SCHEME OF INSTRUCTION & EXAMINATION

B.E III Semester

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination		Credits
			L	T	P/Dg	Contact Hrs/wk	CIE	SEE	
1.	ES301ME	Thermodynamics	3	-	-	3	30	70	3
2.	ES302ME	Machine Drawing	2	-	2	4	30	70	3
3.	ES303ME	Metallurgy and Material Science	3	-	-	3	30	70	3
4.	ES321CE	Mechanics of Materials	3	1	-	4	30	70	3
5.	ES322EE	Electrical Circuits and Machines	3	-	-	3	30	70	3
6.	BS901MT	Mathematics – III	3	1	-	4	30	70	3
7.	ES322EC	Applied Electronics	3	-	-	3	30	70	3
Practicals									
8.	ES351ME	Metallurgy Lab.	-	-	2	2	25	50	1
9.	ES 341CE	Mechanics of Materials Lab.	-	-	2	2	25	50	1
10.	ES 341EC	Applied Electronics Lab	-	-	2	2	25	50	1
			20	2	8	30	285	640	24

B.E III Semester

Service Courses Offered to other Departments

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination		Credits
			L	T	P	Contact Hrs/wk	CIE	SEE	
1.	ES321ME	Section – B Mechanical Technology (For CE)	2	-	-	2	15	35	2
2.	ES322ME	Prime Movers and Pumps (For EE)	3	-	-	3	30	70	3

ES301ME

THERMODYNAMICS

Instruction per week	3 Hours
CIE	30 Marks
Duration of SEE	3 Hours
SEE	70 Marks
Credits	3

Course Objectives:

1. To introduce the principles of thermodynamics through everyday experiences which relate to energy and energy transformation of heat into other forms of energy. The Subject lays the groundwork for subsequent studies in courses like Applied Thermodynamics, Heat Transfer, Refrigeration and Air-conditioning, Automobile Engineering, Thermal Turbomachinery and Gas Dynamics etc.
2. To introduce the first law of thermodynamics with the Conservation of Energy Principles and their application in both closed and open systems.
3. To introduce the second law of thermodynamics with the Concept of Entropy and degradation of energy during the energy transfer in order to determine the theoretical limits for the performance of commonly used engineering systems.
4. To introduce pure substance through the phase change processes in order to establish the relationships among thermodynamic properties .
5. To introduce thermodynamic analysis of gas mixtures with special emphasis on study of moist air properties and design concepts employed in Air conditioning processes.

Course Outcomes:

1. The Students are expected to be explain the laws, symbols and vocabulary of thermodynamics.
2 The Students are expected to be use ideal gas laws and steam tables to successfully solve thermodynamic closed and open system problems.
3. The Students are expected to be able to use a problem solving procedure to process a preliminary statement of a problem into a final numeric solution for thermal power systems using the laws of thermodynamics.
4. The Students are expected to be able to explain working principles of Air conditioning devices.

UNIT-I

Concepts of System, **Surroundings and Universe**. Types of systems. Classification of Properties- fundamental and secondary, intensive and extensive. Basic laws of Thermodynamics. Thermodynamic equilibrium. Temperature Scales. International Practical Temperature Scale (IPTS). Pressures- Absolute and Gauge, Total, Static and Dynamic.

Ideal Gases- Equation of State. Specific Heats, Enthalpy, Internal energy, & Entropy. Real Gases-vander Waals Equation of State, Compressibility Factor.

Types of thermodynamic processes and their representation of P-V and T-s plots. Types of cycles- Open and Closed

UNIT-II

First Law analysis of Closed Systems: First law of thermodynamics. Heat and work transfers. Energy

conservation equation for a closed system. Calculation of Work Transfer, Heat Transfer, and Internal Energy changes.

First Law analysis of Flow processes/Open Systems: Derivation of Unsteady Flow Energy Equation (UFEE) and Steady Flow Energy Equation (SFEE). Calculation of Work Transfer, Heat Transfer, and Enthalpy changes. Thermodynamic analysis of flow through Nozzles, Diffusers, Turbines, Compressors, Throttling devices and Heat Exchangers.

Application of Unsteady Flow Energy Equation (UFEE) : Calculation of Heat transfer during charging /evacuation of a Cylinder.

UNIT-III

Carnot Cycle- Thermodynamic analysis of Carnot Cycle. Applications of Carnot cycle -Heat Engine, Heat Pump and Refrigerator.

Second Law of Thermodynamics: Statements of Second Law of thermodynamics. Equivalence of Kelvin-Planck and Clausius Statements.

Clausius Inequality, Carnot Theorems, Thermodynamic Temperature Scale.

Concept of Entropy: Reversible and Irreversible processes. Calculation of Entropy change during various thermodynamic processes. Principle of Increase of Entropy. Second law analysis of a control Volume.

Concepts of Exergy and Anergy: Loss in available energy. Second law efficiency of Turbines and Compressors.

UNIT-IV

Pure Substances. Concept of Phase Change. Graphical representation of thermodynamic processes on P-V, P-T, T-V, T-s, h-s, P-h and P-V-T diagrams. Thermodynamic relations involving Entropy, Enthalpy and Internal Energy. Derivation of Maxwell's relations. Clapeyron equation.

Properties of Steam- Use of Steam Tables and Mollier diagram.

Power Plant Cycles-Carnot and Rankine Cycles and their representation on P-V, T-s and h-s diagrams. Evaluation of performance parameters–Efficiency, Work ratio, Specific Steam Consumption and Heat Rate.

UNIT-V

Non reactive Ideal homogenous gas Mixtures: Determination of properties of Mixture in terms of properties of individual components of the mixture. Gibbs Phase Rule.

Psychrometry : Moist Air Properties. Use of Psychrometric Chart and Tables.

Concept of Air-Conditioning: Heating, Cooling, Humidification and De-humidification and other psychrometric processes. Adiabatic Mixing of two Streams of Moist Air. Sensible heat factor and Bypass factor for heaters/coolers.

Introduction to summer and winter air-conditioning processes with a brief overview on devices used in Air Conditioning.

Suggested Reading:

1. Yunus Cengel, Michael Boles "*Thermodynamics: An Engineering Approach",* McGraw-Hill Education; 8 edition, 2014
2. Nag P.K, "*Engineering Thermodynamics*': Tata McGraw Hill Publishing, 8th Edn, 3rd Reprint 2010.
3. Nag P.K, "*Basic & Applied Thermodynamics*': Tata McGraw Hill Publishing, 8th Reprint 2006.
4. Richard E.Sonntag, C.Borgnakke, G.J Van Wylen, *"Fundamentals of Thermodynamics':* John Wiley & Sons, 7th Edn., 2009.
5. Rajput R K, " *Engineering Thermodynamics*" Laxmi Publications, 4th Edition, 2010

ES302ME

MACHINE DRAWING

Instruction per week	2+2 Hours
CIE	30 Marks
Duration of SEE	3 Hours
SEE	70 Marks
Credits	3

Course Objectives:

1. To understand format of drawing sheet, angle of projections, isometric projections and practice on simple machine elements
2. To practice free hand sketching of machine elements
3. To understand assembly drawings of typical machine parts such as Connecting rod, Eccentric, Cross head, Machine vice, Screw jack, Non-return valves, Safety valves, Bearings, Tail stock etc.

Course Outcomes:

1. Will be able to draw isometric and orthogonal projections and sectional views of various mechanical components.
2. Will be able to draw free hand sketches of various mechanical components
3. Will be able to understand the shape and structure of different types of joints, screws, keys and Couplings
4. Will be sufficiently knowledgeable to use both the software and drafter to produce assembly views of various mechanical components from part drawings.
5. Will be able to read and understand the industrial drawings pertaining to industries like automobile industry, Aero-space and general engineering industries.

UNIT-I

Standard Drawing Practices

Format of drawing sheet, title block, conventions of drawing lines and dimensions. First and third angle projections, convention for sectional views. Views of simple machine elements from the given pictorial and orthographic views.

UNIT II

Machine Elements: Free hand sketching of the following machine elements

Screwed Fastenings: Screw thread nomenclature, thread series, designation, thread profiles, multi start threads, coupler nut, representation of threads, bolted joints, studded joint, eye bolt, Machine Screws and cap screws, and foundation bolts.

Keys, Cotters and Pin Joints: Introduction, saddle keys, sunk keys, round keys, cotter joint with sleeve, cotter joint with socket and Spigot ends, cotter joint with a Gib and knuckle joint.

Shaft Couplings: Rigid couplings, flexible couplings, disengaging couplings and non-aligned couplings. **Riveted Joints:** Introduction, classification of riveted joints, terminology of riveted joints, rivet heads. **Welded Joints:** Introduction, types of welded joints, representation of welds on drawings.

