B.Tech. in Mechanical Engineering
Scheme of Instruction and Examination
(Choice Based Credit System)

III Semester

S.No	Course Code	Course Title	Instruction			Examination			Credits
			Hours PerWeek			Max. Marks		Duration of SEE in Hours	
			L	T	P/D	CIE	SEE		
1	MM331ES	Material Science and Metallurgy	3	0	0	40	60	3	3
2	ME301PC	Mechanics of Solids	3	0	0	40	60	3	3
3	ME302PC	Production Technology	3	0	0	40	60	3	3
4	ME303PC	Thermodynamics	3	1	0	40	60	3	4
5	ME304PC	Fluid Mechanics and Hydraulic Machines	3	0	0	40	60	3	3
6	MC301HS	Constitution of India	3	0	0	40	60	3	0
7	MM361ES	Metallurgy & Mechanics of Solids Lab.	0	0	2	40	60	3	1
8	ME351PC	Production Technology Lab.	0	0	2	40	60	3	1
9	ME352PC	Fluid Mechanics and Hydraulic Machines Lab.	0	0	2	40	60	3	1
10	ME353PC	Machine Drawing Practice	0	0	2	40	60	3	1
Total Hours/Marks/Credits			**18**	**1**	**8**	**400**	**600**		**20**

IV Semester

S.No	Course Code	Course Title	Instruction			Examination			Credits
			Hours PerWeek			Max. Marks		Duration of SEE in Hours	
			L	T	P/D	CIE	SEE		
1	MA403BS	Probability, Statistics & Complex Variables	3	1	0	40	60	3	4
2	EE431ES	Basic Electrical and Electronics Engineering	3	0	0	40	60	3	3
3	ME401PC	Kinematics of Machinery	3	0	0	40	60	3	3
4	ME402PC	Thermal Engineering - I	3	0	0	40	60	3	3
5	ME403PC	Instrumentation and Control Systems	3	0	0	40	60	3	3
6	EE461ES	Basic Electrical and Electronics Engineering Lab.	0	0	2	40	60	3	1
7	ME451PC	Instrumentation and ControlSystems Lab	0	0	2	40	60	3	1
8	ME452PC	Real-Time Research Project/Field-based Project	0	0	4	50			2
9	MC451HS	Gender Sensitization Lab.	0	0	2	40	60	3	0
Total hours/Marks/Credits			**15**	**1**	**10**	**370**	**480**		**20**

L: Lecture T: Tutorial D: Drawing P: Practical

CIE - Continuous Internal Evaluation SEE - Semester End Examination

L	T	P	C
3	0	0	3

B.Tech. in Mechanical Engineering
III Semester Syllabus
MM331ES: Material Science and Metallurgy
(Common to ME & MCT)

Course Objectives

The objectives of the course is to make the student

- This course provides the fundamental knowledge of science behind metals.
- This course introduces the concept of structure property relations, which lays the basis for studies in fieldssuch as solid-state physics, mechanical behavior of materials, phase diagram and heat treatment.
- To develop an understanding of the atomistic and defect structures, and how they result in the microstructure and influence the properties of metals.
- To develop an understanding of the processes occurring in metals during heating that influences themicrostructure and properties.
- To develop an understanding of the effects of alloying of metals upon the microstructure and properties.

Course Outcomes

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

- Analyze the Structure of materials at different levels, basic concepts of crystalline materials like unit cell,FCC, BCC, HCP, APF and Coordination Number etc.
- Understand the concept of phase, phase diagram and understand the basic terminologies associated withmetallurgy. Construction and identification of iron –Iron carbide phase diagrams and invariant reactions.
- Understand the objectives of heat treatment and suggest the heat treatment process for various applications.Introduce the concept of Hardenability.
- Understand the construction and Significance of Time Temperature Transformation and Continuous Cooling Transformation diagrams. Understand the various Surface hardening mechanisms.
- Understand the significance and microstructure of alloy steels, cast irons and non-ferrous (aluminum,

Unit-I: Crystal Structure

Crystal Structure: Unit cells, Metallic crystal structures, SC, FCC, BCC and HCP, Atomic Packing Factor, coordination number, Ceramics. Imperfection in solids: Point, line, interfacial and volume defects; Edge and screw dislocations, strengthening mechanisms and slip systems, critically resolved shear stress.

Unit-II: Phase Diagrams

Alloys, substitutional and interstitial solid solutions: Hume-Rothery rules, Phase rule, Phase diagrams: Interpretation of binary phase diagrams and microstructure development; eutectic, eutectoid, peritectic, peritectoid and monotecticreactions. Iron-Iron carbide phase diagram and microstructural aspects of ledeburite, austenite, ferrite and cementite.

Unit-III: Heat Treatment of Steel

Objectives of Heat treatment: Annealing, Normalising, Hardening, Tempering and Spheroidising, Isothermal transformation diagrams for Fe-C alloys and microstructures development, Bainite, Pearlite, Martensite. TTT diagrams for eutectoid, hypoeutectoid and hypereutectoid steels, Continuous cooling curves and interpretation of final microstructures and properties-austempering, martempering.

Unit-IV: Surface Hardening Treatments

Surface Hardening Treatments, Case Hardening, Carburizing, Nitriding, Cyaniding, Carbo-Nitriding, Flame and Induction Hardening, Vacuum and Plasma Hardening.

Unit-V: Ferrous and Nonferrous Alloys

Alloying of steel, properties of stainless steel and tool steels, maraging steels, cast irons; grey, white, malleable and spheroidal cast irons, copper and copper alloys (Brass, bronze and cupro-nickel), Aluminium and Al-Cu-Mg alloys, Titanium alloys.

Suggested Readings:

1. V. Raghavan, "Material Science and Engineering', Prentice Hall of India Private Limited, 1999.
2. W. D. Callister, 2006, "Materials Science and Engineering-An Introduction", 6th Edition, Wiley India.

Reference Books:

1. S.H. Armer, Introduction to Physical Metallurgy, Mc. Graw Hill.
2. R.E. Reed Hill, Physical Metallurgical Principles, EWP Publishers.

L	T	P	C
3	0	0	3

B.Tech. in Mechanical Engineering
III Semester Syllabus
ME301PC: Mechanics of Solids

Course Objectives

The objectives of the course is to make the student
- Understand basic concepts of stress, strain and their relations based on elasticity.
- Concepts of material behavior due to different types of loading.
- Calculate stresses and deformation of a bar due to loading under various conditions.
- Draw Shear Force and Bending Moment diagrams of a beam and find the maximum moment/shear and theirlocations.
- Compute normal and shear stresses.

Course Outcomes

At the end of the course, the student will be able to
- Apply knowledge of materials and structural elements for the analysis of simple structures;
- Analyze the behavior of the solid bodies subjected to various types of loading.
- Design the structural members subjected to bending and shear loads.
- Analyze and interpret materials testing data relating to behavior of structures.
- Undertake problem identification, formulation, and solution using a range of analytical methods.

Unit – I

Simple Stresses & Strains: Elasticity and plasticity; Types of stresses & strains; Hooke's law; Stress-strain diagramfor mild steel; Working stress; Factor of safety; Lateral strain, Poisson's ratio & volumetric strain; Elastic moduli & the relationship between them; Bars of varying section; Composite bars; Temperature stresses; Strain energy; Resilience; Gradual, sudden and impact loadings.

