B.Tech.
in
MECHANICAL ENGINEERING (MECHATRONICS)
[MCT]

Scheme of Instruction, Examination and Syllabi
of
III and IV Semesters

Academic Year: 2022-23

MAHATMA GANDHI INSTITUTE OF TECHNOLOGY
(An Autonomous Institution)
Affiliated to JNTUH; Accredited by NAAC with 'A' Grade; 6 U.G. Programs
Accredited by NBA
Kokapet (Village), Gandipet (Mandal), Hyderabad-500075, Telangana
email: principal@mgit.ac.in Website: www.mgit.ac.in Ph: 040-24193057 / 067

MAHATMA GANDHI INSTITUTE OF TECHNOLOGY (Autonomous)
B.Tech. in Mechanical Engineering (Mechatronics)
Scheme of Instruction and Examination

III Semester

S.No.	Course Code	Course Title	Instruction Hours Per Week			Examination Max. Marks		Examination Duration of SEE in Hours	Credits
			L	T	P/D	CIE	SEE		
1	EC301PC	Electronic Devices and Circuits	3	1	0	30	70	3	4
2	MM331ES	Material Science and Metallurgy	3	0	0	30	70	3	3
3	ME301PC	Mechanics of Solids	3	0	0	30	70	3	3
4	MT301PC	Thermal Science	3	0	0	30	70	3	3
5	MT302PC	Fluid Mechanics and Heat Transfer	3	1	0	30	70	3	4
6	MC301HS	Constitution of India	3	0	0	30	70	3	0
7	EC351PC	Electronic Devices and Circuits Lab	0	0	2	30	70	3	1
8	MM361ES	Metallurgy & Mechanics of Solids Lab	0	0	2	30	70	3	1
9	MT351PC	Fluid Mechanics and Heat Transfer Lab	0	0	2	30	70	3	1
10	EN351HS	Finishing School – I	0	0	2	30	70	3	1
		Total Hours/Marks/Credits	**18**	**2**	**8**	**300**	**700**	**--**	**21**

L: Lecture **T**: Tutorial **D**: Drawing **P**: Practical
CIE - Continuous Internal Evaluation **SEE** - Semester End Examination

L	T	P	C
3	1	0	4

III Semester Syllabus
EC301PC: Electronic Devices and Circuits
(Common to ECE & MCT)

Course Objectives

- To introduce components such as diodes, BJTs and FETs.
- To know the applications of components.
- To know the switching characteristics of components
- To give understanding of various types of amplifier circuits.

Course Outcomes

Upon successful completion of the course, students will be able to

- Know the characteristics of various components.
- Understand the utilization of components.
- Understand the biasing techniques
- Design and analyze small signal amplifier circuits

Unit-I: Diode and Applications

Diode equation, Volt-Ampere characteristics, Temperature dependence, Ideal versus practical, Diode - Static and Dynamic resistances, Equivalent circuit, Load line analysis, Diffusion and Transition Capacitances, Derivation of Diffusion and Transition Capacitances, Diode Applications: Switch-Switching times.

Rectifier - Half Wave Rectifier, Full Wave Rectifier, Bridge Rectifier, comparison of rectifiers, Rectifiers with filter, Derivation for ripple factor with capacitor filter and Inductive Filters, Problems related to capacitor and inductor filter, **Clippers & Clampers**-Clipping at two independent levels, Transfer function, Clamper-Clamping Operation, Types of Clampers, Clamping Circuit Theorem, problems on clippers and clampers.

Unit-II: Bipolar Junction Transistor (BJT)

(BJT):Construction, Principle of Operation, Symbol, Amplifying Action, Common Emitter, Common Base and Common Collector Configurations, Transistor Biasing and Stabilization - Operating point, DC & AC load lines, Biasing - Fixed Bias, Collector to Base Bias, Self Bias, Stability factor, Bias Stability, Problems related to Biasing, Bias Compensation using Diodes, Transistor as a switch, switching times.

Unit-III: Junction Field Effect Transistor (FET), Special Purpose Devices

Junction Field Effect Transistor (FET): Construction, Principle of Operation, Pinch-Off Voltage, Volt- Ampere Characteristic, Comparison of BJT and FET, Biasing of FET-Fixed Bias, Self Bias and Voltage divider Bias, FET as Voltage Variable Resistor.

Special Purpose Devices: Zener Diode - **V-I** Characteristics, Zener diode as Voltage Regulator, SCR-Principle of Operation, Applications, Tunnel diode- Principle of Operation, V-I Characteristics, UJT- Principle of Operation, V-I Characteristics and applications, Varactor Diode.

Unit-IV: Analysis and Design of Small Signal Low Frequency BJT Amplifiers

BJT modeling, Hybrid model, Determination of h-parameters from transistor characteristics, Analysis of CE, CB and CC configurations using h-parameters, low frequency response of BJT Amplifiers, effect of coupling and bypass capacitors, Comparison of CE, CB and CC configurations.

Transistor Hybrid model, Determination of h-parameters from transistor Static characteristics, Typical values of h- parameters in CE, CB and CC configurations, Analysis of CE, CC, CB Amplifiers and CE Amplifier with emitter resistance, low frequency response of BJT Amplifiers, effect of coupling and bypass capacitors on CE Amplifier.

Unit-V: FET Amplifiers

Small Signal Model**,** Analysis of JFET Amplifiers, Analysis of CS, CD, CG JFET Amplifiers. MOSFET- Depletion and Enhancement type MOSFET, Volt- Ampere Characteristic of Enhancement and Depletion mode, Basic Concepts of MOSFET Amplifiers.