UNIT III

Assembly Drawings

Assembly drawings from given details of component drawings and working description of the assembly. Ability to supply additional views. The exercises will be drawings of typical machine parts, assemblies e.g., Connecting rod, Eccentric, Cross head, Machine vice, Screw jack, Non-return valves, Safety valves, Bearings, Tail stock etc. These are only examples and actual exercise or examination may include any assembly.

- **Exercises and Practice of Machine Drawing is to be done both manually (using Drafter) and using CAD software.**
- **Pattern of Exam:**

  Internals: Using CAD Software / Drafter
  Externals: Using Drafter (Manual)

Suggested Reading :

1. Siddeshwar N, Kannaiah P and Sastry VVS, "*Machine Drawing*", Tata McGraw Hill Publishing Co. Ltd., 5th Edition, 1994.
2. Bhatt N.D, "*Machine Drawing*", Charotar Publishing House, Anand, New Delhi, 28th Edition, 1993.
3. Narayan K.L, Kannaiah P, Venkat Reddy K, "*Machine Drawing*", New Age International (P) Ltd., 2nd Edition, 1999.
4. K. C. John, "*Text book of Machine Drawing*", PHI Learning, 2010.
5. The Solid Works software manual

ES303ME

METALLURGY AND MATERIAL SCIENCE

Instruction per week	3 Hours
CIE	30 Marks
Duration of SEE	3 Hours
SEE	70 Marks
Credits	3

Course Objectives:

1. To understand the basic concepts of metallurgy of metals and alloys
2. To know the fundamentals of fracture, fatigue, creep and diffusion
3. To familiarize with the principles of heat treatment and manufacturing of steel

Course Outcomes:

1. Student will be able to the understand and apply the different metallurgical phenomenon for Industrial applications
2. Student will be able to apply principles of Fracture, fatigue and creep for selection of materials for specific applications
3. Able to apply the principles of Alloys and heat treatment for various field applications.

UNIT –I

Mechanical behavior of Crystalline materials: Dislocations, Types and Effect of dislocations on strength of metals. Grain boundaries, volume defects in crystalline material, Cold and Hot working. Strain Hardening, Recovery, Recrystallization. Grain growth. Grain size and their effect on mechanical properties of metals.

UNIT-II

Fracture: Types of fracture in metals, Crack propagation, modes of fracture, Griffith theory of brittle fracture, , Ductile fracture, Ductile to Brittle transition, fracture under combined stresses.
Fatigue: S-N curve, Fatigue Crack Propagation, Effect of metallurgical variables on fatigue of metal, low cycle fatigue, Cumulative fatigue, Experimental determination of fatigue strength. (R.R-Moore Test).
Creep: Creep strength, Creep curve, Low temperature and High temperature creep, Creep Test.

UNIT-III

Extractive Metallurgy (General and Elementary Treatment Only): Methods of production of Pig Iron, Steel.

Steels: Types of steels, Plain Carbon Steels and their properties. Alloy Steels, Effect of alloying elements like Nickel, Chromium, Manganese, Silicon and Tungsten. Different types of Cast Irons and their properties. Properties of Copper, Aluminum, Titanium and their alloys

UNIT -IV

Diffusion: Fick's laws of Diffusion, Factors affecting diffusion, Applications of Diffusion theory in engineering.

Structure of Alloys: Gibbs Phase rule, Construction and Interpretation of thermal equilibrium diagram of binary non-ferrous alloys. Study of Eutectic, Eutectoid, Peritectic, Peritectoid reactions. Iron-iron Carbide Equilibrium diagram, Construction and its interpretation.

UNIT -V

Heat Treatment: Annealing, Normalizing, Hardening, Tempering. Construction and Interpretation of T.T.T. Curve. Austempering and Martempering. Case Hardening: Carburising, Nitriding, Carbo-nitriding, Flame Hardening, Induction Hardening, Age Hardening.

Suggested Reading:

1. Raghavan V, "*Material Science and Engineering*", Prentice Hall of India Ltd., 4th Edition, 1994.
2. Avner S.H, "*Introduction to Physical Metallurgy*", McGraw Hill Publishing Co.Ltd., 2nd Edition, 1974.
3. Nayak S.P, "*Engineering Metallurgy And Material Science"*: Charotar Publishing House, 6th Edn., 1995.
4. Dieter G.E, "*Mechanical Metallurgy*", McGraw Hill Publishing Co., SI Metric Edn., 1988.
5. Sir Alan Cottrell, *"An Introduction to Metallurgy*" Universal Press, 2nd Edn., 2009.

ES321CE

MECHANICS OF MATERIALS

Instruction per week	3+1 Hours
CIE	30 Marks
Duration of SEE	3 Hours
SEE	70 Marks
Credits	3

Course Objectives:

1. To understand the basic concept of stress and strains for different materials
2. To know the mechanism of the development of shear force and bending moment in beams
3. To know the theory of simple bending, direct & bending stress and distribution of shear stress
4. To study the deflections and its applications
5. To analyze and understand shear stress, torsional stress and spring applications

Course Outcomes:

1. To understand the theory of elasticity and Hookes's law
2. Analyse beams to determine shear force and bending moments
3. Solve problems on bars and to determine deflections at any point of the beams.
4. Anlalyse and design structural members subjected to combined stresses.

Unit – I

Simple stresses and strains: Types of stresses and strains. Hooks's Law, Stress- Strain curve for ductile materials, moduli of elasticity. Poisson's ratio, linear strain, volumetric strain, relations between elastic constants. Bars of varying sections, bars of uniform strength, compound bars and temperature stresses, change in length.

Unit-II

Shear Force and Bending Moment: Relation between intensity of loading. Shear force and bending moment, shear force and bending moment diagrams for cantilever and simply supported beams with and without overhanging for point loads, uniformly distributed loads, uniformly varying loads and couples.

Compound Stresses: Stresses on oblique planes, principle stresses and principle planes. Mohr circle of stress and ellipse o stress.

Unit-III

Theory of simple bending: Assumptions derivation of basic equation: $M/I = F/y = E/R$

Modulus of section, Moment of resistance, determination of flexural stresses.

Direct and Bending Stresses: Basic concepts, core of sections for rectangular, solid and hollow circular and I sections.

Distribution of shear stress: Equation of shear stress, distribution across rectangular, circular, diamond, T and I sections.

Unit-IV

Deflections: Deflections of cantilever and simply supported beams including overhanging beams for point loads and uniformly distributed loads by double integration and Maualay's method.

Strain Energy: Strain energy in bars due to gradually applied loads, sudden loads, impact loads and shock loads.

Unit-V

Torsion-Theory of pure torsion- derivation of basic equation **T/J = q/R = NΘ/L** and hollow circular shafts, strain energy- Transmission of power, combined bending and torsion.

Springs: Close and open coiled helical springs subjected to axial loads and axial couples, strain energy in springs- carriage springs.

Suggested Readings:

1. D.S. Prakash Rao, Strength of Materials – A practical Approach, Universities Press, 1999.
2. R.K. Rajput, Strenght of Materials, S. Chand & Co., 2003.
3. B.C. Punmia, Strength of Materials and Theory of Structures, Laxmi Publishers, Delhi, 2000.
4. Ferdinand P Beer et.al., Mechanics of Materials, Tata McGraw-Hill, 2004.
5. G.H. Ryder, Strength of Materials, Third Edition in SI units, Macmillan Indian Limited, Delhi, 2002.
6. S. Ramamrutham, Strength of Materials, Dhanpat Rai & Sons, 1993.
7. S.S. Bhavakatti, Strength of Materials, Vikas Publications, 2003.

ES322EE

ELECTRICAL CIRCUITS AND MACHINES

Instruction per week	3 Hours
CIE	30 Marks
Duration of SEE	3 Hours
SEE	70 Marks
Credits	3

Course Objectives:

1. To acquire knowledge in electrical circuits.
2. To be able to understand the basic principle of operation and performance of electrical machines.

Course Outcomes:

1. Students will know the basics of Electrical Engineering with good knowledge on underlying principles of operation.
2. Students can relate these basics with daily experiences.

UNIT I

DC Circuits: Ohm's law, Network elements, Kichhoff's laws, Power in DC circuits, Series & parallel resistances, Thevenin's and Norton's theorems.

AC Circuits: Sinusoidal sources, Phasor representation of sinusoidal quantities, Average and RMS values, Form factor, Analysis of RLC circuits to sinusoidal inputs, Power factor, Active & reactive powers, energy stored in inductance and capacitance, Mutual inductance.