Unit – II

Shear Force and Bending Moment: Definition of beam; Types of beams; Concept of Shear Force (SF) and Bending Moment (BM); SF and BM diagrams for cantilever, simply supported and overhanging beams subjected to point loads, uniformly distributed loads, uniformly varying loads and combination of these loads; Point of contra flexure; Relation between SF, BM and rate of loading at a section of a beam.

Unit - III

Flexural Stresses: Theory of simple bending; Assumptions; Derivation of bending equation: $M/I = f/y = E/R$; Neutral axis; Determination of bending stresses – section modulus of rectangular and circular sections, I-section and T-sections.

Unit-IV

Shear Stresses: Derivation of shear stress equation – Shear stress distribution across various beams sections like rectangular, triangular, I-section and T-sections.

Principal Stresses and Strains: Introduction; Stresses on an inclined section of a bar under axial loading; Normal and tangential stresses on an inclined plane for biaxial stresses; Principal stresses and strains - analytical approach.

Unit – V

Torsion of Circular Shafts: Theory of pure torsion; Assumptions; Derivation of Torsion equation: $T/J = \tau/r = G\theta/L$; Torsional moment of resistance – Polar section modulus.

Thin Cylinders: Thin cylindrical shells; Derivation of formula for longitudinal and circumferential stresses; Hoop, longitudinal and volumetric strains – changes in diameter and volume of thin cylinders; Thinspherical shells

Suggested Readings:

1. S. Ramamrutham and R.Narayanan, Strength of materials, Dhanpatrai Publishing Company.
2. Sadhu Singh, Strength of Materials, Khanna Publishers

Reference Books:

1. Popov, Solid Mechanics.
2. Ryder. G.H.Strength of Materials; Macmillan Long Man Publication.
3. Jindal, Strength of Materials, Umesh Publications.
4. D.S Prakash Rao, Strength of Materials Universities Press Pvt. Ltd.
5. S. S. Rattan, Strength of Materials Tata McGraw Hill Education Pvt. Ltd.
6. M. L. Gambhir, Fundamentals of Solid Mechanics PHI Learning Pvt. Ltd

L	T	P	C
3	0	0	3

B.Tech. in Mechanical Engineering

III Semester Syllabus
ME302PC: Production Technology

Course Objectives

The objectives of the course is to make the student

- Identify the necessity and define with examples the concept of "manufacturing".
- List the main classifications of the manufacturing processes with examples.
- Understand the casting processes, patterns, principles of Gating system risers, methods of melting of metalsand alloys.
- Understand the welding processes: Gas Arc TIG & MIG, Thermit and plasma arc and other welding Processes.
- Know about rolling, extrusion, forging and various metal forming operations.

Course Outcomes

At the end of this course students should be able to

- An ability to understand the technical aspects of Moulding, Melting and casting.
- Exposure to various welding processes and their significance.
- Gain knowledge about soldering, Brazing, HAZ and testing of welds.
- An ability to analyze plane rolling and sheet metal forming processes.
- An ability to understand Extrusion and various forging and high energy rate forming principles and operations.

Unit – I: Casting Process

Steps involved in making a casting – Advantages of casting and its applications; Patterns -Pattern making, Types, Materials used for patterns, pattern allowances; Properties of moulding sands. Methods of Melting - Crucible melting and cupola operation – Defects in castings; Principles of Gating– Requirements of Gating system – Types ofgates – Riser – Functions and types of Risers, Casting processes – Types – Sand moulding, Centrifugal casting, die- casting, Investment casting, shell moulding; Solidification of casting – Solidification of pure metal, Directional Solidification.

Unit – II: Welding processes - 1

Classification – Types of welds and welded joints; Welding Positions - Gas welding - Types, oxy-fuel gas cutting – standard time and cost calculations. Arc welding, forge welding, submerged arc welding, Resistance welding, Thermit welding.

Unit – III: Welding Processes - 2

Inert Gas Welding _ TIG Welding, MIG welding, Friction welding, Friction Stir Welding, induction welding, explosive welding, Laser Welding; Soldering and Brazing; Heat affected zone in welding. Welding defects – causes and remedies; destructive and non- destructive testing of welds.

Unit – IV: Metal Working Processes

Hot working, cold working, strain hardening, recovery, recrystallisation and grain growth. Sheet metal Operations: Stamping, Blanking and piercing, Coining, Strip layout, Hot and cold spinning – Bending and deep drawing. Rollingfundamentals – theory of rolling, types of Rolling mills and products. Forces in rolling and power requirements. Drawing and its types – wire drawing and Tube drawing –. Types of presses and press tools. Forces and power requirement in the above operations.

Unit – V: Extrusion, Forging and HERF Processes

Extrusion of Metals: Basic extrusion process and its characteristics. Hot extrusion and cold extrusion- Forward extrusion and backward extrusion – Impact extrusion – Extruding equipment – Tube extrusion, Hydrostatic extrusion. Forces in extrusion

Forging Processes: Forging operations and principles – Tools – Forging methods – Smith forging, Drop Forging – Roll forging – Forging hammers: Rotary forging – forging defects – cold forging, swaging, Forces in forging operations.

High Energy Rate Forming Processes: Limitations, Principles of Explosive Forming, Electro-hydraulic Forming, Electro-magnetic forming and rubber pad Forming.

Suggested Readings:

1. P.N. Rao, Manufacturing Technology, Vol.1 & 2 / Mc Graw Hill
2. Serope Kalpakjian, Steven R. Schmid, Manufacturing Engineering & Technology Pearson

Reference Books:

1. Serope Kalpakjian, Steven R. Schmid, Metal Casting, T.V Ramana Rao / New Age
2. G. Thirupathi Reddy, Production Technology, Scitech
3. J.P. Kaushish, Manufacturing Processes, PHI Publications

L	T	P	C
3	1	0	4

B.Tech. in Mechanical Engineering

III Semester Syllabus
ME303PC: Thermodynamics

Pre-requisite: Engineering Chemistry and Physics Course

Course Objectives

At the end of the course, the students are expected to
- Understand the treatment of classical Thermodynamics
- Apply the First and Second laws of Thermodynamics to engineering applications
- Understand phase change phenomenon in pure substances and to understand various property diagrams
- Understand various properties of moist air and plot them on psychrometric chart
- Represent various cycles on P-v and T-s diagrams

Course Outcomes

After successful completion of course
- Understand and differentiate between different thermodynamic systems and processes.
- Understand and apply the laws of Thermodynamics to different types of systems undergoing variousprocesses and to perform thermodynamic analysis.
- Analyze the problems related to pure substances and to plot the processes on T-s, P-v and h-s diagrams.
- Analyze various properties of moist air for air-conditioning applications
- Understand and analyze the Thermodynamic cycles and evaluate performance parameters.