Suggested Readings:

1. Jacob Millman, Electronic Devices and Circuits, McGraw Hill Education
2. Robert L. Boylestead, Louis Nashelsky, Electronic Devices and Circuits theory, Pearson**,** 11th Edition, 2009.

Reference Books:

1. ZHorowitz, The Art of Electronics,, 3rd Edition Cambridge University Press
2. David A. Bell, Electronic Devices and Circuits, 5th Edition, Oxford.
3. J. Millman, H. Taub and Mothiki S. Prakash Rao, Pulse, Digital and Switching Waveforms , Mc Graw Hill, 2nd Ed., 2008.

L	T	P	C
3	0	0	3

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 fields such 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 the microstructure 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 with metallurgy. 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, copper and Titanium) alloys.

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 monotectic reactions. 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.

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III Semester Syllabus
ME301PC: Mechanics of Solids
(Common to ME, MCT & MME)

Course Objectives

At the end of this course, students are expected to
- 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 their locations.
- Compute normal and shear stresses.

Course Outcomes

After successful completion of this course, students should 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 diagram for 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 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, circular, 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: $T/J = q/r = G\theta/L$; Torsional moment of resistance – Polar section modulus.

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

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III Semester Syllabus
MT301PC: Thermal Science

Course Objectives

At the end of this course, students are expected to
- Understand the terminology associated with Basic Thermodynamics
- State and illustrate zeroth and I laws of thermodynamics
- Explain the concepts of entropy, illustrate II law of Thermodynamics and causes of irreversibility
- Study various processes involved in gas powered cycles and plot them on P-v, T-s diagrams
- Understand the working of 2S & 4S engines with their ignition systems and know about cooling and lubricating systems.

Course Outcomes

At the end of the course students are able to:
- Identify various processes involved in Thermodynamics and able to calculate work and Heat Transfer
- Apply the laws of thermodynamics to various processes and systems
- Apply II law of Thermodynamics and analyze the effect of entropy and its generation in various processes
- Estimate the performance of various Thermodynamic gas powered cycles
- Distinguish a 4-stroke engine from 2-stroke engine and draw port timing and valve timing diagrams

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, Cycle – Reversibility – Quasi – static Process, Irreversible Process Work and Heat, Point and Path function.

Unit-II: Zeroth Law of Thermodynamics

Concept of quality of Temperature – Principles of Thermometry –Reference Points – Const. Volume gas Thermometer – Scales of Temperature, Ideal Gas Scale – 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.

Unit-III: 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,

Statement of Third Law of Thermodynamics.

Unit-IV: Power Cycles

Otto, Diesel, Dual Combustion cycles, – Description, and representation on P–V and T-S diagram, Thermal Efficiency, Mean Effective Pressures on Air standard basis – comparison with Ideal and Actual Cycles. Determination of friction power, calculation of IP, BP, FP and Break thermal efficiency, Indicated thermal efficiency, Volumetric efficiency, heat balance.

Unit-V: I.C. Engines

Classification – Two & Four Stroke Engines, Working principles, Valve and Port Timing Diagrams, - Types Engine arrangement systems. Fuels used, Modes of fuel Admission to engine cylinder, carburetor, Fuel Injector, Ignition, Cooling and Lubrication systems, Introduction to boilers and air compressors.

Suggested Readings:

1. Rajput, Thermal Engineering, Lakshmi Publications.
2. P. K Nag, Engineering Thermodynamics –TMH.
3. V. Ganesan, I.C. Engines –TMH.
4. Merle C. Potter, Elaine P. Scott, Thermal Sciences –Cengage Learning.

Reference Books:

1. Jones & Dugan, Engineering Thermodynamics.
2. Yunus Cengel & Boles, Thermodynamics – An Engineering Approach –TMH.
3. J. P. Holman, Thermodynamics –Mc Graw Hill.
4. J. P. Holman, An introduction to Thermodynamics, University Press.

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III Semester Syllabus
MT302PC: Fluid Mechanics and Heat Transfer

Pre-requisite: Thermodynamics

Course Objectives

At the end of this course, students are expected to

- Identify the behavior of incompressible fluid in rest and in transit and understand various types of flow
- Learn how to apply laws of mass conservation and energy conservation for various steady flow devices
- Understand modes of the mechanisms of conduction, convection, and radiation heat transfer concepts.
- Differentiate between free convection and forced convection.
- Understand the usage of LMTD and effectiveness NTU methods in the analysis of Heat exchangers

Course Outcomes

After successful completion of this course, students should be able to

- Describe physical properties of a fluid, pressure distribution and formulate the motion of fluid element.
- Apply modified Bernoulli's equation for real time applications and evaluate major and minor losses.
- Understand the basic laws of Heat transfer and analyze problems involved in steady state Heat conduction.
- Evaluate Heat transfer coefficients for natural and forced convections
- Analyze performance of a heat exchanger by using LMTD and Effectiveness-NTU methods and calculate Radiative heat transfer between black body surfaces as well as grey body surfaces.

Note: Heat Transfer Data Book is permitted.

Unit-I

Properties of fluids, Measurement of pressure. Fluid kinematics - Streamline, path line and streak Lines and stream tube, classification of flows, steady, unsteady, uniform, non-uniform, laminar, Turbulent. Rotational and irrotational flows – Equation of continuity for one dimensional flow – Stream and velocity potential functions

Unit-II

Fluid Dynamics: Surface and body forces – Euler's and Bernoulli's equations for flow along a stream Line. Bernoulli's equations for real fluids, Flow measurement by Venturi meter and orifice meter.

Unit-III

Conduction: Modes of Heat Transfer, Fourier heat conduction equation, general heat condition Equation, conduction through homogeneous slab, cylinder and sphere, Heat Transfer through Composite structures as plane wall, cylinder.