UNIT II

Three-Phase Circuits: Production of 3-phase voltages, balanced star and delta connections, Measurement of power by Two-wattmeter method.

Single Phase Transformers: Principle of operation, Transformer on No-load and Load, Equivalent circuit, Efficiency & regulation, O.C and S.C tests, Principle of autotransformer.

UNIT III

DC Machines: Construction and working principle of generator and motor, EMF in generator, Types of excitation, Characteristics of series and shunt generators, Applications, Torque in a DC motor, Characteristics of shunt and series motors, Speed control of dc shunt motors, Losses & efficiency, Three point starter.

UNIT IV

Three-Phase Induction Motors: Production of rotating magnetic field, Construction and principle of Induction motors, Torque-slip characteristics, Star delta and Autotransformer starters, Speed control by Stator voltage and Rotor resistance methods.

UNIT V

Single-Phase Motors: Capacitor start and Capacitor run motor, Universal motors.

Three - Phase alternators: Construction, emf equation, Regulation by synchronous impedance method.

Suggested Reading:

1. Naidu M.S. & Kamakshiah S, "*Introduction to Electrical Engineering*", Tata McGraw Hill, 1995
2. Mehta V.K., "*Principles of Electrical Engineering and Electronics*", S.Chand & Co., 1995
3. A.Chakrabarti, Sudipta Nath, Chandan Kumar Chanda, "*Basic Electrical Engineering*" Tata McGraw Hill Education PVT LTD, 2009

BS901MT

MATHEMATICS -III

Instruction per week	3+1 Hours
CIE	30 Marks
Duration of SEE	3 Hours
SEE	70 Marks
Credits	3

Course Objectives:

1. To introduce the concept of functions of complex variables and their properties
2. To formulate partial differential equations and to introduce a few methods to solve first order linear and non-linear partial differential equations
3. To study Fourier series and its applications to partial differential equations

Course Outcomes:

1. To determine the analyticity of a complex functions and expand functions as Taylor and Laurent series
2. To evaluate complex and real integrals using residue theorem
3. To expand function as a Fourier series
4. To find solutions of first order and second order partial differential equations

UNIT-I

Functions of Complex Variables: Limits and continuity of function, differentiability and analyticity, necessary & sufficient conditions for a function to be analytic, Cauchy- Riemann equations in polar form, harmonic functions, complex integration, Cauchy's integral theorem, extension of Cauchy's integral theorem for multiply connected regions, Cauchy's integral formula, Cauchy's formula for derivatives and their applications.

UNIT-II

Residue Calculus:

Power series, Taylor's series, Laurent's series, zeros and singularities, residues, residue theorem, evaluation of real integrals using residue theorem, bilinear transformation, conformal mapping.

UNIT-III

Fourier series:

Fourier series, Fourier series expansions of even and odd functions, convergence of Fourier series, Fourier half range series.

UNIT-IV

Partial differential equations:

Formation of first and second order partial differential equations, solution of first order equations, Lagrange's equation, Nonlinear first order equations, Charpit's method, higher order linear equations with constant coefficients.

UNIT-V

Fourier series applications to partial differential equations:

Classification of linear second order partial differential equations, separation of variables method (Fourier method), Fourier series solution of one dimensional heat and wave equations, Laplace's equation.

Suggested Reading:

1. R.K.Jain & S.R.K Iyengar, Advanced Engineering Mathematics, Narosa Publication, 4th Edition, 2014.
2 B.S.Grewal, Higher Engineering Mathematics, Khanna Publications, 43rd Edition, 2014.
. 3. Gupta & Kapoor, Fundamentals of Mathematical statistics, Sultan chand & sons, New Delhi, 2014.
4. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, 2012.
5. James Brown and Ruel Churchill, Complex variables and Applications, 9th Edition,2013.

ES322EC

APPLIED ELECTRONICS

Instruction per week	3 Hours
CIE	30 Marks
Duration of SEE	3 Hours
SEE	70 Marks
Credits	3

Course Objectives:

1. To understand the characteristics of diodes and transistor configurations
2. To understand the design concepts of biasing of BJT and FET
3. To understand the design concepts of feedback amplifiers and oscillators
4. To study the design concepts of OP Amp and data converters

Course Outcomes:

1. Study and analyze the rectifiers and regulator circuits.
2. Study and analyze the performance of BJTs, FETs on the basis of their operation and working.
3. Ability to analyze & design oscillator circuits.
4. Ability to analyze different logic gates & multi-vibrator circuits.
5. Ability to analyze different data acquisition systems

Unit I

Characteristics of PN Junction: Half wave rectifier, Full wave rectifier, filters, ripple, regulation, TIF and efficiency, Zener diode and Zener diode regulators. CRT construction and CRO applications

Unit II

Bipolar and Field Effect Transistors : Biasing FET , small signal model, h-parameter equivalent circuits, basic amplifier circuits-CB,CE,CC configurations of BJT and CG,CS and CD configurations of FETs, RC-coupled amplifier and its frequency response.

Unit III

Feedback Concepts: Types of negative feedback-modification of gain, bandwidth, input and output impedances-applications; Oscillators: RC phase shift, Wien bridge, LC and Crystal Oscillators.

Unit IV

Operational Amplifier: Characteristics, applications, Differential amplifiers, logic gate circuits-Introduction to Digital Systems-AND,NAND,NOR,XOR gates, Binary half wave adder, full adder, Multi-vibrators-Bi-stable, Mono-stable and Astable Multi-vibrators (Qualitative treatment only),Schmitt trigger.

Unit V

Data Acquisition Systems: Construction and Operation of transducers-Strain gauge LVDT, Thermocouple, Instrumentation Systems, Magnetic tape recorders, FM recording, Digital recording, Digital to Analog and Analog to Digital conversions.

Suggested Reading:

1 Robert Boylestad L. and Louis Nashelsky, *Electronic Devices and Circuit Theory*, Prentice Hall of India , 2007

2 Helfrick D and David Cooper, *Modern Electronic Instrumentation and Measurements Techniques,* 1st edition, Prentice Hall of India, 2006.

3 Salivahanan, Suresh Kumar and Vallavaraj, *Electronic Devices and Circuits,* 2nd edition, Tata McGraw-Hill, 2010.

ES351ME

METALLURGY LAB.

Instruction per week	2 Hours
CIE	25 Marks
Duration of SEE	3 Hours
SEE	50 Marks
Credits	1

Course Objectives:

1. To get familiarized with the procedure of metallurgical specimen preparation for microscopic examination and viewing the structure
2. To know the method of identifying phases of micro structure and identifying different metals and alloys
3. To understand the effects of various heat treatment procedures
4. To understand relation between material properties with its grain size and shape

Course Outcomes:

1. The student will be able to understand and apply various methods of preparing a specimen for viewing the microstructure
2. The student will know the method of identifying different metals and alloys based on metallurgical phases observed in the micro structure
3. The student will be able to understand grain geometry and know the effects of various heat treatments

List of Experiments:

1. Study of: Metallurgical Microscope
   Iron-Iron Carbide diagram

   Procedure for specimen preparation
2. Metallographic Study of Pure Iron
3. Metallographic Study of Low carbon steel
4. Metallographic Study of Medium carbon steel
5. Metallographic Study of Eutectoid steel
6. Metallographic Study of Hyper Eutectoid steel
7. Metallographic Study of Wrought iron
8. Metallographic Study of Grey cast iron
9. Metallographic Study of White cast iron
10. Metallographic Study of Black heart Malleable cast iron
11. Metallographic Study of white heart Malleable cast iron
12. Metallographic Study of Brass and Bronze
13. Study of microstructure after hardening, normalizing and annealing of steel specimen.

Note: *At least ten experiments should be conducted in the Semester*

ES341CE

MECHANICS OF MATERIALS LAB.

Instruction per week	2 Hours
CIE	25 Marks
Duration of SEE	3 Hours
SEE	50 Marks
Credits	1

Course Objectives:

1. To know and understand the experiments on various materials to assess their behavior/limitations.
2. To know the brittle and ductile material failure patterns etc., by conducting experiments
3. To understand shear force, bending moment and deflections for different types of beams
4. To know the rigidity modulus by conducting spring and torsion test.

Course Outcomes:

1. Will be able to perform various experiments on engineering materials.
2. Will be able to distinguish between brittle and ductile materials.
3. Will be able to determine the mechanical properties of various materials.

Cycle – I

1. Direct tension test on metal bars
2. Young's modulus of metal specimen
3. Harness tests: Brinell and Rockwell
4. Compression test on bricks
5. Impact test
6. Shear force and bending moment tests

Cycle – II

7. Spring test
8. Torsion test
9. Bending test on simply supported beam
10. Bending test on continuous beam
11. Bending test on fixed beam
12. Curved beam

Note: *At least ten experiments should be conducted in the Semester*

ES341EC

APPLIED ELECTRONICS LAB.