Tables/Codes: Steam Tables and Mollier Chart, Refrigeration Tables

Unit-I

Introduction: Basic Concepts- System, Control Volume, Surrounding, Boundaries, Universe, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium, State, Property, Process, Exact & Inexact Differentials, Cycle – Reversibility – Quasi – static Process, Irreversible Process, Causes of Irreversibility – Energy in State and in Transition, Types, Displacement & Other forms of Work, Heat, Point and Path functions, Zeroth Law of Thermodynamics – Concept of Temperature – Principles of Thermometry – Reference Points – Const. Volume gas Thermometer – Scales of Temperature, Ideal Gas Scale

Unit-II

PMM I - Joule's Experiments – First law of Thermodynamics – Corollaries – First law applied to a Process – applied to a flow system – Steady Flow Energy Equation. Limitations of the First Law – Thermal Reservoir, Heat Engine, Heat pump , Parameters of performance, Second Law of Thermodynamics, Kelvin-Planck and Clausius Statements and their Equivalence / Corollaries, PMM of Second kind, Carnot's principle, Carnot cycle and its specialties, Thermodynamic scale of Temperature, Clausius Inequality, Entropy, Principle of Entropy Increase – Energy Equation, Availability and Irreversibility – Thermodynamic Potentials, Gibbs and Helmholtz Functions, Maxwell Relations

Unit-III

Pure Substances, p-V-T- surfaces, T-S and h-s diagrams, Mollier Charts, Phase Transformations – Triple point at critical state properties during change of phase, Dryness Fraction – Clausius – Clapeyron Equation Property tables. Mollier charts – Various Thermodynamic processes and energy Transfer – Steam Calorimetry. Perfect Gas Laws – Equation of State, specific and Universal Gas constants – various Non-flow processes, properties, end states, Heat and Work Transfer, changes in Internal Energy – Throttling and Free Expansion Processes – Flow processes

Unit-IV

Mixtures of perfect Gases – Mole Fraction, Mass friction Gravimetric and volumetric Analysis – Dalton's Law of partial pressure, Avogadro's Laws of additive volumes – Mole fraction, Volume fraction and partial pressure, Equivalent Gas const, vanderwaals equation for real gases. Atmospheric air - Psychrometric Properties – Dry bulb Temperature, Wet Bulb Temperature, Dew point Temperature, Thermodynamic Wet Bulb Temperature, Specific Humidity, Relative Humidity, saturated Air, Vapour pressure, Degree of saturation – Adiabatic Saturation, Carrier's Equation – Psychrometric chart

Unit-V

Power Cycles: Otto, Diesel, Dual Combustion cycles, Ericsson Cycle - Description and representation on P–V and T-S diagram, Thermal Efficiency, Mean Effective Pressures on Air standard basis – comparison of Cycles. Brayton and Rankine cycles – Performance Evaluation. Refrigeration Cycles: Bell-Coleman cycle, Vapour compression cycle-performance Evaluation.

Suggested Readings:

1. P. K Nag, Engineering Thermodynamics –TMH
2. Kenneth A. Kroos, Thermodynamics for Engineers, Merle C. Potter/ Cengage

Reference Books:

1. Yunus. A. Cengel Introduction to Thermodynamics
2. Sonntag, Borgnakke, Van wylen Fundamentals of Thermodynamics
3. Chattopadhyay, Engineering Thermodynamics, Oxford
4. Rogers, Engineering Thermodynamics, Pearson

L	T	P	C
3	0	0	3

B.Tech. in Mechanical Engineering
III Semester Syllabus
ME304PC: Fluid Mechanics and Hydraulic Machines

Course Objectives

The Objectives of the course is to make the student

- To understand the basic principles of fluid mechanics
- To understand kinematic and dynamic flows
- To understand boundary layer concepts and flow through pipes
- To evaluate the performance of hydraulic turbines
- To understand the functioning and characteristic curves of pumps

Course Outcomes

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

- Able to explain the effect of hydro static forces.
- Able to identify type of fluid flow patterns and describe continuity equation.
- To analyze a variety of practical fluid flow and measuring devices and utilize Fluid Mechanics principles in design. Able to demonstrate boundary layer concepts.
- To select and analyze the properties of a turbine with reference to given situation in power plants.
- To estimate performance parameters of a given Centrifugal and Reciprocating pump.

Unit–I

Fluid statics: Dimensions and units: physical properties of fluids-specific gravity, viscosity, and surface tension – vapor pressure and their influence on fluid motion-atmospheric, gauge and vacuum pressures–measurement of pressure-Piezometer-tube and differential manometers.

Hydro static forces on surfaces: Total pressure and center of pressure, vertical plane surface, horizontal plane surface, inclined plane surface and curved surfaces submerged in liquids- Pressure distribution in liquids.

Unit–II

Fluid kinematics: Streamline, path line, streak lines and stream tube, classification of flows-steady& unsteady, uniform & non-uniform, laminar & turbulent, rotational & irrotational flows-equation of continuity for one dimensional flow and three-dimensional flows.

Fluid dynamics: Surface and body forces –Euler's and Bernoulli's equations for flow along a streamline, Measurement of flow applications of Bernoulli's Equation : Pitot tube, venture meter, and orifice meter, Flow nozzle – momentum equation and its application on force on pipe bend.

Unit–III

Boundary Layer Concepts: Definition, thicknesses, characteristics along thin plate, laminar and turbulent boundary layers (No derivation) boundary layer in transition, separation of boundary layer, submerged objects–drag and lift.

Closed conduit flow: Reynolds's experiment- Darcy Weisbach equation- Minor losses and major losses in pipes- pipes in series and pipes in parallel-Total energy line-hydraulic gradient line.

Unit–IV

Basics of turbo machinery: Hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and at its tip, velocity diagrams, work done and efficiency, flow over radial vanes.

Hydraulic Turbines: Classification of turbines, Heads and efficiencies, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies, hydraulic design –draft tube theory-functions and efficiency.

Performance of hydraulic turbines: Geometric similarity, Unit and specific quantities, characteristic curves, governing of turbines, selection of type of turbine, cavitation, surge tank, water hammer.

Unit–V

Centrifugal pumps: Classification, working, work done–barometric head-losses and efficiencies specific speed- performance characteristic curves, NPSH.

Reciprocating pumps: Working, Discharge, slip, indicator diagrams.

Suggested Readings:

1. R.K. Bansal, Fluid Mechanics and Hydraulic Machinery
2. MODI and SETH, Hydraulics, Fluid mechanics and Hydraulic Machinery.
3. Rajput, Fluid Mechanics and Hydraulic Machines.

Reference Books:

1. D.S.Kumar, Fluid Mechanics and Fluid Power Engineering, Kotaria& Sons.
2. D.Rama Durgaiah, Fluid Mechanics and Machinery, New Age International.
3. Banga & Sharma, Hydraulic Machines, Khanna Publishers.

L	T	P	C
3	0	0	0

B.Tech. in Mechanical Engineering
III Semester Syllabus
MC301HS: Constitution of India
(Common to CE, EEE, ME, ECE, MCT & MME)

Course Objectives

- Students will get to know about the history of Indian Constitution
- Students will get to know about President election and his Powers
- Students will get to know about Council of Ministers and their election Procedure and their Powers andResponsibilities
- Students will get know about Judicial System in India
- Students will get know about Panchayat-raj System in India

Course Outcomes

- This enables the Students to know about the Rights of Citizen.
- This enables the Students to know about Fundamental Duties of People.
- This enables the Students to Know the Directive principles of State Policy.
- This enables the Students to know about Functioning of Parliament and its Powers.
- This enables the Students to know about various Constitutional bodies in India.

