Energy Conversion (OTEC), Ocean Thermal Energy Conversion plants, Basic Rankine Cycle and its Working, Closed Cycle, Open Cycle and Hybrid Cycle, Carnot Cycle, Application of OTEC in Addition to Produce Electricity, Advantages, Disadvantages and Benefits of OTEC.

Wave Energy: Introduction, Motion in the sea Waves, Power Associated with Sea Waves, Wave Energy Availability, Devices for Harnessing Wave Energy, Advantages and Disadvantages of Wave Power. 10 Hours

COURSE OUTCOMES

At the end of this course, student should be able to

	COURSE OUTCOMES	RBT LEVEL
CO1	Discuss scenario of renewable energy sources and solar geometry.	**L1, L2, L3**
CO2	Comprehend solar thermal energy conversion.	**L1, L2, L3**
CO3	Explain generation of energy from hydrogen, wind and geothermal system.	**L1, L2, L3**
CO4	Discuss production of energy from biogas and tidal energy resources.	**L1, L2, L3, L4**
CO5	Summarize ocean thermal energy and wave energy.	**L1, L2, L3**
	Total Number Lecture Hours	**48**
	NOTE: All levels mentioned are as per Revised Bloom's Taxonomy	

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1		2	1	2	1				1
CO2	2	2	1		2	1	2	1				1
CO3	2	2	1		2	1	2	1				1
CO4	2	2	1		2	1	2	1				1
CO5	2	2	1		2	1	2	1				1

TEXT BOOKS:

1. Nonconventional Energy Resources by G D Rai, Khanna Publication.

REFERENCES:

1. Nonconventional Energy Resources B.H. Khan McGraw Hill 3rd Edition
2. Renewable Energy; Power for a sustainable Future Godfrey Boyle Oxford 3rd Edition, 2012

SCHEME OF EXAMINATION:

Two questions to be set from each module. Students have to answer five full questions choosing at least one full question from each module

POWER ELECTRONICS

Semester: IV **Year: 2021-22**

Course	Code	Credits	Total Hours - 48 Hours/Week		Assessment		Exam Duration in Hours
			Lecture	Tutorial	SEE	CIE	
Power Electronics	**21EG44**	**03**	**03**	**00**	**50**	**50**	**03**

COURSE OBJECTIVES:

Upon successful completion of the course the students will be familiar with

1. To understand the applications power electronics, different types of power semiconductor devices, their switching characteristics, power diode characteristics, types, their operation and the effects of power diodes on RL circuits.
2. To comprehend the techniques for design and analysis of single phase diode rectifier circuits.
3. To analyse the different power transistors, their steady state and switching characteristics and limitations.
4. To know the different power transistors, their steady state and switching characteristics and limitations.
5. To understand and analyse the design, analysis techniques, performance parameters and characteristics of controlled rectifiers, DC- DC, DC -AC converters and Voltage controllers.

MODULE-1

Introduction: Applications of Power Electronics, Types of Power Electronic Circuits, Peripheral Effects, Characteristics and Specifications of Switches.

Power Diodes: Introduction, Diode Characteristics, Reverse Recovery Characteristics, Power Diode Types, Silicon Carbide Diodes, Silicon Carbide Schottky Diodes, Freewheeling diodes, Free wheeling diodes with RL load.

Diode Rectifiers: Introduction, Diode Circuits with DC Source connected to R and RL load, Single-Phase Full-Wave Rectifiers with R load , Single-Phase Full-Wave Rectifier with RL Load.

10 Hours

MODULE-2

Power Transistors: Introduction, Power MOSFETs – Steady State Characteristics, Switching Characteristics Bipolar Junction Transistors – Steady State Characteristics, Switching Characteristics, Switching Limits, IGBTs, MOSFET Gate Drive, BJT Base Drive, Isolation of Gate and Base Drives, Pulse transformers and Opto-couplers. 10 Hours

MODULE-3

Thyristors: Introduction, Thyristor Characteristics, Two-Transistor Model of Thyristor, Thyristor Turn- On, Thyristor Turn-Off, A brief study on Thyristor Types, Series Operation of Thyristors, Parallel Operation of Thyristors, di/dtProtection, dv/dtProtection, DIACs, Thyristor Firing Circuits, Unijunction Transistor. 10 Hours

MODULE-4

Controlled Rectifiers: Introduction, Single phase half wave circuit with RL Load, Single phase half wave circuit with RL Load and Freewheeling Diode, Single phase half wave circuit with RLE Load, Single-Phase Full Converters with RLE Load, Single-Phase Dual Converters, Principle of operation of Three- Phase duel Converters.