Instruction per week	2 Hours
CIE	25 Marks
Duration of SEE	3 Hours
SEE	50 Marks
Credits	1

Course Objectives:

1. To understand the characteristics of diodes and transistor configurations
2. To understand the design concepts of biasing of BJT and FET
3. To understand the design concepts of feedback amplifiers and oscillators
4. To study the design concepts of OP Amp and data converters

Course Outcomes:

1. Ability to design diode circuits & understand the application of zener diode.
2. Ability to analyze characteristics of BJTs & FETs.
3. Ability to understand the different oscillator circuits.
4. Ability to understand operation of HWR & FWR circuits with & without filters.
5. Ability tom design Analog-to-Digital converters & Digital-to-Analog converters.

List of Experiments:

1. CRO-Applications, Measurements of R, L and C using LCR meter, Color code method and soldering practice.
2. Characteristics of Semiconductors diode (Ge,Si and Zener)
3. Static Characteristics of BJT-Common Emitter
4. Static Characteristics of BJT-Common Base
5. Static Characteristics of FET
6. RC-Phase Shift Oscillator
7. Hartley and Colpitts Oscillators
8. Common Emitter Amplifier
9. Astable Multivibrator
10. Full-wave rectifier with and without filters using BJT
11. Operational Amplifier Applications
12. Strain Guage Measurement
13. Analog-to-Digital and Digital to Analog Converters

Suggested Reading:

1. Maheshwari and Anand, *Laboratory Experiments and PSPICE Simulations in Analog Electronics,* 1st edition, Prentice Hall of India, 2006.
2. David Bell A., *Laboratory Manual for Electronic Devices and Circuits,* Prentice Hall of India, 2001.

ES321ME **SECTION - B**

MECHANICAL TECHNOLOGY

(For Civil Engineering)

Instruction per week	2 Hours
CIE	15 Marks
Duration of SEE	1½ Hours
SEE	35 Marks
Credits	2

Course Objectives:

1. To know the working principle of earth moving equipment
2. To study types and working principle of conveying and hoisting equipment
3. To understand the working principle of concrete producing, concrete screening and concrete mixing equipment
4. To know the principle of pneumatic equipment and tools

Course Outcomes:

1. Will have an in depth knowledge on Earth moving and excavating equipments.
2. Will have knowledge of various conveyor systems and will be able to design conveyor system with optimum system with the given constraints.
3. Will have in depth knowledge about functioning of various components of concrete and aggregate making equipment and as well have exposure to various pneumatic tools.

UNIT-I

General Description, Operation and Selection of the following: Earth moving and Excavation Equipment -Shovels, Dragline, Clam shell, Cable Excavator, Bucket Wheel Excavator, Tractor, Bull - dozer, Scraper, Earth compactors.

UNIT-II

Conveying Equipment: Belt Conveyor, Screw Conveyor, Bucket Conveyor, Aerial ropeway, **Hoisting Equipment:** Hoist Winch, Differential and Worm geared chain hoists. Fork lift truck, Guyed derricks, Swing and non-swing mobile crane, Whirler crane, Tower crane.

UNIT -III

Aggregate and Concrete Producing Equipment: Crushers, Jaw, Gyratory, Hammer and Roll crushers; **Screens**: Stationary, Revolving, Shaking and Vibrating screens. Concrete mixers, Concrete pump. **Pneumatic Equipment:** Reciprocating air-compressor.
Construction of pneumatic tools: Jack hammer, Paving breaker, Concrete vibrator.

Suggested Reading:

1. Peurifoy R.L, "*Construction Planning, Equipment and Methods*", McGraw Hill 6th Edn., 2008.
2. Spence G and Wood C.L, "*Building and Civil Engineering Plant*': John-Wiley & Sons, 2nd Edn., 2004.
3. Mahesh Varma Dr, "*Construction Equipment & its Planning & Application*': Metropolitan Book Co., 3rd Edn., 2009

ES322ME

PRIME MOVERS AND PUMPS

(For Electrical Engineering)

Instruction per week	3 Hours
CIE	30 Marks
Duration of SEE	3 Hours
SEE	70 Marks
Credits	3

Course Objectives:

1. To acquire knowledge of fluid mechanics and governing equations
2. To understand the working principle of hydraulic turbines and pumps
3. To understand the working principle of steam and gas power plants
4. To be able to estimate the power developed in the engine, turbines
5. To familiarize the concepts of increasing the efficiency of turbines.

Course Outcomes:

After completing the course the student will have:

1. Knowledge regarding various theories dealing with the flow phenomenon of fluid
2. Ability to define the nature of a fluid, viscosity effects on flow and characteristics of Newtonian and non-Newtonian fluids.
3. Understanding of basics of the hydraulic, steam and gas turbines, and their components, functions and applications
4. Knowledge of different types of boilers, turbines and pumps.
5. Recognize typical designs of turbines and pumps

UNIT-I

Fluid Mechanics: Properties of fluids, Newtonian and Non-Newtonian fluids. Continuity, Momentum and Energy equations. Bernoulli's equation and its applications. Laminar and Turbulent flows. Basic concepts of Boundary layer theory and boundary layer thickness.

UNIT-II

Hydraulic Turbines: Layout of Hydroelectric power plant. Working principle of Pelton, Francis and Kaplan turbines. Draft tube in Reaction turbine. Velocity diagrams for impulse and Reaction turbines. Blade angles and dimensions for Reaction turbines. Work done, power output and efficiencies. Simple problems on Pelton, Francis and Kaplan turbines. Selection of turbines for electric power generation. Specific speed and its ranges for Pelton, Francis and Kaplan turbines. Unit quantities. Performance and characteristic curves. Cavitation and its effects.

UNIT-III

Pumps: Reciprocating Pumps-Working of single and double acting types. Functions and use of Air vessels. Problems on pressure head, work done, power required without and with air vessels. **Centrifugal pumps**: Parts and working of CF pumps. Need for priming, pump installation. Velocity diagrams and vane angles. Types of Impellers. Work and power required. Manometric and other

efficiencies. Simple problems for single stage pumps; Principles of similarity, specific speed and unit quantities. Performance and characteristic curves.

UNIT-IV

Basic Steam Engineering: Generation, properties and dryness fraction of steam. Functions of a boiler. Working of a simple vertical type and Babcock and Wilcox type boilers with simple sketches. Boiler Mountings and Accessories and their functions. Rankine cycle, Re-heat and Re-generation cycles.

UNIT -V

Steam and Gas Power Plants: Layout of simple steam power plant and working of its individual units. Classification and compounding of steam turbines. Velocity diagrams for single stage impulse and reaction turbines. Simple problems on work done, blade angles, power output and thermal efficiencies of turbines. Working of reheat and bleeding cycles. **Gas Turbine Power Plant:** Brayton cycle for gas turbines. Simple closed cycle and open cycle gas turbine plants. Layout and efficiency of gas turbine plants. Intercooling and Reheating cycles. Evaluation of power output, cycle temperatures and thermal efficiencies for simple gas turbine plants.

Suggested Reading:

1. Ballaney P. L, "*Thermal Engineering*", Khanna Publishers, 19th Edn., 1993.
2. Yadav R, "*Steam and Gas turbines*", Galgotia Publishers, 6th Edn., 1992.
3. Rajput., "Thermal Engineering", Laxmi Publications (P) Ltd, New Delhi.
4. Bansal R.K., "Fluid Mechanics and Hydraulic Machines", Laxmi Publications(P) ltd, New Delhi.
5. Kumar D.S, "*Fluid Mechanics and Fluid Power Engineering*", S.K. Kataria & Sons, 6th Edn., 2003.