Course content

1. Meaning of the constitution law, and constitutionalism
2. Historical perspective of the Constitution of India
   - Drafting Committee
3. Salient features and characteristics of the Constitution of India
   - Preamble
   - Salient Features
   - Major Sources of Indian Constitution
4. Scheme of the fundamental rights
   - Article 13 to 32
   - Scheme of the Fundamental Right to Equality
   - Scheme of the Fundamental Right to certain Freedom
   - Scope of the Right to Life and Personal Liberty
5. The scheme of the Fundamental Duties and its legal status
   - List of Fundamental Duties
   - Justifiability of Fundamental Duties
6. The Directive Principles of State Policy – Its importance and implementation
   - Categories - Gandhian, Socialist and Liberal Principles
   - Significance of Directive Principles of State Policy
   - Relation between Fundamental rights and Directive Principles of State Policy
7. Federal structure and distribution of legislative and financial powers between the Union and the States
   - Union List
   - State List
   - Concurrent List
   - Residuary Powers
8. Parliamentary Form of Government in India.
9. The constitutional powers and status of the President of India vs the constitutional powers and status of theCouncil of ministers headed by the Prime Minister
10. Amendment of the Constitution and its Procedure

- Procedure of Amendment to Constitution of India
- Important Amendments

11. Emergency Provisions: National Emergency, President Rule, Financial Emergency
12. Local Self Government – Constitutional Scheme in India

- Urban local Self Government
- Rural local Self Government

13. Important Constitutional Bodies

- Election Commission of India
- Finance Commission of India
- Union Public Service Commission
- C-AG

Suggested Readings:

1. Subhash Kashyap, Our Constitution, National Book Trust, 5th Edition,Reprint- 2017.
2. V. N Shukla, The Constitution of India,Law literature Publication, 11th Edition, 2020.

Reference Books:

1. M P Jain, Indian Constitutional Law, Lexis Nexis, 8th Edition, 2018.
2. Samaraditya Pal, Indian Constitution-Origin& Evolution, Lexis Nexis, 1st Edition, 2019

L	T	P	C
0	0	2	1

B.Tech. in Mechanical Engineering
III Semester Syllabus
MM361ES: Metallurgy & Mechanics of Solids Lab
(Common to ME & MCT)

A) Metallurgy Lab

Course Objectives

At the end of this course, students are expected to
- Impart fundamental knowledge of materials properties, their selection and application.
- Explain the role of Metallurgy and Material Science in all manufacturing processes.
- Understand the metallography of ferrous and non-ferrous metals.

Course Outcomes

After successful completion of this course, students should be able to develop following skills
- Study the atomic structure of the materials.
- Analyze the microstructure of the materials.
- Correlate the microstructure to mechanical properties of the materials.

List of Experiments:

1. Preparation and study of crystal structure models for simple cubic, body centred cubic, face centered cubic andhexagonal close packed structures.
2. Preparation and study of microstructure of pure metals like Iron, Cu, and Al.
3. Preparation and study of microstructure of mild steels, low carbon steels and high carbon steels.
4. Study of microstructures of Cast Irons.
5. Study of microstructures of Non-Ferrous alloys.
6. Hardenability of steels by Jominy End Quench Test.

B) Mechanics of Solids:

Course Objectives

- Understand basic concepts of stress, strain and their relations based on elasticity.
- Understand basic concepts of material behavior due to different types of loading.
- Understand how to calculate stresses and deformation of a bar due to an axial loading.

Course Outcomes

- Analyze the behavior of the solid bodies subjected to various types of loading.
- Apply knowledge of materials and structural elements to the analysis of simple structures.
- Analyze and interpret laboratory data relating to behavior of structures and the materials they are made of.

List of Experiments:

1. Tension test
2. Bending test on Simply supported beam
3. Bending test on Cantilever beam
4. Torsion test
5. Hardness test (Brinell & Rockwell)
6. Test on springs
7. Impact test.(Charpy and Izod)

Note: Any 10 experiments from the above are to be conducted taking at least four from each section.

L	T	P	C
0	0	2	1

B.Tech. in Mechanical Engineering
III Semester Syllabus
ME351PC: Production Technology Lab

Course Objectives

The objectives of the course is to make the student
- Understand the manufacturing of simple patterns and making a casting.
- Fabricate welded joints using processes like Arc welding, TIG welding, Plasma welding, Spot welding.
- Study simple, compound and progressive dies and the process to perform blanking and piercing operations.
- Gain knowledge in deep drawing, extrusion bending and other operations using hydraulic press
- Prepare plastic products by using Injection and & Blow moulding equipment

Course Outcomes

At the end of the course, the student will be able to
- Design and manufacture simple patterns, test Sand properties and perform moulding, melting and casting.
- Operate Arc welding, Gas welding, TIG, Water Plasma and Spot welding Equipment for making different joints.
- Use of various dies and perform blanking and piercing operations
- Perform deep drawing and extrusion operations using Hydraulic Press.
- Use injection moulding and blow moulding equipment for processing of plastics.

Minimum of 10 Exercises need to be performed:

I. Metal Casting Lab:
1. Pattern Design and making - for one casting drawing.
2. Sand properties testing - Exercise -for strengths, and permeability – 1
3. Moulding Melting and Casting - 1 Exercise

II. Welding Lab:
1. ARC Welding Lap & Butt Joint - 2 Exercises
2. Spot Welding - 1 Exercise
3. TIG Welding - 1 Exercise
4. Plasma welding and Brazing - 2 Exercises(Water Plasma Device)

III. Mechanical Press Working:
1. Blanking & Piercing operation and study of simple, compound and progressive press tool.
2. Hydraulic Press: Deep drawing and extrusion operation.
3. Bending and other operations

IV. Processing Of Plastics
1. Injection Moulding
2. Blow Moulding

Reference Books:
1. G.H.F. Nayler, Dictionary of Mechanical Engineering –Jaico Publishing House.

L	T	P	C
0	0	2	1

B.Tech. in Mechanical Engineering
III Semester Syllabus
ME352PC: Fluid Mechanics and Hydraulic Machines Lab

Course Objectives

At the end of this course students are expected to:

- Verify the Bernoulli's equation and to calculate pressure heads along pipe flow
- Determine the coefficient of discharge for venturimeter, orifice meter.
- Find out the major losses in flow through pipes.
- Study the characteristic of a centrifugal and reciprocating pump
- Evaluate the coefficient of impact of jet on different kinds of vanes and also to study the performance of hydraulic turbines

Course Outcomes

After successful completion of the course, student will:

- Understand on calibration of venturimeter and orifice meter.
- Understand about different coefficients of discharges for different flow devices
- Obtain the knowledge on design of turbines with the available heads and speeds
- To estimate performance parameters of a given centrifugal and reciprocating pump
- To analyze the losses of a fluid flow in pipes

List of Experiments:

(To conduct any Ten Experiments)

1. Impact of jets on Vanes.
2. Performance Test on Pelton Wheel.
3. Performance Test on Francis Turbine.
4. Performance Test on Kaplan Turbine.
5. Performance Test on Single Stage Centrifugal Pump.
6. Performance Test on Multi Stage Centrifugal Pump.
7. Performance Test on Reciprocating Pump.
8. Calibration of Venturimeter.
9. Calibration of Orifice meter.
10. Determination of friction factor for a given pipe line.
11. Calibration of V- Notch and Rectangular Notch
12. Verification of Bernoulli's Theorem

L	T	P	C
0	0	2	1

B.Tech. in Mechanical Engineering

III Semester Syllabus

ME353PC: Machine Drawing Practice

Course Objectives:

The objectives of the course is to make the students

- Familiarize with the standard conventions for different materials and machine parts in working drawings.
- Make part drawings including sectional views for various machine elements.
- Prepare assembly drawings given the details of part drawings.
- Learn the concept of fluid system and analyzing the applications of fluid systems in power transmission.

