AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

II B.Tech I Semester (ME)	L	T	P	[C]
	3	0	0	[3]

(13HS116) MATHEMATICS-II

Objectives: The course is aimed at developing the basic mathematical skills of engineering students that are imperative for effective understanding of engineering subjects. The topics introduced will serve as basic tools for specialized studies in many engineering fields.

UNIT – I:

Matrix Algebra:

Rank of a matrix – Normal form, Echelon form – Inverse of a matrix using elementary operations – Consistency of system of Linear equations (Homogenous and Non-homogeneous) Hermitian & Skew Hermitian- unitary matrices and their properties. Eigen Values and Eigen Vectors (Real and Complex Matrices) Cayley- Hamilton theorem and its applications. Diagonalization of a matrix – Reduction of a quadratic form to canonical form by orthogonal transformation. Norm of a matrix – Euclidian and Infinite norms.

UNIT – II:

Numerical Analysis:

Numerical solutions of algebraic and transcendental equations by Bisection – Iteration and Newton – Raphson methods,. Forward, backward differences, Interpolation - Newton's forward and backward interpolation formulae, Lagrange interpolation, Numerical differentiation at the tabulated points with forward and backward differences. Numerical Integration with Trapezoidal rule, Simpson's 1/3 rule and Simpson's 3/8 rule.

UNIT – III:

Numerical Solutions of Ordinary Differential Equations:

Numerical Solutions of ODEs – solution by Taylor series method, Euler's method, Picard's Method, Modified Euler's method, Runge-Kutta method of 2^{nd} & 4^{th} orders

UNIT IV – Fourier Series:

Expansion of a function in Fourier series for a given range – Half range sine and cosine expansions. Complex form of Fourier series – Fourier transformation – sine and cosine transformations – simple illustrations.

Z-Transforms: Inverse Z-transforms-Damping Rule and shifting Rule, initial and final value theorems – Convolution theorem.

Text Books:

1. T.K.V. Iyengar ,Mathematical Methods , 8th Edition(2013) ,S. Chand publication.
2. E. Rukmangadachari & E. Keshava Reddy, Engineering Mathematics, Volume - II, 1st Edition (2010),Pearson Publisher.

Reference Books:

1. B.S.Grewal ,Higher Engineering Mathematics, 42 Edition(2012),Khanna publishers.
2. B.V.Ramana , Higher Engineering Mathematics, Mc Graw Hill publishers(2008).
3. S.S. Sastry ,Introductory Methods of Numerical Analysis, 5th Edition(2012), PHI publisher .
4. Erwin Kreyszig,Advanced Engineering Mathematics, 10th Edition(2013),Wiley India.

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

II B.Tech I Semester (ME)

L	T	P	[C]
2	0	0	[2]

(13HS120) PROFESSIONAL ETHICS AND HUMAN VALUES

Objectives: To create awareness on Engineering Ethics and Human Values, to instill Moral and Social Values and Loyalty, to appreciate the rights of others.

UNIT-I:

Human Values: Morals, Values and Ethics – Integrity – Work Ethic – Service Learning – Civic Virtue – Respect for Others – Living Peacefully – caring – Sharing – Honesty – Courage – Valuing Time – Co-operation – Commitment – Empathy – Self-Confidence – Character – Spirituality

UNIT-II:

Engineering Ethics: Senses of 'Engineering Ethics' - variety of moral issued - types of inquiry - moral dilemmas - moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy – Models of Professional Roles - theories about right action - Self-interest - customs and religion - uses of ethical theories.

UNIT-III:

Engineering as Social Experimentation: Engineering as experimentation - engineers as responsible experimenters - codes of ethics - a balanced outlook on law - the challenger case study

UNIT-IV:

Safety, Responsibilities and Rights: Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk - the Three Mile Island and Chernobyl case studies. Collegiality and loyalty - respect for authority - collective bargaining - confidentiality - conflicts of interest - occupational crime - professional rights - employee rights - Intellectual Property Rights (IPR) - discrimination.

Text Books:

1. Mike Martin and Roland Schinzinger, “Ethics in Engineering”, McGraw-Hill, New York 1996.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, “Engineering Ethics”, Prentice Hall of India, New Delhi, 2004.

Reference Books:

1. Charles D. Fleddermann, “Engineering Ethics”, Pearson Education / Prentice Hall, NeJersey, 2004 (Indian Reprint)
2. Charles E Harris, Michael S. Protchard and Michael J Rabins, “Engineering Ethics – Concepts and Cases”, Wadsworth Thompson Learning, United States, 2000 (Indian Reprint now available).
3. John R Boatright, “Ethics and the Conduct of Business”, Pearson Education, New Delhi, 2003.
4. Edmund G Seebauer and Robert L Barry, “Fundamentals of Ethics for Scientists and Engineers”, Oxford University Press, Oxford, 2001.