SCHEME OF INSTRUCTION & EXAMINATION
B.E IV Semester

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination		Credits
			L	T	P/Dg	Contact Hrs/wk	CIE	SEE	
1.	PC401ME	Applied Thermodynamics	3	-	-	3	30	70	3
2.	PC402ME	Kinematics of Machines	3	1	-	4	30	70	3
3.	PC403ME	Manufacturing Processes	3	-	-	3	30	70	3
4.	BS401MT	Mathematics-IV	3	1	-	4	30	70	3
5.	PC404ME	Fluid Mechanics	3	-	-	3	30	70	3
6.	HS 901BT	Environmental Science	3	-	-	3	30	70	3
7.	PC405ME	Automobile Engineering	3	-	-	3	30	70	3
Practicals									
8.	ES441EE	Electrical circuits and Machines Lab	-	-	2	2	25	50	1
9.	PC451ME	Thermodynamics Lab	-	-	2	2	25	50	1
10.	PW961ME*	Engineering Applications with Social Perspective*	-	-	-	-	-	-	-
11.	MC**	Mandatory Course	-	-	3	3	50	-	3 Units
			20	02	09	31	310	590	23

Note: *Engineering Applications with Social Perspective along with credits will be reflected in V semester memorandum of marks

B.E. IV Semester
Service Courses Offered to other Departments

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination		Credits
			L	T	P	Contact Hrs/wk	CIE	SEE	
1.	ES441ME	Prime Movers and Pumps Lab (For EE)	-	-	2	2	25	50	1

Mandatory Course**	
MC951SP	Yoga Practice
MC952SP	NSS
MC953SP	Sports

****Students can opt for any one of the mandatory courses.**

PC401ME

APPLIED THERMODYNAMICS

Instruction per week	3 Hours
CIE	30 Marks
Duration of SEE	3 Hours
SEE	70 Marks
Credits	3

Course Objectives:

1. To study the application of thermal science in mechanical engineering, consisting of the fundamental laws and processes for energy conversion.
2. To understand thermal design aspects of reciprocating machinery-reciprocating compressors and IC Engines.
3. To analyse Rankine cycle applied to thermal power plants and its improvements.
4. To gain the knowledge on the power plant thermal devices-Boilers, Condensers, Pumps &Nozzles.

Course Outcomes:

1. The Students are expected to be able to quantify the behavior of reciprocating compressors.
2. The Students are expected to be able to explain thermal design and working principles of IC Engines,their supporting systems and Combustion chambers.
3. The Students are expected to be able to quantify the behavior of power plants based on the Rankine cycle, including the effect of enhancements such as superheat, reheat and regeneration.
4. The Students are expected to be able to explain the thermal design and working principles of Power plant devices - Boilers, Condensers, Pumps &Nozzles.

Unit-I

Reciprocating Air Compressors: Classification and applications. Ideal and actual P-V diagrams, work input and efficiency relations for single and multi stage compressors. Effect of clearance volume on work input and efficiency. Inter cooling and after cooling concepts.

Unit-II

Internal Combustion Engines: Classification and applications. Working principles of four stroke and two stroke engines, Spark Ignition and Compression ignition engines. Deviation of actual cycles from Air Standard cycles. Performance parameters of I.C. Engines. Heat balance sheet of I. C. Engine.

Overview of Engine supporting systems- Cooling Systems, Lubrication systems- Wet sump, Dry sump and Mist Systems. Working principles of S.I. Engine fuel systems- Carburetors, Battery and Magneto Ignition systems. Working principles of C.I. Engine fuel systems- Fuel pump and Fuel injector.

Unit-III

I.C. Engine Combustion phenomena: Stages of combustion in S.I. Engines- Ignition delay, Flame front propagation and After burning. Abnormal combustion- Pre-ignition and Knocking.

Factors affecting Knocking. Stages of combustion in C.I. Engines, Delay period, Period of Uncontrolled

Combustion, Period of Controlled Combustion and after burning. Abnormal Combustion-Knocking. Factors affecting Knocking. Octane and Cetane rating of fuels. Design considerations for combustion chamber and cylinder head. Type of combustion chambers of S.I. engines and C.I. engines.

Unit-IV

Steam Boilers: Classification and Working Principles. Water tube boilers- Babcok & Wilcox and Stirling boilers. Fire tube boilers- Cornish, Cochran, Locomotive and Lancashire boilers. High Pressure boilers / Supercritical boilers: La mont, Benson boiler, Loeffler boiler and Velox boiler.

Boiler Mountings and Accessories: Working Principles of Water level indicator, Pressure gauge, Steam stop valve, Feed check valve, Blow-off cock, Fusible plug, Safety valves, Economizers, Superheaters and Steam separator. Steam Condensers: Jet and Surface condensers, Principle of Operation and Applications.

Unit-V

Steam power plant cycles: Carnot and Rankine cycles of operation and their efficiencies. Analysis of Rankine cycle with superheating, reheating and regeneration (Direct and Indirect types).

Steam Nozzles: Flow of steam through convergent - divergent nozzles, velocity of steam flowing through the nozzle, mass of steam discharge through the nozzle, condition for maximum discharge, critical pressure ratio and nozzle efficiency. Super saturated expansion of steam through nozzles. General relationship between area, velocity and pressure in Nozzle flow.

Suggested Reading

1. R.K. Rajput, " *Thermal Engineering"*, Laxmi Publications, 9th Edn., 2013
2. V. Ganesan, "*Internal Combustion Engines",* Tata McGraw Hill Publishing, 2007
3. P.L. Ballaney, "*Thermal Engineering",* Khanna Publishers, 19th Edn., 1993.
4. Richard Stone, *"Introduction to I.C. Engines*", Mac Millan, 2nd Edn., 1997

PC402ME

KINEMATICS OF MACHINES

Instruction per week	3+1 Hours
CIE	30 Marks
Duration of SEE	3 Hours
SEE	70 Marks
Credits	3

Course Objectives:

1. To understand the basic elements of machinery and their motion characteristics
2. To know the kinematic properties of mechanisms and machines
3. To understand basic machine elements
4. To know classification and applications of cams, gears and gear-trains

Course Outcomes:

1. Will be able to determine the degree of freedom of a given mechanical system.
2. Will be able to understand the importance of mechanisms and their applications.
3. Will be able to develop new mechanisms for various applications.
4. Will be able to develop a power drive system for a specific system.
5. Will be able to understand the importance of friction and its applications.

UNIT-I

Definitions of link, pair, chain mechanism, degrees of freedom, Kutzbach's and Grubbler's criterion. Grashof's Law, Inversions of four bar mechanisms with all revolute joints, single and double slider crank mechanisms. Instantaneous Centre, Space Centrode and Body Centrode, Kennedy Theorem. Definitions and scope of Type, Number and Dimensional Synthesis. Pantograph and Geneva mechanisms. Ackerman and Davis steering gear mechanisms and Hooke's Joint. Peaucellier, Hart, Scott-Russel, Watt and Tchebicheff mechanisms.

UNIT-II

Analytical method to find velocities and accelerations in mechanisms. Velocities in mechanisms by instantaneous centre method, velocity and acceleration of mechanisms by using relative velocity method including Coriolis component of acceleration.

UNIT- III

Laws of friction. Screw threads, Pivots, Collars. Clutches -Single and Multi plate, Cone and centrifugal clutches. Friction circle and friction axis of a link. Belt, Rope and introduction to Chain drives.

UNIT-IV

Brakes and Dynamometers: Block or shoe, band, band and block, internal expanding shoe brakes and disc brakes. Prony, Rope brake, Belt transmission and epicyclic train Dynamometers.

Cams and Followers: Types of Cams and followers, motion of the follower, follower displacement diagram, Cam profile for specified follower motion and Cams with specified contours.

UNIT-V

Theory of Gearing, Terminology and Definitions, Law of Gearing, Tooth profiles, Path of contact and Arc of contact. Interference, methods of avoiding interference. Contact Ratio. Introduction to Helical, Bevel and worm gears.

Gear Trains: Simple, Compound, Reverted and Epicyclic gear trains. Differential of an Automobile.

Suggested Reading:

1. J. E. Shigley and John J. Uicker "Theory of Machines and Mechanisms", Tata McGraw Hill, 2nd Edn., 1995.
2. Thomas Bevan, "Theory of Machines", College Book Store (CBS) Publishers Ltd., 3rd Edn., 1985.
3. S.S. Rattan, "Theory of Machines", Tata McGraw Hill, 3rd Edn., 1995.
4. J.S. Rao and R.V. Dukkipati, "Mechanisms and Machine Theory", Wiley Eastern Limited, 1992.
5. Amitabha Ghosh and Ashok Kumar Mallik, Theory of Mechanisms and Machines, East West Press Pvt. Ltd, 2008

PC403ME

MANUFACTURING PROCESSES

Instruction per week	3+1 Hours
CIE	30 Marks
Duration of SEE	3 Hours
SEE	70 Marks
Credits	3

Course Objectives:

1. To understand the basic concepts of casting and welding
2. To understand the manufacturing of plastics and composites
3. To familiarize the forming processes and forming load estimation.
4. To understand the principle of high energy rate forming processes

Course Outcomes:

1. Understand the basic working principles of casting, forming and welding.
2. Some understanding of types, manufacturing processes and applications of plastics and composite materials.
3. Recommend appropriate part manufacturing processes when provided a set of functional requirements.
4. Ability to analyze problems on forging, rolling, drawing and extrusion.
5. Communicate effectively with industry personnel by developing a manufacturing-centric vocabulary.