Prepare CAD 2D and 3D part models using AUTOCAD and Solid works

Course Outcomes:

At the end of the course the students will be able to

- Prepare engineering and working drawings with dimensions and bill of material during design and development. Developing assembly drawings using part drawings of machine components.
- Use conventional representation of materials, common machine elements and parts such as screws, nuts, bolts, keys, gears, webs and ribs, Sections
- Learn and draw different types of Drawings – working drawings for machine parts.
- Prepare Title boxes, their size, location and details and methods of dimensioning.
- Understand the types of sections – selection of section planes and drawing of sections and auxiliary sectional views. Parts not usually sectioned.

Preparation of 2D Drawings and 3D Basic solid models using CAD

Machine Drawing Conventions:

Need for drawing conventions– introduction to BIS conventions, Conventional representation of materials,common machine elements and parts such as screws, nuts, bolts, keys, gears, webs and ribs.

I. Drawing of Machine Elements and simple parts

Selection of Views, additional views for the following machine elements and parts with easy Drawingproportions.

1) Popular forms of Screw threads, bolts, nuts, stud bolts, tap bolts, set screws and gears.
2) Keys, cotter joints and knuckle joint.
3) Rivetedjointsforplates.
4) Shaft coupling: Universal coupling, Oldham's coupling.
5) Journal, pivot and collar and foot step bearings.

II. Assembly Drawings:

Drawings of assembled views, detailing for the part drawings of the following using conventions and easy drawingproportions.

1) Engine parts – stuffing box, Eccentric, Petrol Engine connecting rod.
2) Machine tool parts: Tool Post, Machine Vice.
3) Other machine parts- Screws jack, Plummer block.
4) Valves: Air Cock, Rams bottom safety valve, blow-off cock valve.

NOTE: First angle projection to be adopted. The student should be able to provide working drawings of actualparts.

TEXTBOOKS:

1. Machine Drawing–Ajeet Singh, TMH Publications
2. Machine Drawing–K.L.Narayana, P.Kannaiah & K.VenkataReddy /NewAge/Publishers
3. MachineDrawing–N.D.Bhatt.
4. EngineeringGraphicswithAutoCAD–JamesD.Bethune–PHI2009Edition.

REFERENCEBOOKS:

1. Machine Drawing–P.S.Gill.
2. Machine Drawing–Luzzader
3. MachineDrawing-Rajput

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B.Tech. in Mechanical Engineering

IV Semester Syllabus

MA403BS: Probability, Statistics & Complex Variables

(Common to ME, MCT & MME)

Course Objectives

The objectives of the course is to make the student

- The ideas of probability and random variables and various discrete and continuous probability distributions and their properties.
- The statistical methods of studying data samples.
- Differentiation and integration of complex valued functions.
- Evaluation of integrals using Cauchy's integral formula and Cauchy's residue theorem.
- Expansion of complex functions using Taylor's and Laurent's series.

Course Outcomes

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

- Formulate and solve problems involving random variables
- Apply statistical methods for analyzing experimental data.
- Analyze the complex function with reference to their analyticity, integration using Cauchy's integral and residue theorems.
- Taylor's and Laurent's series expansions of complex function.

Unit-I: Basic Probability

Probability spaces, conditional probability, independent events, and Bayes' theorem. Random variables: Discrete and continuous random variables and their distributions functions, Expectation of random variables, Variance of random variables.

Unit-II: Probability Distributions

Binomial and Poisson distributions with their Mean, Mode and Variance, Poisson approximation to the binomial distribution. Normal and exponential distributions with their Mean, Mode and Variance. Binomial approximation to normal distribution.

Unit-III: Testing of Hypothesis

Test of significance: Basic of testing of Hypothesis. Null and alternate Hypothesis, types of errors, level of significance, critical region. Large sample test of hypothesis for single proportion, difference of proportions, single mean, difference of means; small sample tests: Test for single mean, difference of means.

Unit-IV: Complex Variables (Differentiation)

Limit, Continuity and Differentiation of Complex functions, Analyticity, Cauchy-Riemann equations (Cartesian and polar forms without proof), Harmonic conjugate and its evaluation using CR equations and Milne-Thomson Method.

Unit-V: Complex Variables (Integration)

Line integral, Cauchy's theorem, Cauchy's Integral formula, Zeros of analytic functions, Singularities, Taylor's series, Laurent's series; Residues, Cauchy Residue theorem.

Suggested Readings:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2010.
2. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, keying Ye, Probability and statistics for engineersand scientists, 9th Edition, Pearson Publications.
3. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Ed., Mc- Graw Hill, 2004.

Reference Books:

1. S. C. Gupta and V. K. Kapoor, Fundamentals of Mathematical Statistics, Khanna Publications.
2. Miller and Freund's, Probability and Statistics for Engineers, 8th Edition, Pearson Educations
3. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.
4. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
5. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010

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B.Tech. in Mechanical Engineering
IV Semester Syllabus
EE431ES: Basic Electrical and Electronics Engineering
(Common to CE, ME & MME)

Course Objectives

The objectives of the course is to make the student

- To introduce the concepts of electrical circuits and its components
- To understand magnetic circuits, DC circuits and AC single phase & three phase circuits
- To study and understand the different types of DC/AC machines and Transformers.
- To impart the knowledge of various electrical installations
- To introduce the concept of power, power factor and its improvement.
- To introduce the concepts of diodes & transistors
- To impart the knowledge of various configurations, characteristics and applications.

Course Outcomes

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

- To analyze and solve electrical circuits using network laws and theorems.
- To understand and analyze basic Electric and Magnetic circuits
- To study the working principles of Electrical Machines
- To introduce components of Low Voltage Electrical Installations
- To identify and characterize diodes and various types of transistors.

Unit – I: DC Circuits

The SI System of Units, Electrical circuit elements (Resistor, Inductor & Capacitor), V-I Characteristics of circuit elements, Color Coding of Resistors, Ohm's Law, voltage and current sources (Independent and Dependent), Power, Energy, Kirchhoff's Voltage Law & Kirchhoff's Current Law, Voltage Division Rule, Current Division Rule, Analysis of Series-Parallel Circuits with DC excitation - Mesh (Loop) Analysis, Nodal Analysis, Delta-Star & Star Delta Conversion

A.C. Circuits:

Representation of sinusoidal waveforms, peak value and rms values, phasor representation, real power, reactive power, apparent power, power factor, Analysis of single-phase ac circuits with phasor diagrams, Three-phase balanced circuits, voltage and current relations in star and delta connections

Unit-II: Electrical Installations

Components of LT Switchgear: Switch Fuse Unit (SFU), Miniature Circuit Breaker (MCB), Earth leakage Circuit Breaker (ELCB), Moulded Case Circuit Breaker (MCCB), Residual Current Circuit Breaker (RCCB), Residual Current Circuit Breaker (RCCB), Residual Current Circuit Breaker with Over current Protection (RCBO), Types of Wires and Cables: PVC, XLPE, Rubber, cable sizing. Earthing, Necessity of Earthing, Types of earthing, Batteries, Working Principle, Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

Unit-III: DC Machines

Working principle of Single-phase transformer, equivalent circuit, phasor diagram of transformer at no load and load, losses in transformers, open circuit and short circuit test on transformer, efficiency & regulation calculation. Three- phase transformer connections. Construction and working principle of DC generators, Types of Dc generators: Separately excited, Self Excited (Shunt, Series, Compound), EMF equation. working principle of DC motors, Types of Dc motors, Torque equations and Speed control of DC motors, Construction and working principle of Three-phase Induction motor, Slip, Torques equations, Torque Slip Characteristics, and Speed control of Three-phase induction motor. Construction and working principle of synchronous generators.