Unit-IV

Convection: Dimensional analysis, Rayleigh and Buckingham methods applied to heat transfer, Non- dimensional members in heat transfer. Thermal and velocity boundary layer, Mean Temperature for evaluation of fluid properties. Forced convection of laminar flow inside ducts and Over bodies. Local and average heat transfer coefficients.

Unit-V

Radiation: Emission characteristics and laws of Black body radiation, Incident radiation, total and Monochromatic quantities. Laws of black, Kirchoff, Lambart, Stephan and Boltzman. Concept of Shape factor, Emissivity. Classification of heat exchangers – overall heat transfer Coefficient and Fouling factor – Concepts of LMTD and NTU methods.

Suggested Readings:

1. Sachdev, Heat Transfer–TMH
2. Sachdev, Heat Transfer - TMH
3. Dr. R. K. Bansal, Fluid Mechanics and Hydraulics Machines

Reference Books:

1. Sukhatme, Heat Transfer
2. Yunus Cengel, Boles, Heat Transfer – A Practical Approach –TMH.
3. Michael J Moran, Fundamentals of Engineering Thermodynamics, John Wiley & Sons
4. K. L. Kumar, Engineering Fluid Mechanics, S. Chand & Co.

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III Semester Syllabus
MC301HS: Constitution of India
(Common to CE, EEE, ME, ECE, MCT & MME)

Course Objectives

At the end of this course, students are expected to
- 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 and Responsibilities
- Students will get know about Judicial System in India
- Students will get know about Panchayat-raj System in India

Course Outcomes

After successful completion of this course, students should be able to
- 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 the Council 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

III Semester Syllabus
EC351PC: Electronic Devices and Circuits Lab
(Common to ECE & MCT)

Course Objectives

- To familiarize with various circuit components, Display devices.
- To understand the characteristics of Diode, Zener Diode
- To understand the applications of diode as rectifiers, clippers and clampers.
- To understand the characteristics of BJT and FET
- To understand the Common Emitter Amplifier Characteristics

Course Outcomes

Upon completing of this course, the student will be able to:

- Illustrate the utility of various semiconductor devices, passive elements, circuit behaviour and parameters to be estimated.
- Identify specifications, choice of device and equipment required.
- Measurement of various diodes and transistor circuit characteristics.
- Set up different types of rectifier and Filter circuits and estimate of their performance characteristics.
- Design, develop and test BJT and FET amplifier circuits and estimate the Amplifier parameters.

List of Experiments (Twelve experiments to be done):

Verify any twelve experiments in H/W Laboratory

1. PN Junction diode characteristics A) Forward bias B) Reverse bias.
2. Zener diode characteristics and Zener as voltage Regulator
3. Full Wave Rectifier with & without filters
4. Input and output characteristics of BJT in CE Configuration
5. Input and output characteristics of FE in CS Configuration
6. Common Emitter Amplifier Characteristics
7. Common Base Amplifier Characteristics
8. Common Source amplifier Characteristics
9. Measurement of h-parameters of transistor in CB, CE, CC configurations
10. Switching characteristics of a transistor
11. SCR Characteristics.
12. Types of Clippers at different reference voltages
13. Types of Clampers at different reference voltages

14. The steady state output waveform of clampers for a square wave input

Major Equipment required for Laboratories:

1. Regulated Power Suppliers, 0-30V.
2. 20 MHz, Dual Channel Cathode Ray Oscilloscopes.
3. Functions Generators-Sine and Square wave signals.
4. Multimeters.
5. Electronic Components.

L	T	P	C
0	0	2	1

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 and hexagonal 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
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III Semester Syllabus
MT351PC: Fluid Mechanics and Heat Transfer Lab

Course Objectives

At the end of this course, students are expected to
- Determine the co-efficient of discharge for various flow measuring devices
- Distinguish between major losses and minor losses and their impact
- Determine the performance characteristics of impulse and reaction turbines
- Understand the performance of impact of jet on vanes
- Calculate the co-efficient of discharge for various flow measuring devices
- Calculate the major losses and minor losses in the flow through pipes
- Analyze the characteristics of hydraulic turbines
- Analyze the coefficient of jets for different vanes

Course Outcomes

After successful completion of this course, students should be able to develop following skills
- Calculate the co-efficient of discharge for various flow measuring devices
- Calculate the major losses and minor losses in the flow through pipes
- Analyze the characteristics of hydraulic turbines and coefficient of jets for different vanes
- Perform steady state conduction experiments to estimate thermal conductivity of different materials for different geometries
- Estimate Heat Transfer coefficients in forced and free convections and determine effectiveness of Heat exchangers
- Perform radiation experiments and determine emissivity using emissivity apparatus
- Determine Stefan Boltzmann constant and experimentally

Any six experiments from each Lab

A) Fluid Mechanics Lab

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. Calibration of Venturi meter.
6. Calibration of Orifice meter.
7. Determination of friction factor for a given pipeline.
8. Calibration of V- Notch and Rectangular Notch

B) Heat Transfer Lab

1. Composite slab apparatus – Overall heat transfer co-efficient.
2. Heat transfer through lagged pipe.
3. Heat transfer through a concentric sphere.
4. Thermal conductivity of given metal rod.
5. Heat transfer in forced convection apparatus.
6. Heat transfer in natural convection.
7. Emissivity apparatus.
8. Stefan Boltzman constant.

L	T	P	C
0	0	2	1

III Semester Syllabus

EN351HS: Finishing School-I

(Common to all Branches)

Course Overview

In view of the growing importance of English as a tool for global Communication and the consequent emphasis on training students to acquire language skills, this syllabus has been designed to develop linguistic, communicative and critical thinking competencies of Engineering students.