UNIT-I

Introduction to Casting: Moulding Sands, Properties of sands, Testing of Sand properties and their improvements. Types of patterns and pattern materials, Pattern allowances. Core sands, core sand properties and core making processes. Machine Moulding techniques. Riser and Riser size estimation-Chvorinov and Caine's rules. Types gates and components of gating system. Theory of solidification. **Introduction to Furnaces:** Cupola, Arc and Induction.

UNIT-II

Special Casting Processes: Shell Mould Casting, Co_2 Casting, Investment Casting, Gravity and Pressure Die Casting, Centrifugal Casting and Continuous Casting. Cleaning of Castings, Casting defects and their Causes. **Processing of Plastics:** Blow molding, Injection molding, Reaction injection molding, Rotational molding and Extrusion. **Processing of Composites:** Hand lay-up, Filament winding, Compression molding, Resin infusion molding.

UNIT-III

Sheet Metal Working: Geometry of Punch and Die for Blanking/Piercing operations, Cup Drawing, Strip Layout, Force Calculations. Metal spinning. **High Energy Rate Forming**: Explosive forming, Magnetic forming, Electro-hydraulic forming and Rubber pad forming.

UNIT - IV

Bulk Deformation Processes: Simple Estimation of Forces in Forging, Rolling, Rod Drawing and Extrusion. Hydrostatic Extrusion. **Powder Metallurgy:** Powder production methods, steps in powder metallurgy processes, cold and hot isostatic pressing, typical industrial applications.

UNIT-V

Gas Welding: Oxy-Acetylene Welding-Basic set up, Welding and Cutting Torches, Types of Flames. **Arc Welding:** Schematics of SMAW, GTAW, GMAW, PAW, SAW, LBW and EBW, Electrode Coatings and Electrode Specifications. **Resistance Welding:** Spot, Seam, Projection and butt welding, Flash welding. **Solid State Welding:** Pressure Welding, Ultrasonic Welding, Friction welding and Explosive welding. Basics of soldering, brazing and adhesive bonding.

Suggested Reading:

1. P.N.Rao, "*Manufacturing Technology*," Vol. 1, Tata McGraw Hill Publ., 3nd Ed., 2011.
2. Amitabh Ghosh & Mallick, "*Manufacturing Science"*, Assoc. East west Press Pvt. Ltd. 4th Ed., 2011.
3. Serope Kalpakjian, "*Manufacturing Engineering and Technology"*, Addison, Wesley Publishing Company, 2006
4. Kaushish J.P, "*Manufacturing Processes"*, PHI Learning Pvt. Ltd., 2nd, 2010

BS401MT

MATHEMATICS-IV

Instruction per week	3+1 Hours
CIE	30 Marks
Duration of SEE	3 Hours
SEE	70 Marks
Credits	3

Course Objectives:

1. To introduce transforms like Laplace, Fourier , Z-transforms and their properties
2. To introduce a few numerical methods to solve certain types of problems
3. To understand curve fitting, correlation and regression

Course Outcomes:

At the end of the courese students will be able to

1. solve differential equations using Laplace and Fourier transforms
2. solve difference equation using Z-transforms
3. find numerical solution of algebraic, trancendental equations and ordirnary differential equations.
4. perform a regression analysis and to compute and interpret the coefficient of correlation

UNIT- I

Laplace transforms: Introduction of Laplace transforms, sufficient condition for existence of Laplace transform, Laplace transform of Derivatives, Laplace transform of integrals, Translation theorems (I & II shifting theorems), Differentiation of Laplace transform (Multyplication by t), Integration of Laplace transform(Division by t), convolution theorem, Solving initial value problems using Laplace transform.

UNIT- II

Fourier transforms: Introduction, Fourier integrals, Fourier sine and cosine integrals, Complex form of Fourier integral, Fourier transform, Fourier sine and cosine transforms, Finite Fourier sine and cosine transforms, Properties of Fourier transforms, Convolution theorem for Fourier transforms.

UNIT- III

Z-Transforms: Introduction, basic theory of Z-transforms, Z-transforms of standard sequences, existence of Z-transform, linearity property, translation theorem, scaling property, initial and final value theorems, differentiation of Z-transform, convolution theorem, solution of difference equations using Z-transforms.

UNIT- IV

Numerical methods: Solution of Algebraic and Transcendental equations**:** Bisection method,Newton-Raphson method, Solution of linear system of equations: Gauss elimination method, Gauss- Seidel iteration method, Interpolation: Lagrange's interpolation, Newton's divided difference interpolation, Newton's Forward and Backward difference interpolations, Numerical differentiation, Numerical solutions of ordinary differential equations : Taylor's series method, Euler method, Runge-Kutta method of 4^{th} order.

UNIT- V

Curve fitting:

Curve fitting by method of least squares**,** correlation and regression, types of correlations, Karl Pearson's coefficient of correlation, Spearman's rank correlation coefficient, equal ranks, equations to the lines of regression.

Suggested Reading:

1. R.K.Jain & S.R.K Iyengar, Advanced Engineering Mathematics, Narosa Publication, 4th Edition, 2014.
2. B.S.Grewal, Higher Engineering Mathematics, Khanna Publications, 43rd Edition, 2014.
3. Vasishtha and Gupta, Integral Transforms, Krishnan Prakashan Publications, 2014.
4. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, 2012.

PC404ME

FLUID MECHANICS

Instruction per week	3 Hours
CIE	30 Marks
Duration of SEE	3 Hours
SEE	70 Marks
Credits	3

Course Objectives:

1. To introduce the concept of fluid flow phenomena and their properties.
2. To study mass and momentum conservation concepts/ laws of moving fluids.
3. To analyze different flow characteristics of laminar and turbulent flows and introduce boundary layer and viscous flow concepts.
4. To understand aerodynamics of flow over an airfoil and learn calculation of Airfoil coordinates of NACA 4 digit Series.
5. To lay the groundwork for subsequent studies in courses like Hydraulics Machinery and Systems, Thermal Turbomachinery and Gas Dynamics etc.

Course Outcomes:

1. The Students are expected to be explain the laws and terminology of fluid flows, classify fluid flows and derive relevant equations.
2. The Students are expected to be able to use a problem solving procedure to determine pressure and flow parameters.
3. The Students are expected to be able to explain aerodynamics of flow over Airfoils..
4. The Students are expected to be able to calculate 2D coordinates of NACA 4 digit series Airfoils.
5. The Students are expected to be able to explain boundary layer and viscous flow concepts

UNIT-I

Fluid Properties: Fluid density, specific weight, specific gravity, viscosity-causes of viscosity in gases and liquids. Surface tension, capillary effect, vapor pressure and cavitation, fluid compressibility and bulk modulus.. Hypothesis of continuum. Shear stress and shear strain in a moving fluid.

Classification of fluids : Newtonian and non Newtonian fluids, Ideal and real fluids, Incompressible and Compressible flows. Potential and viscous flows. Lagrangian and Eularian Methods of Study of fluid flow.

Parameters used for Flow description : Stream lines. Stream tube. Path lines. Streak lines and Time lines. Velocity and acceleration vectors in Cartesian coordinates. Circulation and Vorticity. Stream function and Velocity Potential function.

UNIT-II

Pressures and Head: Types of Pressure, Pascal's law of pressure at a point, variation of pressure vertically in a fluid under gravity, equality of pressure at the same level in a static fluid, general equation for the variation of pressure due to gravity from a point to point in a static fluid, pressure and head, the hydrostatic paradox, pressure measurement using manometers.

Static Forces on Surface and Buoyancy:

Fluid static, action of fluid pressure on surface, resultant force and center of pressure on a plane surface

under uniform pressure, resultant force and center of pressure on a plane surface immersed in a liquid, pressure diagrams, forces on a curved surface due to hydrostatic pressure, buoyancy, equilibrium of floating bodies, stability of a submerged body, stability of floating bodies, determination of the metacentric height, determination of the position of the metacentre relative to the center of buoyancy.

UNIT-III

Laws of fluid flow – Continuity equation- derivation in differential and Integral forms. Derivation of Euler's and Bernoull's equations and dimensional analysis. Application of Bernoullis equations. Flow measuring devices-venturimeter, orificemeter and nozzle meter and pitot static tube. Navier–Stoke' equation –Derivation and applications.

Unit IV

Viscous Flow: Reynolds number and Reynolds experiment, flow of viscous fluid through circular pipe-Hagen Poiseuille formula, Flow of viscous fluid between two parallel fixed plates, power absorbed in viscous flow through - journal, foot step and collar bearing , movement of piston in dash pot, methods of measurement of viscosity.