Unit-IV: P-N Junction and Zener Diode

Principle of Operation, Forward bias, Reverse bias, Diode equation, Static Volt-Ampere characteristics, Temperaturedependence, Ideal versus practical, Static and dynamic resistances, Equivalent circuit, Operation of Zener diode, Characteristics of zener diode and applications.

Rectifiers and Filters: P-N junction as a rectifier - Half Wave Rectifier, Ripple Factor, Peak Inverse Voltage, Efficiency – Full Wave Rectifier, Bridge Rectifier, Mid Point Rectifier, Ripple Factor, Peak Inverse Voltage, Efficiency, Harmonic components in Rectifier Circuits, Filters – Inductor Filters, Capacitor Filters, L- section Filters,π- section Filters.

Unit -V: Bipolar Junction Transistor (BJT)

Construction, Principle of Operation, NPN and PNP Transistor, Amplifying Action, Common Emitter, Common Baseand Common Collector configurations, Input and Output Characteristics, Comparison of CE, CB and CC configurations. Transistor Application: Transistor as Amplifier & Transistor as Switch.

Field Effect Transistor (FET):

Construction, Principle of Operation of JFET, Output Characteristics , Transfer Characteristics, JFET applications: JFET as Amplifier & JFET as a Switch, Comparison of Bipolar Junction Transistor and Field Effect Transistor, Biasing of FET.

Suggested Readings:

1. M S Sukija, TK Nagasarkar, Basic Electrical and electronics Engineering, Oxford University
2. D P Kothari, I J Nagrath Basic Electrical and electronics Engineering, McGraw Hill Education

Reference Books:

1. R. L. Boylestad and Louis Nashelsky, Electronic Devices and Circuits, PEI/PHI, 9th Ed, 2006.
2. J. Millman and C. C. Halkias, Satyabrata Jit, Millman's Electronic Devices and Circuits, TMH, 2/e, 1998.
3. William Hayt and Jack E. Kemmerly, Engineering circuit analysis, McGraw Hill Company, 6th edition.
4. Raymond A. De Carlo and Pen-Min-Lin, Linear circuit analysis (time domain phasor and Laplace transformapproaches) - 2 nd edition, Oxford University Press-2004.
5. N. C. Jagan& C. Lakshminarayana, Network Theory, B.S. Publications.
6. Sudhakar, Shyam Mohan Palli, Network Theory, TMH.
7. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
8. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
9. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.

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B.Tech. in Mechanical Engineering
IV Semester Syllabus
ME401PC: Kinematics of Machinery
(Common to ME & MCT)

Course Objectives

The objectives of the course is to make the student

- To study the relative motion, velocity, and accelerations of the various elements in a mechanism.
- To study the concept of mobility of Linkages, mechanismssuchasfourbar/slidercrank/doubleslidercrank/straightlinemotionmechanismetc.
- To analyze and understand the mechanisms with Lower pairs and Steering gear mechanisms and working of hooks joint.
- Develop the skills for designing and analyzing the mechanisms with higher pair such as Cams, Gears and Gear Trains.

Course Outcomes

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

- Identify different relative motions among various elements in mechanisms.
- Understand the position, velocity and acceleration in kinematics of mechanisms.
- Design the mechanisms with lower pairs and higher pairs.
- Understand the application of gears and gear trains

Unit–I

Mechanisms: Elements or Links – Classification – Rigid Link, flexible and fluid link – Types of kinematics pairs – sliding, turning, rolling, screw and spherical pairs – lower and higher pairs – closed and open pairs– constrained motion–completely, partially or successfully and incompletely constrained.

Mechanism and Machines – Mobility of Mechanisms: Grubler's criterion, classification of machines – kinematics chain – inversions of mechanism – inversions of quadric cycle chain, single and double slider crank chains, Mechanical Advantage.

Unit–II

Kinematics: Velocity and acceleration – Motion of link in machine – Determination of Velocity and acceleration– Graphical method – Application of relative velocity method.

Plane motion of body: Instantaneous center of rotation-centrodes and axodes–Three centers inline theorem – Graphical determination of instantaneous center, determination of angular velocity of points and links by instantaneous center method.

Kliens construction - Coriolis acceleration - determination of Coriolis component of acceleration **Analysis of Mechanisms:** Analysis ofslidercrankschainfordisplacement-velocityandaccelerationofslider– Acceleration diagram for a given mechanism.

Unit–III

Straight-line motion mechanisms: Exact and approximate copied and generated types–Peaucellier - Hart - Scott Russel – Grasshopper – Watt -Tchebicheff's and Robert Mechanism – Pantographs Steering gears : Conditions for correct steering – Davis Steering gear, Ackerman's steering gear. Hooke's Joint: Single and double Hooke's joint– velocity ratio –application–problems.

Unit–IV

Cams: Definitions of cam and followers – their uses – Types of followers and cams – Terminology –Types of follower motion - Uniform velocity, Simple harmonic motion and uniform acceleration and retardation. Maximum
velocity and maximum acceleration during outward and return strokes in the above three cases.
Analysis of motion of followers: Tangent cam with Roller follower – circular arc cam with straight, concave and convex flanks.

Unit–V

Higher pair: Friction wheels and toothed gears–types–law of gearing, condition for constant velocity ratio for transmission of motion –velocity of sliding. Forms of teeth, cycloidal and involutes profiles–phenomena of interferences – Methods of interference. Condition for minimum number of teeth to avoid interference – expressions for arc of contact and path of contact of Pinion & Gear and Pinion & Rack Arrangements– Introduction to Helical– Bevel and worm gearing

Gear Trains: Introduction – Types – Simple – compound and reverted gear trains – Epicyclic gear train. Methods of finding train value or velocity ratio of Epicyclic gear trains. Selection of gear box –Differential gear for an automobile.

Suggested Readings:

1. JOSEPH E. SHIGLEY, Theory of Machines and Mechanisms, Oxford
2. R S Khurmi & J.K. Gupta.Theory of Machines

Reference Books:

1. S. S. Rattan, Theory of Machines Mc Graw Hill Publishers
2. Sadhu Singh, Theory of Machines, Pearson.
3. Thomas Bevan, Theory of Machines, CBS.

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B.Tech. in Mechanical Engineering
IV Semester Syllabus
ME402PC: Thermal Engineering – I

Course Objectives

The objectives of the course is to make the student

- To apply the laws of thermodynamics to analyze air standard cycles.
- To understand the combustion phenomena in spark ignition and compression ignition engines.
- To evaluate the performance parameters of major components and systems of internal combustion engines.
- To understand the working and the performance of reciprocating and centrifugal compressor.
- To apply the principles of thermodynamics to analyze different types of refrigeration systems and tounderstand the concepts of Air-refrigeration.

Course Outcomes

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

- Explain basic concepts of actual cycles with analysis and to describe the fundamental concepts of ICengines along with its working principles
- To describe the combustion phenomenon in SI and CI engines.
- To evaluate the performance parameters (Brake power, Friction power, Torque, Efficiencies) of internalcombustion engines.
- To analyze working and the performance of (Isothermal efficiency, volumetric efficiency) reciprocating andcentrifugal compressor.
- To differentiate between different types of refrigeration systems with respect to application and evaluate theperformance parameters of air-refrigeration systems.

Unit – I

I.C. Engines: Classification - Working principles of Four & Two stroke engine, SI & CI engines, Valve and Port Timing Diagrams, Air – Standard, air-fuel and actual cycles - Engine systems – Carburetor and Fuel Injection Systems for SI engines, Fuel injection systems for CI engines, Ignition, Cooling and Lubrication system, Fuel properties and Combustion Stoichiometry.