Course Objectives

The main objective of this finishing school curriculum is to provide content for developing the LSRW skills of language learning and to facilitate proficiency in both receptive and productive skills, among students.

Methodology:

- Every Session will have activities on all the four skills-Listening, Speaking, Reading and Writing.
- To personalize the learning a variety of case studies and structured problem solving activities will be given to small groups and the teachers will facilitate peer reviews.
- Continuous grading, peer review and positive reinforcement will be emphasized
- Vocabulary exercises will also be a part of every session
- All sessions are designed to be student-centric and interactive.

Unit-I: Fundamentals of Communication

Unit Overview:

This is an introductory module that covers the fundamentals of communication. This module is intended to enable the students to communicate using greetings and small sentences/queries.

Learning Outcomes:

The students should be able to:

- Respond to questions
- Engage in informal conversations.
- Speak appropriately in formal situations
- Write formal and informal emails/letters

Competencies:

- Greeting appropriately
- Introducing themselves, a friend
- Situational Dialogue writing
- Responding to simple statements and questions both verbally and in writing

- Writing an email with appropriate salutation, subject lines, introduction and purpose of mail.
- Using appropriate vocabulary for both formal and informal situations.
- JAM sessions.

Sessions:

1. Introduction to Formal and Informal Conversations (Listening Activity)
2. Informal Conversations
3. Informal Conversations - Writing
4. Formal Conversations
5. Formal Conversations – Writing
6. Grammar-Prepositions
7. Adjectives and Degrees of Comparison
8. Word formation: Prefixes and Suffixes

Unit–II: Rational Recap

Unit Overview:

The module enables the participants to organize their communication, structure their speaking and writing, explain their thoughts/ideas, and summarize the given information.

Learning Outcomes:

The students should be able to:

- Classify content and describe in a coherent form
- Recognize and list the key points in a topic/message/article.
- Compare and contrast using appropriate structure
- Explain cause and effect
- Use appropriate transitions in their presentations and written assignments

Competencies:

- Organizing the communication based on the context and audience
- Structuring the content based on the type of information.
- Explaining a technical/general topic in detail.
- Writing a detailed explanation/process
- Recapitulating

Sessions:

1. Introduction to Mind maps
2. Classification
3. Sequencing
4. Description and Enumeration

Unit-III: Narrations and Dialogues

Unit Overview:

The Module is intended to develop the desired level of language competence that enables them to narrate and participate in casual dialogues.

Learning Outcomes:

The students should be able to

- Narrate a message/story/incident, both verbally and in writing.
- Describe an event/a session/ a movie/ an object / image
- Understand Vocabulary in context

Competencies:

- Framing proper phrases and sentences to describe in context
- Reading Stories and articles and summarizing.
- Speaking fluently with clarity
- Listening for main ideas and reformulating information in his/her own words
- Drawing and write appropriate conclusions, post reading a passage.
- Speaking Reading and Writing descriptive sentences and paragraphs
- Using appropriate tenses, adjectives and adverbs in conversations and written tasks

Sessions:

Grammar: Verb, Tenses

1. Recalling and Paraphrasing
2. Describing Events
3. Describing Objects/ Places
4. Story Telling
5. Describing Hypothetical events

Unit-IV: Technical Expositions and Discussions

Unit Overview:

The module enables the students to build strategies for effective interaction and help them in developing decisive awareness and personality, maintaining emotional balance.

Learning Outcomes:

The students should be able to:

- Participate in Professional discussions by providing factual information, possible solutions, and examples.

Competencies:

- Comprehending key points of a topic and identifying main points including supporting details.
- Construct a logical chain of arguments and decisive points.
- Writing a review about a product by providing reasons, causes and effects

Sessions:

Based on Case Studies

1. Compare and Contrast
2. Cause and Effect
3. Problem and Solution

Unit-V: Drawing Conclusions

Unit Overview:

This module is intended to provide necessary inputs that enable the students to draw

conclusions out of a discussion and provide reports.

Learning Outcomes:

Students should be able to:

- Provide logical conclusions to the topics under discussion.
- Prepare, present, and analyze reports.

Competencies:

- Reasoning skills - Coherent and logical thinking
- Reporting and Analyzing skills.
- Analyzing the points discussed.
- Connecting all points without gaps.
- Connectives
- Communicating the decisions

Sessions:

1. Report Writing
2. Reasoning
3. Analyzing
4. Generalization and Prediction
5. Précis writing

Reference Books:

1. Learn Correct English – A Book of Grammar, Usage and Composition by Shiv K. Kumar and Hemalatha Nagarajan, Pearson 2007.
2. Professional Communication by Aruna Koneru, McGraw Hill Education (India) Pvt. Ltd, 2016.
3. Technical Communication by Meenakshi Raman & Sangeeta Sharma, Oxford University Press 2009.
4. Technical Communication by Paul V. Anderson. 2007. Cengage Learning Pvt. Ltd. New Delhi.
5. English Vocabulary in Use series, Cambridge University Press 2008.
6. Handbook for Technical Communication by David A. Mc Murrey & Joanne Buckley. 2012, Cengage Learning.
7. Communication Skills by Leena Sen, PHI Learning Pvt Ltd., New Delhi, 2009.
8. Job Hunting by Colm Downes, Cambridge University Press 2008.
9. English for Technical Communication for Engineering Students, Aysha Vishwamohan, Tata Mc Graw-Hill 2009.
10. Effective Technical Communication by M Asharaf Rizvi. McGraw Hill Education (India) Pvt. Ltd, 2nd Edition.