AC Voltage Controllers: Introduction, Principle of phase control & Integral cycle control, Single-Phase Full-Wave Controllers with Resistive Loads, Single- Phase Full-Wave Controllers with Inductive Loads, Three-Phase Full-Wave Controllers. 09 Hours

MODULE-5

DC-DC Converters: Introduction, principle of step down and step-up chopper with RL load, performance parameters, DC-DC converter classification.

DC-AC Converters: Introduction, principle of operation single phase bridge inverters, three phase bridge inverters, voltage control of single-phase inverters, Harmonic reductions, Current source inverters. 09 Hours

COURSE OUTCOMES

At the end of this course, student should be able to

	COURSE OUTCOMES	RBT LEVEL
CO1	To give an overview of applications power electronics, different types of power semiconductor devices, their switching characteristics, power diode characteristics, types, their operation and the effects of power diodes on RL circuits.	**L1**
CO2	To explain the techniques for design and analysis of single phase diode rectifier circuits.	**L1, L3**
CO3	To explain different power transistors, their steady state and switching characteristics and limitations.	**L1, L2, L3**
CO4	To explain different types of Thyristors, their gate characteristics and gate control requirements.	**L3**
CO5	To explain the design, analysis techniques, performance parameters and characteristics of controlled rectifiers, DC- DC, DC -AC converters and Voltage controllers	**L1, L3**
	Total Number Lecture Hours	**48**
	NOTE: All levels mentioned are as per Revised Bloom's Taxonomy	

CO-PO Mapping

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1			1						1
CO2	3	2	1			1						2
CO3	3	1	1			1						1
CO4	3	2	1			2						1
CO5	2	2	1			1						1

TEXT BOOKS:

1. Power Electronics: Circuits Devices and Applications Mohammad H Rashid, Pearson 4th Edition, 2014

REFERENCES:

1. Power Electronics P.S. Bimbhra Khanna Publishers 5th Edition, 2012
2. Power Electronics: Converters, Applications and Design Ned Mohan et al Wiley 3rd Edition, 2014

3. Power Electronics Daniel W Hart McGraw Hill 1st Edition, 2011
4. Elements of Power Electronics Philip T Krein Oxford Indian Edition, 2008

INTRODUCTION TO HEAT TRANSFER

Semester: IV **Year: 2021-22**

Course	Code	Credits	Total Hours - 48 Hours/Week		Assessment		Exam Duration in Hours
			Lecture	Tutorial	SEE	CIE	
Introduction to Heat Transfer	**21EG45**	**03**	**02**	**01**	**50**	**50**	**03**

COURSE OBJECTIVES:

Upon successful completion of the course the students will be familiar with

1. To explain the basic modes of heat transfer, applications, fundamental rule and one-dimensional steady state heat transfer with boundary condition.
2. To understand the concept of fins and its application for various engineering field.
3. Learn how to formulate and solve 1-D steady heat conduction problems
4. To comprehend the heat transfer due to free and forced convective heat transfer.
5. Understand the principles of radiation heat transfer related engineering problems.
6. Study the basic principles of heat exchanger analysis, LMTD and thermal design.

MODULE-1

Introductory Concepts and Definitions: Modes of heat transfer: Basic laws of governing conduction, convection and radiation heat transfer, Thermal conductivity, convective heat transfer coefficient, radiation heat transfer and combined heat transfer mechanism, Types of boundary condition, general heat conduction equation: derivation of the equation in cartesian and polar co-ordinate system, Simple numerical.

One Dimensional Steady State Heat Conduction: steady state one dimensional heat conduction problems without heat generation for slab, composite wall, and cylinder wall in cartesian system with various possible boundary condition. 10 Hours

MODULE-2

Critical Thickness of insulation: introduction, Critical Thickness of insulation for Cylinder surface and spherical surface, simple numerical.