Turbulent Flow: Expression for coefficient of friction -Darchy Weishbach Equation, Moody diagram resistance of smooth and rough pipes shear stress and velocity distribution in turbulent flow through pipes.

Flow through pipes: Head losses in pipes, bends and fittings. Major energy losses, Minor energy losses, Hydraulic gradient and total energy lines, Pipes in series and parallel, Equivalent pipes, Siphon, power transmission through pipe, Flow through nozzle at end of pipe, Water hammer in pipes.

UNIT-V

Airfoil Aerodynamics : Fundamental Theory of Aerofoils - flow around an aerofoil, pressure distribution around an airfoil. Introduction to Airfoil Cascades. Blade terminology – leading and trailing edges, flow angles, blade angles, camber line, chord line, solidity, chord to space ratio, aspect ratio, Comparison of turbine and compressor cascades.

Design of NACA Airfoil : Nomenclature of NACA series Airfoils -Calculation of coordinates of airfoil for NACA 4 digit series.

Boundary layer theory: Introduction, thickness of boundary layer, boundary layer along a flat thin plate and its characteristics. Laminar and turbulent boundary layer, laminar sub layer, separation of boundary layer.

Suggested Reading:

1. P.N.Modi,and S.M.Seth., Hydraulics and Fluid Mechanics, Standard Book House
2. Bansal, R. K. (2011). Textbook of fluid mechanics and hydraulic machine: SI units. New Delhi, India: Laxmi Publication
3. Gupta, V., & Gupta, S. K. (2012). Fluid mechanics and its applications. Tunbridge Wells: New Academic Science.
4. K.Subramanya, Theory and Applications of Fluid Mechanics, Tata McGraw-Hill Publishing Company Ltd., New Delhi.
5. K.L.Kumar, Engineering Fluid Mechanics, Eurasia Publishing House PvT Ltd, New Delhi

HS901BT

ENVIRONMENTAL SCIENCE

Instruction per week	3 Hours
CIE	30 Marks
Duration of SEE	3 Hours
SEE	70 Marks
Credits	3

Course Objectives:

1. To know about natural resources and their benefits to the public
2. To study the concept of ecosystems and biodiversity
3. To understand the types of pollutions, social issues and disaster management

Course Outcomes:

1. Will have an awareness of effects of hazardous environment.
2. Will have an idea about optimum utilization of natural resources.
3. Will be a catalyst in moving towards Green technologies
4. Will have information about rules and regulations of pollution control

UNIT-I

Environmental studies: Definition, scope and importance, need for public awareness. **Natural resources:** Water resources; use and over utilization of surface and ground water, Floods, drought, conflicts over water, dams-benefits and problems. Effects of modern Agriculture, Fertilizer-pesticide problems, water logging and salinity.

UNIT-II

Ecosystems: Concept of an ecosystem, structure and function of an ecosystem, producers, consumers and decomposers, energy flow in ecosystem, food chains, ecological pyramids, aquatic ecosystem (ponds, streams, lakes, rivers, oceans, estuaries)

Energy resources: Growing energy needs renewable and non-renewable energy sources. Land Resources, land as a resource, land degradation, soil erosion and desertification.

UNIT-III

Biodiversity: Genetic species and ecosystem diversity, bio-geographical classification of India. Value of biodiversity, threats to biodiversity, endangered and endemic species of India, conservation of biodiversity.

UNIT-IV

Environmental Pollution: Cause, effects and control measures of air pollution, water pollution, soil pollution, noise pollution , thermal pollution and solid waste management.

Environmental protection act: Air, water, forest and wild life Acts, enforcement of Environmental legislation.

UNIT-V

Social issues and the Environment: Water conservation, watershed management, and environmental ethics. Climate change, global warming, acid rain, ozone layer depletion.

Disaster management: Types of disasters, impact of disasters on environment, infrastructure, and development. Basic principles of disaster mitigation, disaster management, and methodology, disaster management cycle, and disaster management in India.

Suggested Reading:

1. De A.K., "*Environmental Chemistry*", Wiley Eastern Ltd.,
2. Odum E.P., "*Fundamentals of Ecology*", W.B. Sunders Co., USA.
3. Rao M.N and Datta A.K., "*Waste Water Treatment*", Oxford and IBK Publications.
4. Benny Joseph, "*Environmental studies*", Tata McGraw Hill, 2005
5. Sharma V.K., "*Disaster Management*", National Centre for Disaster management, IIPE, Delhi,1999.

PC405ME

AUTOMOBILE ENGINEERING

Instruction per week	3 Hours
CIE	30 Marks
Duration of SEE	3 Hours
SEE	70 Marks
Credits	3

Course Objectives:

1. To introduce working principles of mechanical components of automobiles.
2. To understand basic operating principles of various sub systems of Automobiles – Fuel, Ignition, Lubrication, Cooling, Transmission, Suspension, Steering and braking systems etc.,

Course Outcomes:

1. The Students are expected to be explain differences between SI and CI engines Fuel Systems
2. The Students are expected to be to understand different types of subsystems of Automobiles- Fuel, Ignition, Lubrication, Cooling, Transmission, Suspension, Steering and braking systems etc.,
3. The Students are expected to be able to identify several parts of an automobile and be able to suggest improvements of their working

Unit-I

Multi cylinder engine arrangement - Firing order - crank shaft proportions – Balance weights – single plane and multi plane crank shafts – Poppet valves and their operating mechanisms. Petrol engine fuel system-single jet carburetor-compensation circuits used in carburetor- Types of carburetors – Air filters – Petrol injection. Diesel fuel system – Plunger pump – Injector unit – Types of injector nozzles.

Unit-II

Engine lubricating systems – Wet sump, dry sump and Petrol systems, Engine cooling – Air cooling – Liquid cooling – Thermosyphon circulating system – Thermostat control – Pressurised cooling system. Electrical system – Magneto, coil and electronic ignition systems – Distributor – Spark plug – Batteries – Dynamo – Alternator – Wiring and lighting systems – Electrical instruments.

Unit-III

Friction clutch-Desired features – Description and operation of multi coil spring clutch and diaphragm spring clutch.

Gear box – Charcteristics of vahicle resistance to motion and tractive effort – Multi speed gear box of sliding gear, constant mesh and synchromesh gear boxes – Gear changing mechanisms – Gear box lubrications. Propeller shaft – Hook's type universal joint – constant velocity universal joints – slip joint.

Unit-IV

Final drive: Different gearing – Rear axle – Semi floating and fully floating axle hub.

Suspension: Sprung and unsprung mass – Rigid axle suspension – Leaf spring shackle arrangement – independent suspension – Double transverse wishbone suspension – Torsion bar suspension –Shock absorbers – Pneumatic type construction – tubeless and tubed tyres – Cross ply and radial ply tyres – Comparitive merits – Slip angle – Common defects in tyre wear.

Unit-V

Steering system – Linkage arrangement and its components – Ackermann principle applied to steering linkage and modified Ackermann linkage – Wheel alignment – Caster and Camber – Rack and pinion steering assembly. Brake systems – Description and operation of hydraulic brake – Leading and trailing shoe layout – Disc brakes – Master cylinder – Hand brake linkage.

Suggested Reading

1. H. Heisler, "Vehicle and Engine Technology", ELBS, 1965.
2. P.L. Kohli, "Automotive Electrical Equipment, Tata McGraw Hill, 1985.
3. William H. Crouse & Donald L. Anglin, "Automotive Mechanics, Tata McGraw Hill Publishing Company, 2004.
4. Gouse and Anglin, "Automotive mechanics", 10th Ed., Tata Mc Graw Hill Pubilshers Co. Ltd., 2004.

ES441EE

ELECTRICAL CIRCUITS AND MACHINES LAB.

Instruction per week	2 Hours
CIE	25 Marks
Duration of SEE	3 Hours
SEE	50 Marks
Credits	1

Course Objectives:

1. To learn practical electric AC & DC circuits.
2. To learn operation and performance characteristics of electrical machines by conducting various tests practically.

Course Outcomes:

1. Aware of various electric safety rules to be followed while working with electric circuits and equipments
2. Explore themselves in designing basic electric circuits
3. Identify requirements for electric machines for domestic and industrial purpose

List of Experiments:

1. Verification of Kirchhoff's Laws.
2. Verification of Thevenin's and Norton's Theorems.
3. Study of Three-Phase Balanced Circuits.
4. Measurement of Power by Two-Wattmeter Method.
5. Study of Single-Phase RLC Series Circuits.
6. Magnetization Curve of a Separately Excited DC Generator.
7. Load Characteristics of Shunt Generator.
8. Performance Characteristics of Shunt Motor.
9. Speed Control of DC Shunt Motor.
10. O.C and S.C Tests on Single-Phase Transformer.
11. Load Test on Single-Phase Transformer.
12. Load Test on Three-Phase Induction Motor.