IV Semester

S.No.	Course Code	Course Title	Instruction Hours Per Week			Examination Max. Marks		Examination Duration of SEE in Hours	Credits
			L	T	P/D	CIE	SEE		
1	MA407BS	Probability Distributions and Complex Variables	3	1	0	30	70	3	4
2	EC432PC	Switching Theory and Logic Design	3	1	0	30	70	3	4
3	EE432ES	Electrical Engineering	3	0	0	30	70	3	3
4	ME401PC	Kinematics of Machinery	3	1	0	30	70	3	4
5	MT401PC	Machine Drawing and Computer Aided Graphics	0	0	6	30	70	3	3
6	EE462ES	Electrical Engineering Lab	0	0	2	30	70	3	1
7	MT451PC	Thermal Science Lab	0	0	2	30	70	3	1
8	EN452HS	Finishing School –II	0	0	2	30	70	3	1
9	MC451HS	Gender Sensitization Lab	0	0	2	30	70	3	0
Total Hours/Marks/Credits			**12**	**3**	**14**	**270**	**630**	**--**	**21**

L: Lecture **T**: Tutorial **D**: Drawing **P**: Practical
CIE - Continuous Internal Evaluation **SEE** - Semester End Examination

L	T	P	C
3	1	0	4

IV Semester Syllabus

MA407BS: Probability Distributions and Complex Variables

(Common to ME, MCT & MME)

Course Objectives

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

- 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

After successful completion of the course, students should be able to

- Formulate and solve problems involving random variables
- Apply statistical methods for analyzing experimental data.
- Analyse 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 distribution 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 distribution with their Mean, Mode and Variance. Binomial approximation to normal distribution.

Unit-III: Testing of Hypothesis

Test of significance: Basics 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 engineers and 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.

L	T	P	C
3	1	0	4

IV Semester Syllabus
EC432PC: Switching Theory and Logic Design

Course Objectives

This course provides in-depth knowledge of switching theory and the design techniques of digital circuits, which is the basis for design of any digital circuit. The main objectives are:

- To learn basic techniques for the design of digital circuits and fundamental concepts used in the design of digital systems.
- To understand common forms of number representation in digital electronic circuits and to be able to convert between different representations
- To implement simple logical operations using combinational logic circuits
- To design combinational logic circuits, sequential logic circuits
- To impart to student the concepts of sequential circuits, enabling them to analyze sequential systems in terms of state machines.
- To implement synchronous state machines using flip-flops.

Course Outcomes

Upon completion of the course, students should possess the following skills:

- Be able to manipulate numeric information in different forms, e.g. different bases, signed integers, various codes such as ASCII, Gray, and BCD.
- Be able to manipulate simple Boolean expressions using the theorems and postulates of Boolean algebra and to minimize combinational functions.
- Be able to design and analyze small combinational circuits and to use standard combinational functions/building blocks to build larger more complex circuits.
- Be able to design and analyze small sequential circuits and devices and to use standard sequential functions/building blocks to build larger more complex circuits.

Unit - I

Number System and Boolean Algebra and Switching Functions: Number Systems, Base Conversion Methods, Complements of Numbers, Codes- Binary Codes, Binary Coded Decimal Code and its Properties, Unit Distance Codes, Alpha Numeric Codes, Error Detecting and Correcting Codes. **Boolean Algebra:** Basic Theorems and Properties, Switching Functions, Canonical and Standard Form, Algebraic Simplification of Digital Logic Gates, Properties of XOR Gates, Universal Gates, Multilevel NAND/NOR realizations.

Unit - II

Minimization and Design of Combinational Circuits: Introduction, The Minimization with theorem, The Karnaugh Map Method, Five and Six Variable Maps, Prime and Essential Implications, Don't Care Map Entries, Using the Maps for Simplifying, Tabular Method, Partially Specified Expressions, Multi- output Minimization, Minimization and Combinational Design, Arithmetic Circuits, Comparator, Multiplexers, Code Converters, Wired Logic, Tristate

Bus System, Practical Aspects related to Combinational Logic Design, Hazards and Hazard Free Relations.

Unit - III

Sequential Machines Fundamentals: Introduction, Basic Architectural Distinctions between Combinational and Sequential circuits, The Binary Cell, Fundamentals of Sequential Machine Operation, The Flip-Flop, The D-Latch Flip-Flop, The "Clocked T" Flip-Flop, The "Clocked J-K" Flip- Flop, Design of a Clocked Flip-Flop, Conversion from one type of Flip- Flop to another, Timing and Triggering Consideration, Clock Skew.

Unit - IV

Sequential Circuit Design and Analysis: Introduction, State Diagram, Analysis of Synchronous Sequential Circuits, Design Steps, Realization using Flip-Flops Counters - Design of Single mode Counter, Ripple Counter, Ring Counter, Shift Register, Shift Register Sequences, Ring Counter Using Shift Register.

Unit - V

Sequential Circuits: Finite state machine-capabilities and limitations, Mealy and Moore models- minimization of completely specified and incompletely specified sequential machines, Partition techniques, and Merger chart methods-concept of minimal covertable approaches. Design of Synchronous Sequential Finite State Machines, Design Aspects, State Reduction

Algorithmic State Machines: Salient features of the ASM chart-Simple Examples-System design using data path and control subsystems-control implementations-examples of Weighing machine and Binary multiplier.

Suggested Readings:

1. Zvi, Kohavi & Niraj K. Jha -Switching and Finite Automata Theory, 3rd Edition, Cambridge.
2. Morris Mano, PHI, 3rd Edition -Digital Design.