Fins: Fins, Necessity of fins, types of fins, application, steady state heat conduction in fins of uniform cross section Rectangular and circular fins, case1: Infinitely long fin, case 2: fin with insulated end, efficiency and effectiveness of fin. 10 Hours

MODULE-3

Forced convection: introduction, dimensional analysis of forced convection, significance, correlation for forced convection, simple numerical

Natural convection: introduction, dimensional analysis of free convection, significance, correlation for free convection, simple numerical. 09 Hours

MODULE-4

Radiation: introduction, characteristics, absorptivity, reflectivity and transmissivity of black, Gray and white body, Stefan Boltzman law, total emissive power, Planck's law, Rayleigh jeans law, Wein's displacement law, Kirchhoff's law, concept of gray body, emissivity.

Heat exchange between black bodies, heat exchange between gray bodies, Radiation shield, electrical network for radiation heat exchanger, simple numerical. 09 Hours

MODULE-5

Heat Exchanger: Introduction, Classification, over all heat transfer coefficient, fouling, analysis of heat exchanger: LMTD Parallel flow and counter flow.

Capacity rates, Analysis of heat exchanger by NTU-Effective method: parallel and counter flow heat exchanger, heat pipe and simple numerical. 10 Hours

COURSE OUTCOMES

At the end of this course, student should be able to

	COURSE OUTCOMES	RBT LEVEL
CO1	Understand the modes of heat transfer and apply the basic laws to formulate engineering systems.	**L1**
CO2	Understand and apply the basic laws of heat transfer to extended surface, fins and problems	**L1, L3**
CO3	Analyze heat transfer due to free and forced convective heat transfer.	**L1, L2, L3**
CO4	Analyze heat conduction through numerical methods and apply the fundamental principle to solve radiation heat transfer problems.	**L3**
CO5	Understand the design and performance analysis of heat exchangers and their practical applications	**L1, L3**
	Total Number Lecture Hours	**48**
	NOTE: All levels mentioned are as per Revised Bloom's Taxonomy	

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2				2	1	1	1				1
CO2	2				2	1	1	1				1
CO3	2				2	1	1	1				1
CO4	2				2	1	1	1				1
CO5	2				2	1	1	1				1

TEXT BOOKS:

1. Principals of heat transfer,FrankKreith, Raj M. Manglik, Mark S. Bohn, Seventh Edition, Cengage learning, 2011.
2. Yunus A. Cengel - Heat transfer, a practical approach, Fifth edition,Tata Mc Graw Hill.
3. J P Holman, Souvik Bhattacharyya, 10th Edition, McGraw Hill Education Private Ltd.,

REFERENCE BOOKS

1. Heat and mass transfer, Kurt C, Rolle, second edition, Cengage learning.
2. Heat Transfer, M. NecatiOzisik, A Basic Approach, McGraw Hill, New York, 2005.
3. Fundamentals of Heat and Mass Transfer, Incropera, F. P. and De Witt, D. P., 5th Edition, John Wiley and Sons, New York, 2006.

4. Heat Transfer, Holman, J. P., 9th Edition, Tata McGraw Hill, New York, 2008.

SCHEME OF EXAMINATION:

Two questions to be set from each module. Students have to answer five full questions choosing at least one full question from each module

HEAT TRANSFER LAB

Semester: IV **Year: 2021-22**

Course	Code	Credits	Total Hours - 24 Hours /Week		Assessment		Exam Duration in hrs
			Lecture	Practical	SEE	CIE	
Heat Transfer Lab	21EGL46	01	00	02	50	50	03

COURSE OBJECTIVES:

Upon successful completion of this laboratory, the students should be able to have hands on experience in

1. The primary objective of this course is to provide the fundamental knowledge necessary to understand the behavior of thermal systems.
2. This course provides a detailed experimental analysis, including the application and heat transfer through solids, fluids, and vacuum.
3. Convection, conduction, and radiation heat transfer in one and two dimensional steady and unsteady systems are examined.

PART-A

1. Determination of Thermal Conductivity of a Metal Rod
2. Determination of Overall Heat Transfer Coefficient of a Composite wall.
3. Determination of Effectiveness on a Metallic fin.
4. Determination of Heat Transfer Coefficient in free Convection
5. Determination of Heat Transfer Coefficient in a Forced Convention
6. Determination of Emissivity of a Surface.

PART-B

1. Determination of Stefan Boltzmann Constant.
2. Determination of LMDT and Effectiveness in Parallel Flow Heat Exchangers.
3. Determination of LMDT and Effectiveness in Counter Flow Heat Exchangers.
4. Performance Test on a Vapour Compression Refrigeration.
5. Performance Test on a Vapour Compression Air – Conditioner.