Note: At least ten experiments should be conducted in the Semester.

PC451ME

THERMODYNAMICS LAB

Instruction per week	2 Hours
Duration of SEE	3 Hours
SEE	50 Marks
CIE	25 Marks
Credits	1

Course Objectives:

1. To understand applications of thermal engineering concepts through experimentation.
2. To measure flow properties of fuel /lubricants
3. To test reciprocating and heat transfer machinery.

Course Outcomes:

1. Will be able to perform experiments to find the efficiency of Petrol and Diesel engines.
2. Will be able to find the properties of unknown fuels/lubricants.
3. Will be able to perform experiments CI and SI engines.
4. Will be able to experiments on heat exchangers and design suitable exchangers for a given application.

List of Experiments:

1) To determine valve / port timing diagram of a diesel/ petrol engine
2) To conduct performance test on diesel engine
3) To conduct heat balance test on diesel engine
4) To conduct performance test on petrol engine
5) To conduct heat balance test on petrol engine
6) To determine the viscosities of lubricating oils
7) To determine the flash point and fire points of fuels
8) To determine LMTD of parallel flow heat exchanger
9) To determine LMTD of counter flow heat exchanger
10) To determine volumetric efficiency and mass flow rates of a two stage reciprocating air compressor.

PW961ME

ENGINEERING APPLICATIONS WITH SOCIAL PERSPECTIVE

CIE	50 Marks
Credits	1*

Objectives:

1. To develop scientific temper.
2. To identify engineering problems in and around the once locality.
3. To inculcate research culture in science and technology domain.

Outcomes:

1. Will be able to identify and analyze the socially relevant engineering problems.
2. Will be able to think in the direction of improving ideas or attempt to find alternatives
3. Will be able to share his engineering problems with peers to get additional information.

This an attempt to inculcate engineering bent of thinking for solving problems in one's locality. Every engineering student should develop this scientific temper and contribute to the society in whichever manner possible. Here he/she will identify such areas where his specialized knowledge can be applied. This is in synchronous with the Government of India policy of promoting grass roots level innovation and feed the research prospects of future India. Research alone can make India a world leader in science and Technology domain and the best way is by building engineering graduate force with the capability required for growth in that direction.

A student can pursue this organically in three stages

First stage: Developing scientific temper

In this stage student will identify certain engineering applications in his locality, which needs improvement. This should be done during the academic year at his /her own convenience.

Second stage: Engineering Applications with scientific perspective

He/she will present an amateurish idea on how to improve it. This can be done by interacting with the application end users. This has to be carried out during the summer vacation. He/she can come back and present his /her experience at the college.

NOTE:

Third stage: Science, Technology and Innovation with social perspective (will be taken-up at VI Semester)

This is a stage where the student himself/herself takes interest in it and pursue the innovative idea into an Industrial Tour, Project work, Post graduate specialization and Research work etc. This process would in turn enable India to do some quality research which is socially relevant for the country's development and contribute to its Economic growth. This very philosophy is enlisted in the Science, Technology and Innovation policy of India, 2013

***Engineering Applications with Social Perspective along with credits will be reflected in V semester memorandum of marks**

MC951SP

YOGA PRACTICE

Instruction per week	3 Hours
CIE	50 Marks
Credits	3 Units

Objectives:

1. Enhances body flexibility
2. Achieves mental balance
3. Elevates Mind and Body co-ordination
4. Precise time management
5. Improves positive thinking at the expense of negative thinking

Outcome:

1. Students will become more focussed towards becoming excellent citizens with more and more discipline in their day-to-day life.
2. An all-round development-physical, mental and spiritual health-takes place.
3. Self-discipline and discipline with respect society enormouly increases.
4. Univesity environment becomes more peaceful and harmonious.

Unit-I

Introduction

Yoga definition-Health definition from WHO - Yoga versus Health - Basis of Yoga - yoga is beyond science - Zist of 18 chapters of Bhagavadgita - 4 types of yoga: Karma, Bhakti, Gnyana and Raja yoga - Internal and External yoga - Elements of Ashtanga yoga (Yama, Niyama, Asana, Pranayama, Prathyahara, Dharana, Dhyana and Samadhi) - Pancha koshas and their purification through Asana, Pranayama and Dhyana.

Unit-II

Suryanamaskaras(Sun salutations)

Definition of sun salutations - 7 chakras (Mooladhaar, Swadhishtaan, Manipura, Anahata, Vishuddhi, Agnya and Sahasrar) - Vaious manthras(Om Mitraya, Om Ravaye, Om Suryaya, Om Bhanave, Om Marichaye, Om Khagaye, Om Pushne, Om Hiranya Garbhaye, Om Adhityaya, Om Savitre, Om Arkhaya, and Om Bhaskaraya) and their meaning while performing sun salutations - Physiology - 7 systems of human anatomy - Significance of performing sun salutations.

Unit-III

Asanas (Postures)

Pathanjali's definition of asana - Sthiram Sukham Asanam - 3rd limb of Ashtanga yoga - Loosening or warming up excersises - Sequence of performin asanas(Standing, Sitting, Prone, Supine and Inverted) - Nomenclature of asanas (animals, trees, rishis etc) - Asanas versus Chakras - Asanas versus systems - Asanas versus physical health -Activation of Annamaya kosha.

Unit-IV

Pranayama(Breathing techniques)

Definition of Pranayama as per Shankaracharya - 4th limb of Ashtanga yoga - Various techniques of breathing - Pranayama techniques versus seasons - Bandhas and their significance in Pranayama - Mudras and their significance in Pranayama - Restrictions of applying bandhas with reference to health disorders - Pranayama versus concentration - Pranayama is the bridge between mind and body - Pranayam versus mental health - Activation of Pranamaya kosha through Pranayama.

Unit-V

Dhyana(Meditation)

Definition of meditation - 7th limb of Ashtanga yoga - Types of mind (Conscious and Sub-Conscious) - various types of dhyana. Meditation versus spiritual health - Dharana and Dhyana - Extention of Dhyana to Samadhi - Dhyana and mental stress - Activation of Manomaya kosha through dhyana - Silencing the mind.

Suggested Reading:

1. Light on Yoga by BKS Iyengar
2. Yoga education for children Vol-I by Swami Satyananda Saraswati
3. Light on Pranayama by BKS Iyengar
4. Asana Pranayama Mudra and Bandha by Swami Satyananda Saraswati
5. Hatha Yoga Pradipika by Swami Mukhtibodhananda
6. Yoga education for children Vol-II by Swami Niranjanananda Saraswati
7. Dynamics of yoga by Swami Satyananda Saraswati

MC952SP

NSS

Instruction per week	3 Hours
CIE	50 Marks
Credits	3 Units

MC953SP

SPORTS

Instruction per week	3 Hours
CIE	50 Marks
Credits	3 Units

ES441ME

PRIME MOVERS AND PUMPS LAB.

(For Electrical Engineering)

Instruction per week	2 Hours
CIE	25 Marks
Duration of SEE	3 Hours
SEE	50 Marks
Credits	1

Course Objectives:

1. To gain knowledge of working of petrol and diesel engines
2. To be able to estimate the power developed in the engine
3. To understand the working principle of hydraulic turbines and pumps
4. To understand the performance of turbines using characteristic curves
5. To gain the knowledge of various flow meters and the concept of fluid mechanics

Course Outcomes:

1. Knowledge regarding components and functioning of engines
2. Ability to calculate the power developed, losses in the engines
3. Understanding of viscosity of oils
4. Knowledge of flash and fire point of oils, and its importance
5. Knowledge of estimating the power of turbines and pumps

List of Experiments:

a) Thermal Engineering Laboratory:

1. Flash and Fire point test.
2. Performance test on diesel engine
3. Valve timing diagram test on a I.C engine
4. Morse test on multi-cylinder petrol engine.
5. Heat balance test on diesel engine.
6. Performance test on VCR engine

b) Hydraulic Machinery Laboratory:

7. Performance test on Pelton wheel turbine.
8. Characteristics curves test on Pelton wheel turbine.
9. Performance test on Francis turbine.
10. Characteristics curves test on Francis turbine.
11. Performance test on Turgo wheel.
12. Characteristics curves test on Turgo wheel.
13. Performance test on Reciprocating pump.

Note: *At least ten experiments should be conducted in the Semester*