Reference Books:

1. Fredriac J. Hill, Gerald R. Peterson, 3rd Ed, John Wiley & Sons Inc -Introduction to Switching Theory and Logic Design.
2. Thomas L. Floyd, Pearson, 2013-Digital Fundamentals – A Systems Approach.
3. Ye Brian and Holds Worth, Elsevier -Digital Logic Design.
4. Charles H. Roth, Cengage Learning, 5th, Edition, 2004-Fundamentals of Logic Design.
5. John M. Yarbrough, Thomson Publications, 2006-Digital Logic Applications and Design.
6. Comer, 3rd, Oxford, 2013-Digital Logic and State Machine Design.

L	T	P	C
3	0	0	3

IV Semester Syllabus
EE432ES: Electrical Engineering

Course Objectives

This course introduces
- The concepts of electrical DC and AC circuits, basic laws of electricity
- Instruments to measure the electrical quantities,
- Different methods to solve the electrical networks
- The construction, operational features of energy conversion devices i.e. DC machines, transformers, induction motors and synchronous machines.

Course Outcomes

After going through this course the student gets a thorough knowledge on
- Basic electrical circuits, parameters
- Analysis of simple electrical circuits
- Operation of the transformers in the energy conversion process, electromechanical energy conversion
- Construction, operation characteristics of DC and AC machines
- Different applications of DC and AC machines

Unit – I: DC Circuits

The SI System of Units, Electrical circuit elements (R, L and C), Color Coding of Resistors, Ohm's Law, voltage and current sources, Power, Energy, Circuit Ground, Current Sources in Parallel and Series, Voltage Sources in Parallel and Series, Series Circuits, Parallel Circuits, Kirchhoff's Voltage Law & Kirchhoff's Current Law, The Voltage Divider Rule, Current Divider Rule, Analysis of Series-Parallel Circuits, analysis of simple circuits with DC excitation - Mesh (Loop) Analysis, Nodal Analysis, Delta-Wye Conversion, Force on a current carrying conductor in magnetic field– electromagnetic induction, Faraday's law, Lenz's law – Self and mutual inductances. Electrical Instruments: Basic principles of indicating instruments – moving coil and moving iron instruments.

Unit – II: AC Circuits

Generating AC Voltages, Frequency, Period, Amplitude, and Peak Value, Representation of AC sinusoidal waveforms, peak and rms values, Complex Number Review, phasor representation, R, L, and C Circuits with Sinusoidal Excitation, The Impedance Concept, Analysis of single-phase AC circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), real power, reactive power, apparent power, power factor, The Relationship between P, Q, and S, resonance in series RL-C circuit. Three-Phase Voltage Generation, Three-phase connections, voltage and current relations in star and delta connections, Power in a Balanced System.

Unit – III: DC Machines

Working principle and construction of DC machine, EMF equation of DC generator, types of DC generators, Magnetization and Load characteristics of DC generators, Principle of operation of DC Motor, torque in DC motor, Back EMF Equation, Significance of the Back emf—Voltage Equation of a Motor, Characteristics of DC motor, types of DC motors, Efficiency of DC machine, DC Motor Starter (Three Point starter), DC machine losses, Efficiency Calculation, Swinburne's Test and Factors Controlling Motor Speed—Speed Control of Shunt Motors– armature and flux control methods.

Unit – IV: AC Machines

Principle of operation, construction of transformers, EMF equation of transformer, voltage and turns ratio, losses in transformers, Open circuit and short circuit tests, regulation and efficiency calculations, condition for maximum efficiency and zero regulation, Generation of rotating magnetic fields, construction and working of a three-phase induction motor, types of induction motor, synchronous speed, slip of induction motor, rotor emf and frequency, rotor current, rotor power factor, Starting Torque, torque in three phase induction motor, significance of torque-slip characteristic.

Unit – V: Alternators

Basic Principle, Stationary Armature, Details of Construction, salient pole Rotor, and non-salient pole rotor, Damper Windings, Speed and Frequency, Armature Windings, Equation of Induced E.M.F, Alternator on Load, Synchronous Reactance, Determination of Voltage Regulation, Open circuit and short circuit tests, Synchronous Impedance Method.

Suggested Readings:

1. PS Subramanyam, Basic concepts of Electrical Engineering, B S Publications.
2. S.N. Singh, Basic Electrical Engineering, PHI.
3. T.K. Nagasarkar and M.S. Sukhija, Basic Electrical Engineering, Oxford University Press.

Reference Books:

1. Abhijit Chakrabarthi, Sudiptanath, Chandra kumar Chanda, Basic Electrical Engineering, Tata-McGraw-Hill.
2. V.K Mehta, Rohit Mehta, Principles of Electrical Engineering, S. Chand Publications.
3. Rajendra Prasad, Fundamentals of Electrical Engineering, PHI.
4. D.P. Kothari, I. J. Nagrath, Basic Electrical Engineering by McGraw-Hill.

L	T	P	C
3	1	0	4

IV Semester Syllabus

ME401PC: Kinematics of Machinery

(Common to ME & MCT)

Prerequisites: Basic principles of Mechanics

Course Objectives

At the end of this course, students are expected

- To study the relative motion, velocity, and accelerations of the various elements in a mechanism.
- To study the concept of mobility of Linkages, mechanisms such as four bar /slider crank/double slider crank/straight line motion mechanism etc.
- 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.
- To study the types and motion relation of the belt, rope and chain drives.

Course Outcomes

Upon successful completion of this 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.
- Apply the knowledge of the types and motion relation of the belt, rope and chain drives in industrial applications and solve the problems on power transmission.

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.

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 in line 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 of slider crank chain for displacement- velocity and acceleration of slider – 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 3 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.