COURSE OUTCOMES

At the end of this course, student should be able to:

	COURSE OUTCOMES	RBT LEVEL
CO1	Determine the thermal conductivity of a metal rod and overall heat transfer coefficient of composite slabs.	L1, L3
CO2	Determine convective heat transfer coefficient for free and forced convection and correlate with theoretical values.	L3
CO3	Comprehend the surface emissivity of a given test plate.	L1
CO4	Determine surface emissivity of Stefan Boltzmann constant.	L3
CO5	Estimate performance of a refrigerator and effectiveness of a fin and Double pipe heat exchange.	L3
	Total Number Lecture Hours	**24**
	NOTE: All levels mentioned are as per Revised Bloom's Taxonomy	

CO-PO Mapping:

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1					1	1				1
CO2	1	1					1	1				1
CO3	1	1					1	1				1
CO4	1	1					1	1				1
CO5	1	1					1	1				1
CO6	1	1					1	1				1

Scheme of Examination:

ONE question from par –A: 15 Marks
ONE question from part –B: 25Marks
Viva -Voice: : 10 Marks
Total: : 50 Marks

ELECTRICAL MACHINES LAB-1

Semester: IV **Year: 2021-22**

Course	Code	Credits	Total Hours - 24 Hours /Week		Assessment		Exam Duration in hrs
			Lecture	Practical	SEE	CIE	
Electrical Machine Lab-1	21EGL47	01	00	02	50	50	03

COURSE OBJECTIVES:

This course will enable the students:

1. Conducting different tests on transformers and Induction machines and evaluating their Performance.
2. Verify the parallel operation of two single phase transformers.
3. Study the connection of single-phase transformers for three phase operation and phase conversion.
4. To conduct load test on single phase and three phase induction motors.
5. To conduct test on induction motor to determine the performance characteristics.

LIST OF EXPERIMENTS:

PART-A

1. (a)Predetermination of efficiency and regulation by Open Circuit and Short circuit tests on single - phase transformer. (b)Calculation of parameters of equivalent circuit from the readings of the tests and determination of efficiency and regulation from the equivalent circuit to correlate results obtained earlier.

2. Sumner's test on similar transformers and determination of combined and individual transformer efficiency.

3. Parallel operation of two dissimilar (different kVA) single-phase transformers and determination of load sharing and analytical verification-given the Open Circuit and Short circuit tests details.

4. Polarity test and connection of 3 single-phase transformers in star – delta and determination of efficiency and regulation under balanced resistive load.

5. Scott connection with balanced and unbalanced resistive loads.

PART-B

1. Load test on 3-phase induction motor- and plot of Torque versus speed, output hp versus efficiency, power factor and slip.
2. (a)Determination of parameters of the equivalent circuit of a 3-phase Induction Motor by conducting NO load and Blocked rotor tests. (b)Determination of performance parameters of the induction motor from the equivalent circuit to correlate the results obtained from the load test or circle diagram.
3. Speed control of 3-phase induction motor by varying rotor resistance.
4. Load test on- induction generator.
5. Load test on single- phase induction motor.

COURSE OUTCOMES:

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

	COURSE OUTCOMES	**RBT LEVEL**
CO1	Evaluate the performance of transformers from the test data obtained.	**L1, L2, L3**
CO2	Connect and operate two single phase transformers of different KVA rating in parallel.	**L1, L2, L3**
CO3	Connect single phase transformers for three phase operation and phase conversion.	**L1, L2, L3**
CO4	Perform load test on single phase and three phase induction motors to assess the performance.	**L1, L2, L3, L4**
CO5	Conduct test on induction motor to pre-determine the performance characteristics	**L1, L2, L3**
	Total Number Lecture Hours	**48**
	NOTE: All levels mentioned are as per Revised Bloom's Taxonomy	

CO-PO Mapping

PO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	1	1		2		1		2			2
CO2	2		2	1	2		2		2			2
CO3	3	1	2	1	2				2			2
CO4	2	2	1	1		2			2			2
CO5	2	1	1	1		2			2			2

Conduct of Practical Examination:

1) All laboratory experiments are to be included for practical examination.
2) Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.
3) Students can pick one experiment from the questions lot prepared by the examiners.
4) Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero

Scheme of Examination:

ONE question from par –A: 15 Marks
ONE question from part –B: 25Marks
Viva -Voice: : 10 Marks
Total: : 50 Marks

POWER ELECTRONICS LAB

Semester: IV **Year: 2021-22**

Course	Code	Credits	Total Hours - 24 Hours /Week		Assessment		Exam Duration in hrs
			Lecture	Practical	SEE	CIE	
Power Electronic Lab	**21EGL48**	**01**	**00**	**02**	**50**	**50**	**03**

COURSE OBJECTIVES:

Upon successful completion of this laboratory, the students should be able to have hands on experience in

1) Study Characteristics of power electronic devices.
2) Understand the converters with different Loads
3) Control the speed of different motors.