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

II B.Tech I Semester (ME)	L	T	P	[C]
	3	1	0	[3]

(13ME301) MECHANICS OF SOLIDS

Objectives: The objective of the subject is to learn the fundamental concepts of stress, strain and deformation of solids with applications to bars and beams. The students shall understand the theory of elasticity including strain/displacement and hooks law relationships. To accesses stresses and deformations through the mathematical models of beams for bending and bars for twisting or combination of both. The knowledge of this subject will help in the design & Theory of machines courses.

UNIT-I:

Simple Stresses and Strains: Elasticity and plasticity – Types of stresses & strains – Hooke'slaw – stress & strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio & volumetric strain – Elastic module & the relationship between them – Bars of varying section – composite bars – Temperature stresses. Strain energy –Resilience – Gradual, sudden, impact and shock loadings. Principle stresses and strains-computation of principle stresses and strains on inclined planes-theory of failures- minimum principle stress, strain, shear stress and strain energy theories.

UNIT- II:

Shear Force And Bending Moment : Definition of beam – Types of beams – Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, U.D.L., uniformly varying loads and combination of these loads – Point of contra flexure – Relation between S.F., B.M and rate of loading at a section of a beam.

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 (Solid and Hollow), I,T, Angle and Channel sections – Design of simple beam sections

UNIT- III:

Shear Stresses: Introduction, Shear stress at a section (derivation of equation), Shear stress distribution for different sections (rectangular, circular, solid and hollow, I, T, angle sections.

Torsion of Circular Shafts- Theory of pure torsion- Derivation of torsion equations; $T/J=q/r=N\theta/L$ – Assumptions made in the theory of pure torsion- torsional moment of resistance-polar section modulus.

Deflection Of Beams: Bending into a circular arc – slope, deflection and radius of curvature – Differential equation for the elastic line of a beam – Double integration and Macaulay's methods – Determination of slope and deflection for cantilever and simply supported beams subjected to point loads, - U.D.L uniformly varying load. Mohr's theorems – Moment area method – application to simple cases including overhanging beams

UNIT- IV:

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 – Riveted boiler shells – Thin spherical shells.

Thick Cylinders: Lame's equation – cylinders subjected to inside & outside pressure -Compound cylinders.

Text Books:

1. R. K. Bansal, Strength of materials ,Lakshmi Publications, 5th Edition, 2012.
2. R. K. Rajput, Strength of Materials ,S. Chand and Co., New delhi.1999
3. S. S. Bhavikatti, Strength of Materials I & II ,New Age Publications,2012

Reference Books:

1. Strength of Materials and mechanics of solids Vol-1 & 2 by B.C. Puunmia, Laxmi Publications, New Delhi,2013
2. Introduction to Engg mechanics of solids by Egor Popov.
3. Theory of structures by Ramamratam,jain book depot , New Delhi
4. James M. Gere, Stephen Timoshenko, Mechanics of materials, CBS Publisher ,2004.

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

II B.Tech I Semester (ME)	L	T	P	[C]
	3	1	0	[3]

(13ME302) FLUID MECHANICS AND HYDRAULIC MACHINERY

Objectives: This course gives an introduction to the fundamentals of fluid flow and its behavior so as to equip the students to learn related subjects and its application in the day to day life in a very effective manner

UNIT- I:

Introduction: Dimensions and units – physical properties of fluids, specific gravity, viscosity, surface tension and capillarity, vapor pressure and their influences on fluid motion. Newtonian and non Newtonian fluids. Fluid Pressure at a Point; Pascal's law, Hydrostatic law, Atmospheric, Absolute and gauge pressure; Hydrostatic paradox, Pressure measurement manometers; Simple, differential and Micro Manometers

Kinematics of Fluid Motion: Methods of describing fluid motion; Classification of flow; Steady, unsteady, uniform and non-uniform flows; Laminar and turbulent flows; Three, two and one dimensional flows; Irrotational and rotational flows; Streamline; Pathline; Streakline; Equation for acceleration; Convective accelaration; Local acceleration; Continuity equation; Velocity potential and stream function.

UNIT – II:

Dynamics of Fluid Flow: Forces acting on a Fluid in Motion; Euler's equation of motion; Bernoulli's equation ; Energy correction factor; Momentum principle; Force exerted on a pipe bend. Discharge through Venturi Meter; Discharge through Orifice Meter; Discharge through flow nozzle; Measurement of velocity by Pitot tube,pitot-static tube.

Closed Conduct Flow: Energy losses in pipelines; Darcy – Weisbach equation; Minor losses in pipelines; Hydraulic Grade Line and Total Energy Line; Concept of equivalent length; Hydraulic power transmission through a pipe; Siphon; Pipes in series, parallel & branched pipes.

UNIT – III:

Basics of Turbo Machinery: Hydrodynamic force of jets on stationary and moving flat, inclined and curved vanes, jet striking centrally and at tip, velocity triangles at inlet and outlet, expressions for work done and efficiency-Angular momentum principle, Torque and head transferred in roto dynamic machines.