L	T	P	C
0	0	6	3

IV Semester Syllabus
MT401PC: Machine Drawing and Computer Aided Graphics

Course Objectives

At the end of this course, students are expected to
- 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 analysing the applications of fluid systems in power transmission.
- Prepare CAD 2D and 3D part models using AUTOCAD and Solid works.

Course Outcomes

Upon successful completion of this course, the student will be able to
- Preparation of engineering and working drawings with dimensions and bill of material during design and development. Developing assembly drawings using part drawings of machine components.
- Conventional representation of materials, common machine elements and parts such as screws, nuts, bolts, keys, gears, webs and ribs, Sections
- Types of Drawings – working drawings for machine parts. Title boxes, their size, location and details–Methods of dimensioning.
- Understand the use of hydraulic and pneumatic systems and design of hydraulic and Pneumatic circuits for industrial applications.
- 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 Drawing proportions.

1) Popular forms of Screw threads, bolts, nuts, stud bolts, tap bolts, set screws and gears.
2) Keys, cotter joints and knuckle joint.
3) Riveted joints for plates.
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 drawing proportions.

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.

III. Introduction to Industrial fluid system

Circuit Drawings for Double Acting Hydraulic Cylinder, Single Acting / Double Acting Pneumatic Cylinder with direct, flow, and pressure control Valves

IV. Introduction to Computer Aided Graphics:

(For internal Evaluation weightage only)

Fundamentals of 2D construction- line, circular, polyline, spline, polygon, simple problems, conversion of simple pictorial views into orthographic views.

Note: First angle projection to be adopted. The student should be able to provide working drawings of actual parts.

Suggested Readings:

1. Ajeet Singh, Machine Drawing–TMH Publications.
2. K.L.Narayana, P.Kannaiah & K.VenkataReddy, Machine Drawing–New Age/Publishers.
3. N.D.Bhatt, Machine Drawing
4. James D.Bethune, Engineering Graphics with AutoCAD–PHI2009Edition.
5. S.R. Majundar, Oil Hydraulic Systems: Principles & Maintenance–Mc.Grawhill Publication

Reference Books:

1. P.S.Gill, Machine Drawing.
2. Luzzader, Machine Drawing.
3. Rajput, Machine Drawing.

L	T	P	C
0	0	2	1

IV Semester Syllabus
EE462ES: Electrical Engineering Lab

Course Objectives

- To analyze a given network by applying various electrical laws and network theorems
- To know the response of electrical circuits for different excitations
- To calculate, measure and know the relation between basic electrical parameters.
- To analyze the performance characteristics of DC and AC electrical machines

Course Outcomes

- Get an exposure to basic electrical laws.
- Understand the response of different types of electrical circuits to different excitations.
- Understand the measurement, calculation and relation between the basic electrical parameters
- Understand the basic characteristics of transformers and electrical machines.

List of Experiments:

1. Verification of KVL and KCL.
2. Serial and Parallel Resonance.
3. Time response of first order RC/RL network for periodic non-sinusoidal inputs – time constant and steady state error determination.
4. Verification of Superposition theorem.
5. Verification of Reciprocity theorem.
6. Verification of maximum power transfer theorem.
7. Verification of Thevenin's theorem.
8. Verification of compensation theorem.
9. Verification of Milliman's theorem.
10. Verification of Norton's theorem.
11. Magnetization characteristics of D.C. Shunt generator.
12. Swinburne's Test on DC shunt machine.
13. Brake test on DC shunt motor.
14. OC & SC tests on Single-phase transformer.
15. Load Test on Single Phase Transformer.

Note: Any 10 of the above experiments are to be conducted.

L	T	P	C
0	0	2	1

IV Semester Syllabus
MT451PC: Thermal Science Lab

Course Objectives

At the end of this course, students are expected to
- Impart practical knowledge of operating an IC engine, i.e Spark ignition Engine and compression ignition engine.
- Analyse the working and performance of IC engines.
- Learn experimentally the performance characteristics of an IC engine and performance of air compressors.
- Understand the various components of steam boilers.
- Understand valve and port timing diagrams experimentally.

Course Outcomes

Upon successful completion of this course, the student will be able to
- Analyse the performance and operating characteristics of an IC engine using rope brake and electrical dynamometer.
- Draw the heat balance sheet for an IC engine.
- Analyse the performance of reciprocating air compressor.
- Understand of working of steam boilers and their accessories and mountings.
- Calculate & compare the performance characteristics and IC engine load variations with air fuel ratio.

List of Experiments

1. I.C. Engines Performance Test of 4 -S single cylinder Diesel Engine
2. Heat Balance test on 4-S single cylinder Diesel Engine
3. I.C. Engines Performance Test of 4 -S double cylinder Diesel Engine
4. I.C. Engines - Determination of A/F Ratio and Volumetric Efficiency
5. Performance Test on Variable Compression Ratio Engines.
6. I C Engine Morse and retardation Test
7. Performance Test on Reciprocating Air Compressor
8. Study of I.C. Engines Valve / Port Timing Diagrams
9. Dis-Assembly and Assembly of a automobile vehicle
10. Study of Boiler Models

Note: Perform all TEN experiments.

L	T	P	C
0	0	2	1

IV Semester Syllabus
EN452HS: Finishing School- II

(Common to all Branches)

Course Overview

In view of the growing importance of English as a tool for global Communication and the consequent emphasis on training students to acquire language skills, this syllabus has been designed to develop linguistic, communicative and critical thinking competencies of Engineering students.

Course Objectives

The main objective of this finishing school curriculum is to provide content for developing the LSRW skills of language learning and to facilitate proficiency in both receptive and productive skills, among students.