LIST OF EXPERIMENTS:

PART-A

1. Study of Characteristics of SCR,
2. Study of Characteristics of MOSFET
3. Study of Characteristics of IGBT
4. Study of Characteristics of Triac
5. Single Phase Half controlled converter with R load

PART-B

1. Single Phase fully controlled bridge converter with R and RL loads
2. Single Phase AC Voltage Controller with R and RL Loads
3. Speed control of DC motor using single semi converter.
4. Speed control of stepper motor.
5. Speed control of universal motor using ac voltage regulator.

COURSE OUTCOMES:

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

	COURSE OUTCOMES	RBT LEVEL
CO1	Understand Characteristics of different power electronic devices.	**L1, L2, L3**
CO2	Verify the performance of single phase controlled full wave rectifier with different Loads	**L1, L2, L3**
CO3	Verify AC voltage controller with R and RL loads.	**L1, L2, L3**
CO4	Control the speed of a DC motor, universal motor and stepper motors.	**L1, L2, L3**
	Total Number Lecture Hours	**48**
	NOTE: All levels mentioned are as per Revised Bloom's Taxonomy	

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	1	-					1		
CO2	1	2	1	1		1	1					1
CO3		2	1					1				1
CO4	1	2	1	1	2							1

Scheme of Examination:

ONE question from par –A: 15 Marks
ONE question from part –B: 25Marks
Viva -Voice: : 10 Marks
Total: : 50 Marks

PROJECT-IV

Semester: IV **Year: 2021-22**

Course	Code	Credits	Total Hours - 32 Hours /Week		Assessment		Exam Duration in hrs
			Lecture	Project	SEE	CIE	
Project-4	21PROJ49	01	00	02	50	50	03

OBJECTIVES:

To Introduce fundamental concepts and analysis techniques in engineering to students across all disciplines.

Mini-Project Work:

Based on the ability/abilities of the students and recommendations of the mentor, a single discipline or a multidisciplinary Mini-Project can be assigned to an individual student or to a group having not more than 4 students.

COURSE OUTCOMES

At the end of this course, student should be able to:

	COURSE OUTCOMES	RBT LEVEL
CO1	Comprehend how to identify issues related to environment, society and industry.	L1, L3
CO2	Able to prepare the model and report on society, environment and industry related projects.	L2
	Total Number Lecture Hours	**32**
	NOTE: All levels mentioned are as per Revised Bloom's Taxonomy	

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2		1	2	2	1	2	1	1	1
CO2	2	2	2		1	2	2	1	2	1	1	1

KANNADA KALI-IV/
MAHADASOHIGALU

Semester: IV **Year: 2021-22**

Course	Code	Credits	Total Hours - 24 Hours /Week		Assessment		Exam Duration in hrs
			Lecture	Tutorial	SEE	CIE	
Kannada Kali-IV/ Mahadasohigalu	21KANKK410/ 20KANMD410	01	01	00	50	50	03

OBJECTIVES:

OUTCOMES:

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

COMPUTATIONAL LAB

Semester: IV **Year: 2021-22**

Course	Code	Credits	Total Hours - 24 Hours /Week		Assessment		Exam Duration in hrs
			Lecture	Practical	SEE	CIE	
Computational Lab	21AEC401	01	01	00	50	50	03

OBJECTIVES:

OUTCOMES:

CO-PO Mapping:

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

ADDITIONAL MATHEMATICS-II

Semester: IV **Year: 2021-22**

Course	Code	Credits	Total Hours - 24 Hours /Week		Assessment		Exam Duration in hrs
			Lecture	Practical	SEE	CIE	
Additional Mathematics-II	21MATDIP41	00	03	01	50	50	03

OBJECTIVES:

OUTCOMES:

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												