Unit – II

Normal Combustion and abnormal combustion in SI engines – Importance of flame speed and effect of engine variables – Abnormal combustion, pre-ignition and knocking in SI Engines – Fuel requirements and fuel rating, anti-knock additives – combustion chamber – requirements, types of SI engines.

Four stages of combustion in CI engines – Delay period and its importance – Effect of engine variables – Diesel Knock– Need for air movement, suction, compression and combustion induced turbulence in Diesel engine – open and divided combustion chambers and fuel injection– Diesel fuel requirements and fuel rating.

Unit – III

Testing and performance: parameter of performance, Measurement of cylinder pressure, fuel consumption, air intake, exhaust gas composition, Brake power – determination of frictional losses and indicated power.– performance test-heat balance sheet and chart.

Classification of compressors-fans blowers and compressors-positive displacement and dynamic types – reciprocating and rotary type.

Reciprocating compressors: principle of operation, work required, isothermal efficiency, volumetric efficiency and effect of clearance volume, staged compression under cooling, saving of work, minimum work condition for staged compression.

Unit-IV

Rotary flow compressors: Roots Blower, vane sealed compressor, Lysholm compressor- mechanical details and principle of working – efficiency considerations.

Centrifugal Compressors: Mechanical details and principle of operation – velocity and pressure variation. Energy transfer-impeller blade shape-losses, slip factor, power input factor, pressure coefficient and adiabatic coefficient – velocity diagrams – power.

Axial Flow Compressors: Mechanical details and principle of operation – velocity triangles and energy transfer per stage degree of reaction, work done factor - isentropic efficiency- pressure rise calculations – Polytropic efficiency.

Unit–V

Mechanical refrigeration and types-unit of refrigeration-air refrigeration system, details and principle of operation- applications of air refrigeration, vapor compression refrigeration systems-calculation of COP-effect of superheating and sub cooling, desired properties of refrigerants and common refrigerants-vapor absorption system-mechanical details-working principle. Use of p-h charts for calculations.

Air conditioning: concept of psychrometry: concept of psychrometry- properties of moist air-usage of psychrometric chart-calculation of moist air properties.

Types of air-conditioning systems-requirements –schematic layout of a typical plant.

Suggested Readings:

1. V. Ganesan, I.C. Engines Mc Graw Hill
2. Mahesh M Rathore, Thermal Engineering, Mc Graw Hill

Reference Books:

1. J.B Heywood, I.C. Engines Fundamentals, TMH
2. Taylor, The I.C. Engine in theory and Practice Vol.I, IT Prof. and Vol. II
3. R.K. Rajput, Thermal Engineering, Lakshmi Publication.
4. Engine emission -Springer and Patterson, Plenum Press.

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B.Tech. in Mechanical Engineering

IV Semester Syllabus

ME403PC: Instrumentation and Control Systems

Course Objectives

At the end of this course students are expected to:

- Know the basic principles of Measurements, General measurement system, Static Characteristics, Errors in various measuring instruments and the measurement of Displacement using various transducers.
- Understand the construction, working, advantages, limitations and applications of Instruments used for the measurement of Temperature and Pressure.
- Learn the principles of measurement of Level, Flow, Speed, Vibration and Acceleration.
- Understand the construction, working, advantages, limitations and applications of devices used for the measurement of Stress – strain, Humidity, Force.
- Learn the basic concepts of open & closed loop control systems and Transfer functions of Mechanical systems.

Course Outcomes

After successful completion of the course, student will:

- Be familiar with the basic principles of Measurements, Static Characteristics, Errors in various measuring instruments and the measurement of Displacement through various transducers.
- Be able to demonstrate the use of various measurement systems for the measurement of Temperature and Pressure.
- Possess a reasonable level of competence in the use of different sensors/gauges for the measurement of Level, Flow, Speed, Vibration and Acceleration.
- Be able to demonstrate the use of various sensors and transducers used for the measurement of Stress – Strain, Humidity and Force.
- Be able to apply the knowledge of Open and Closed loop control systems and Transfer functions of Mechanical systems

Unit – I

Definition – Basic principles of measurement – Measurement systems, generalized configuration and Functional description of measuring instruments – examples. Static performance characteristics –Classification of errors. Measurement of Displacement: Theory and construction of various transducers to measure displacement – Using Piezo electric, Inductive, capacitance, resistance, and Photo electric transducers;

Unit – II

Measurement of Temperature: Various Principles of measurement - Classification: Expansion Type: Bimetallic Strip- Liquid in glass Thermometer; Electrical Resistance Type: Thermistor, Thermocouple, RTD; Radiation Pyrometry: Optical Pyrometer; Measurement of Pressure: Dead weight pressure gauge, Bourdon pressure gauges, Bulk modulus pressure gauges, Bellows, Diaphragm gauges. Low pressure measurement –McLeod pressure gauge.

Unit – III

Measurement of Level: Direct methods – Indirect methods – Capacitive, Radioactive, Ultrasonic, Bubbler levelindicators. Flow measurement: Rotameter, magnetic, Ultrasonic, Turbine flowmeter, Hot – wire anemometer.

Measurement of Speed: Mechanical Tachometers, Electrical tachometers, Non-contact typeStroboscope; Measurement of Acceleration and Vibration: Different simple instruments

Unit – IV

Stress-Strain measurements: Various types of stress and strain measurements –Selection and installation of metallic strain gauges; electrical strain gauge – gauge factor –Use of strain gauges for measuring torque, Strain gauge Rosettes.

Measurement of Humidity: Sling Psychrometer, Absorption Psychrometer, Dew point meter.Measurement of Force - Elastic force meters, load cells

Unit – V

Elements of Control Systems: Introduction, Importance – Classification – Open and closed systems- Difference between open and closed loop systems, systems- Transfer functions- First and Second order mechanicalsystems

Suggested Readings:

1. Dr.D.S.Kumar, Mechanical Measurements and control –
2. Alavala, Principles of Industrial Instrumentation & Control Systems, - - Cengage Learning
3. S. Bhaskar, Basic Principles – Measurements (Instrumentation) & Control Systems – AnuradhaPublications.
4. S K Singh, Industrial Instrumentation and control –

Reference Books:

1. E. O. Doebelin, Measurement Systems: Applications & design, TMH
2. B.C. Nakra& K.K. Choudhary, Instrumentation, Measurement & Analysis, TMH
3. Holman, Experimental Methods for Engineers
4. R. K. Jain, Mechanical and Industrial Measurements, Khanna Publishers.
5. Sirohi and Radhakrishna, Mechanical Measurements, New Age International.

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B.Tech. in Mechanical Engineering
IV Semester Syllabus
EE461ES: Basic Electrical and Electronics Engineering Lab
(Common CE, ME & MME)

Course Objectives

The objectives of the course is to make the student
- To introduce the concepts of electrical circuits and its components
- To understand magnetic circuits, DC circuits and AC single phase & three phase circuits
- To study and understand the different types of DC/AC machines and Transformers.
- To introduce the concepts of diodes & transistors, and
- To impart the knowledge of various configurations, characteristics and applications

Course Outcomes

Upon completing this course, the student will be able to
- To analyze and solve electrical circuits using network laws and theorems.
- To understand and analyze basic Electric and Magnetic circuits
- To study the working principles of Electrical Machines
- To identify and characterize diodes and various types of transistors.