Methodology:

- Students will be given Reading/Listening exercises that they would have to do as a prerequisite for the class room intervention
- Every Session will have activities on all the four skills. Listening, Speaking, Reading and Writing
- Vocabulary exercises will also be part of every session
- Students will be asked to summarize their takeaways in every class in three sentences.
- The students will be given a self study plan for language enhancement and will be given extra reading and writing exercises as and when necessary.
- To personalize learning, a variety of case studies and structured problem solving activities will be given in small groups and the trainers will facilitate peer reviews.

Unit-I: Discussions and Debates

Module Overview:

The module enables the students to build strategies for effective group interaction. It focuses on developing decisive awareness and positive personality while maintaining emotional balance.

Learning Outcomes:

The students should be able to:

- Participate in group discussions by providing factual information, real time solutions, and examples.
- Debate on a topic by picking up the key points from the arguments offered.

Competencies:

- Analytical and Probing Skills

- Interpersonal Skills
- Identifying key points of the debate.
- Problem solving ability
- Constructing a logical chain of arguments and presenting winning view points.

Sessions:

1. Six Thinking Hats
2. Initiation Techniques
3. Generating points
4. Summarization Techniques

Unit-II: Powerful Presentations

Unit Overview:

Presentations need to be clear and logical. This Module is designed to introduce students to an ideal structure for a presentation

Learning Outcomes:

Students should be able to:

- Prepare, present, and analyze reports
- Analyze the points discussed
- Connect all points logically with coherence
- Connectives
- Communicate the decisions
- Provide logical conclusions

Sessions:

1. Persuasion skills
2. Cultivate appropriate body language and group dynamics
3. Debating Structure and Content
4. Case Study based Group Discussions

Unit-III: Effective Technical Writing

Unit Overview:

Organizing the writing in a logical order, using headings, linkers and sequence markers. This module is designed to give the students inputs on how to organize using Information Mapping. The students are also given inputs to correct spelling, language and Punctuation errors, as part of editing.

Learning Outcomes:

The Students should be able to choose appropriate words and tone to present accurate, specific, and factual written documents

Competencies:

- Reporting an incident
- Writing/Presenting an essay
- Language and Vocabulary

Sessions:

1. Information Mapping
2. Report writing
3. Memos
4. SoP (Statement of Purpose)
5. MoM (Minutes of the Meeting)

Unit-IV: Reading for Content and Context

Unit Overview:

This course is designed to develop and improve reading and study skills needed for employability. Topics include identifying main idea and supporting details, determining author's purpose and tone, distinguishing between fact and opinion, identifying patterns of organization in a paragraph or passage and the transition words associated with each pattern. Also recognizing the relationship between sentences, puzzling out meanings in context, identifying logical inferences and conclusions.

Learning Outcomes:

Upon completion of the course, students should be able to:

1. Compose a summary of a given text.
2. Apply reading skills appropriate to different genres

Competencies

- Distinguish facts from opinions.
- Make inferences
- Identify author's purpose, point of view, tone, and perspective.
- Comprehend the use of figurative language.
- Synthesize information gathered from reading in order to give informedopinion.

Sessions:

1. Skimming and Scanning Techniques
2. Recognition of author's purpose
3. Awareness of stylistic differences
4. Evaluation and Discernment of fact and opinion

Unit-V: Critical Reading Skills

Unit Overview:

Research shows that good reading skills can lead to well written assignments. In this unit, students will learn reading strategies to understand and retain information, organization of reading passages, and strategies for learning and retaining vocabulary. Building on these basic strategies, students will develop skills to critically analyze texts. In addition, students will practice and develop paraphrasing and summarizing skills. Students' feedback is integral to the learning process.

Learning Outcomes:

- Recognition of propaganda techniques
- Present vocabulary building methods

- Use comprehension and vocabulary strategies to improve reading skills.

Competencies:

The students will develop enhanced ability to apply the following critical thinking skills when reading:

a. Understand the meaning of new vocabulary through:
1. Context clues, e.g., synonyms, antonyms, examples, definitions, and restatements, etc.
2. Roots and affixes

b. Analyze text (simple outlining and note taking) summarize, draw conclusions, and apply information to personal experiences.

Sessions

1. Contextual Vocabulary-One-word substitutes
2. Homophones, Homonyms and Homographs
3. Idioms and Phrases
4. Synonyms, Antonyms and Phrasal verbs
5. Note making and Inference
6. Main idea identification
7. Précis Writing.

Reference Books:

1. Learn Correct English – A Book of Grammar, Usage and Composition by Shiv K. Kumar and Hemalatha Nagarajan, Pearson 2007.
2. Professional Communication by Aruna Koneru, McGraw Hill Education (India) Pvt. Ltd, 2016.
3. Technical Communication by Meenakshi Raman & Sangeeta Sharma, Oxford University Press 2009.
4. Technical Communication by Paul V. Anderson. 2007, Cengage Learning Pvt. Ltd. New Delhi.
5. English Vocabulary in Use series, Cambridge University Press 2008.
6. Handbook for Technical Communication by David A. Mc Murrey & Joanne Buckley. 2012. Cengage Learning.
7. Communication Skills by Leena Sen, PHI Learning Pvt Ltd., New Delhi, 2009.
8. Job Hunting by Colm Downes, Cambridge University Press 2008.
9. English for Technical Communication for Engineering Students, Aysha Vishwamohan, Tata Mc Graw-Hill 2009.
10. Effective Technical Communication by M Asharaf Rizvi. McGraw Hill Education (India) Pvt. Ltd, 2nd Edition.

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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%.