List of experiments/demonstrations:

Part A: Electrical

1. Verification of KVL and KCL
2. (i) Measurement of Voltage, Current and Real Power in primary and Secondary Circuits of a Single PhaseTransformer
   (ii) Verification of Relationship between Voltages and Currents in a Three Phase Transformer
3. Measurement of Active and Reactive Power in a balanced Three-phase circuit
4. Performance Characteristics of a Separately Excited DC Shunt Motor
5. Performance Characteristics of a Three-phase Induction Motor
6. No-Load Characteristics of a Three-phase Alternator

Part B: Electronics

1. Study and operation of (i) Multi-meters (ii) Function Generator (iii) RPS (iv) CRO.
2. PN Junction diode characteristics
3. Zener diode characteristics and Zener as voltage Regulator
4. Input & Output characteristics of Transistor in CB/CE configuration
5. Full Wave Rectifier with & without filters
6. Input and Output characteristics of FET in CS configuration

Any 5 experiments from PART-A and 5 experiments from PART-B are to be conducted

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B.Tech. in Mechanical Engineering

IV Semester Syllabus

ME451PC: Instrumentation and Control Systems Lab

Course Objectives

At the end of this course, the students are expected to:

- Study the working of Thermocouple, Thermister and Resistance Temperature Detector (RTD) for temperature measurement.
- Study and use of Rotameter, LVDT transducers.
- Study the measurement of vibration using accelerometer.
- Study the working of Optical, Proximity and Tacho Pickups for the measurement of speed.
- Study the measurement and control of Process parameters like Flow, Pressure, Temperature and Level using SCADA

Course Outcomes

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

- Understand the calibration of Thermocouple, Thermister and Resistance Temperature Detector (RTD) for temperature measurement.
- Analyze the calibration of Rotameter and LVDT transducers.
- Understand the calibration of accelerometers for the measurement of vibration amplitude of an engine bed at various loads.
- Apply the calibration using Optical, Proximity and Tacho Pickups used for the measurement of speed of a d.c motor.
- Design a Closed loop circuit for the measurement and control of Process parameters like Flow, Pressure, Temperature and Level using SCADA

List of Experiments:

1. Calibration of Pressure Gauges.
2. Calibration of transducer for temperature measurement.
3. Study and calibration of LVDT transducer for displacement measurement.
4. Calibration of strain gauge for temperature measurement.
5. Calibration of thermocouple for temperature measurement.
6. Calibration of capacitive transducer for angular displacement.
7. Study and calibration of photo and magnetic speed pickups for the measurement of speed.
8. Calibration of resistance temperature detector for temperature measurement.
9. Study and calibration of a rotameter for flow measurement.
10. Study and use of a Seismic pickup for the measurement of vibration amplitude of an engine bed at variousloads.
11. Study and calibration of McLeod gauge for low pressure.
12. Measurement and control of Pressure of a process using SCADA system.
13. Measurement and control of level in a tank using capacitive transducer with SCADA.
14. Measurement and control of temperature of a process using resistance temperature detector with SCADA.

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B.Tech. in Mechanical Engineering
IV Semester Syllabus
MC451HS: Gender Sensitization Lab
(An Activity-based Course)
(Common to CE, EEE, ECE, ME, MCT & MME)

Course Objectives

This course aims:
- To develop students' sensibility with regard to issues of gender in contemporary India.
- To provide a critical perspective on the socialization of men and women.
- To introduce students to information about some key biological aspects of genders.
- To expose the students to debates on the politics and economics of work.
- To help students reflect critically on gender violence.
- To expose students to more egalitarian interactions between men and women.

Course Outcomes

- Students will have developed a better understanding of important issues related to gender in contemporary India.
- Students will be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature and film.
- Students will attain a finer grasp of how gender discrimination works in our society and how to counter it.
- Students will acquire insight into the gendered division of labour and its relation to politics and economics.
- Men and women students and professionals will be better equipped to work and live together as equals.
- Students will develop a sense of appreciation of women in all walks of life.
- Through providing accounts of studies and movements as well as the new laws that provide protection and relief to women, the textbook will empower students to understand and respond to gender violence.

Course Description

This course offers an introduction to Gender Studies, an interdisciplinary field that asks critical questions about the meanings of sex and gender in society. The primary goal of this course is to familiarize students with key issues, questions and debates in Gender Studies, both historical and contemporary. It draws on multiple disciplines – such as literature, history, economics, psychology, sociology, philosophy, political science, anthropology and media studies –to examine cultural assumptions about sex, gender, and sexuality. This course integrates analysis of current events through student presentations, aiming to increase awareness of contemporary and historical experiences of women, and of the multiple ways that sex and gender interact with race, class, caste, nationality and other social identities. This course also seeks to build an understanding and initiate and strengthen programmes combating gender-based violence and discrimination. The course also features several exercises and reflective activities designed to examine the concepts of gender, gender-based violence, sexuality, and rights. It will further explore the impact of gender- based violence on education, health and development.

Unit-I: Understanding Gender

Introduction: Definition of Gender-Basic Gender Concepts and Terminology-Exploring Attitudes towards Gender- Construction of Gender-Socialization: Making Women, Making Men - Preparing for Womanhood. Growing up Male.

Unit-II: Gender Roles and Relations

Two or Many? -Struggles with Discrimination-Gender Roles and Relations-Types of Gender Roles-Gender Roles and Relationships Matrix-Missing Women-Sex Selection and Its Consequences-Declining Sex Ratio. Demographic Consequences-Gender Spectrum: Beyond the Binary

Unit-III: Gender and Labour

Division and Valuation of Labour-Housework: The Invisible Labor- "My Mother doesn't Work." "Share the Load."- Work: Its Politics and Economics -Fact and Fiction. Unrecognized and Unaccounted work. -Gender Development Issues-Gender, Governance and Sustainable Development-Gender and Human Rights-Gender and Mainstreaming

Unit–IV: Gender - Based Violence

The Concept of Violence- Types of Gender-based Violence-Gender-based Violence from a Human Rights Perspective-Sexual Harassment: Say No! -Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment- Further Reading: "Chupulu".

Domestic Violence: Speaking Out -Is Home a Safe Place? -When Women Unite [Film]. Rebuilding Lives. Thinking about Sexual Violence Blaming the Victim-"I Fought for my Life…."

Unit – V: Gender and Culture

Gender and Film-Gender and Electronic Media-Gender and Advertisement-Gender and Popular Literature-Gender Development Issues-Gender Issues-Gender Sensitive Language-Gender and Popular Literature - Just Relationships: Being Together as Equals Mary Kom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers. Rosa Parks-The Brave Heart.

Note: Since it is Interdisciplinary Course, Resource Persons can be drawn from the fields of **English Literature** or Sociology or Political Science or **any other qualified faculty who has expertise in this field from engineering departments.**

- Classes will consist of a combination of activities: dialogue-based lectures, discussions, collaborative learning activities, group work and in-class assignments. Apart from the above prescribed book, Teachers can make use of any authentic materials related to the topics given in the syllabus on "Gender".

Suggested Readings:

- The Textbook, "Towards a World of Equals: A Bilingual Text Book on Gender" written by A. Suneetha, Uma Bhrugubanda, DuggiralaVasanta, Rama Melkote, Vasudha Nagaraj, Asma Rasheed, Gogu Shyamala, Deepa Sreenivas and Susie Tharu published by Telugu Akademi, Telangana Government in 2015.

Assessment and Grading:

- Discussion & Classroom Participation: 20%
- Project/Assignment: 30%
- End Term Exam: 50%