Hydraulic Turbines-I: Introduction, head and efficiencies of hydraulic turbines, Classification of turbines; pelton wheel: parts, Velocity triangles, work done and efficiency, working proportions, design of pelton wheel. Radial flow reaction turbines: velocity triangles and work done for inward radial flow turbine, degree of reaction, discharge, speed ratio, flow ratio.

UNIT – IV:

Hydraulic Turbines-II: Francis turbine: main components and working, work done and efficiencies, design proportions; design of francis turbine runner. Kaplan turbine: main components and working, working proportions. Draft tube: theory and efficiency; specific speed, unit quantities, characteristic curves of hydraulic turbines. Cavitation: causes, effects.

Centrifugal Pumps: Introduction, component parts and working of a centrifugal pump, work done by the impeller; heads, losses and efficiencies; minimum starting speed; Priming ;specific speed; limitation of suction lift, net positive suction head(NPSH);Performance and characteristic curves; Cavitation effects ;Multistage centrifugal pumps; troubles and remedies.

Text Books:

1. Hydraulics & Fluid Mechanics by P. N. Modi & S. N. Seth; Standard Book house, New Delhi
2. Fluid Mechanics & Hydraulic Machines by Dr. R. K. Bansal; Laxmi Publications, New Delhi.

Reference Books:

1. Hydraulic Machines by Jagdish Lal, Metropolitan.
2. A. K. Jain; Fluid Mechanics, Khanna Publishers, Delhi
3. Rajput, Fluid mechanics and fluid machines, S.Chand &Co.
4. D.S. Kumar Kataria, Fluid Mechanics & Fluid Power Engineering ,Publishers: D.S. Kumar Kataria&Sons.
5. K R Arora, Fluid Mechanics, Hydraulics and Hydraulic Machines ,Standard Publishers
6. Kumar K.L., Engineering Fluid Mechanics , Eurasia Publishing House (P) Ltd., New Delhi

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

II B.Tech I Semester (ME)	L	T	P	[C]
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(13ME303) THERMODYNAMICS

Objectives: By this subject students will get the awareness on basic thermodynamic principles, skills to perform the analysis and design of thermodynamic systems, First law and second law of thermodynamics and its applications to a wide variety of systems, principles of psychrometry and properties of pure substances. And also understand the concept of various air standard cycles with the help of P-V and T-S Diagrams.

UNIT – I:

Basic Concepts: Macroscopic and Microscopic Approaches, Thermodynamic System, State, Property, Process and Cycle, Quasi Static Process, Thermodynamic Equilibrium, Quasi-static Process, Zeroth Law of Thermodynamics,

Work & Heat Transfer: Work transfer, types of work transfers, Point and Path Functions, Heat transfer, Comparison of Work and Heat transfers.

First Law of Thermodynamics: First Law applied to a process and a cycle, Energy - a Property, Forms and transformation of Energy, Internal Energy and Enthalpy, PMM I.

UNIT-II:

Flow Systems: Control Volume, Steady Flow Process, Mass balance and Energy Balance, Applications of Steady Flow Processes.

Second Law of Thermodynamics: Heat Engine, Statements of Second law and their equivalence, Refrigeration and Heat Pump, Reversibility and Irreversibility, Carnot cycle and Carnot's Theorem, Thermodynamic Temperature Scale, Efficiency of Heat Engine, PMM II

Entropy: Clausius' Theorem, Entropy as a property, T-s Plot, Clausius Inequality, Principle of Entropy Increase and its applications. Available Energy, Quality of Energy, definitions of dead state, Availability.

UNIT-III:

Pure Substances: P-V, P-T, T-S diagrams of Pure Substances, Mollier Diagram, Dryness Fraction, Use of Steam Tables for Thermodynamic Properties

Thermodynamic Relations: Maxwell's equations, TDS equations, Joule-Kelvin Effect, Clausius-clapeyron equation.

UNIT-IV:

Properties of Gases and Gas Mixtures: Ideal Gas, Equation of State, Avogadro's Law, Internal Energy and Enthalpy of Ideal Gas, Entropy Change of Ideal Gas, Mixture of Gases-Dalton's Law of Partial Pressure , Specific Heats, Internal Energy and Enthalpy of Gas Mixtures

Gas Power Cycles: Carnot Cycle, Sterling Cycle, Ericson Cycle, Otto Cycle, Diesel Cycle, Dual Cycle, their applications, comparison of Otto, Diesel and Dual cycles, Second Law Analysis of Gas Power Cycles

Text Books:

1. Engineering Thermodynamics, P.K Nag, TMH Publishers, New Delhi, 5th Edition, 2013.

Reference Books:

1. Engineering Thermodynamics by P. Chattopadhyam, Oxford,1st Revised ,2011.
2. Fundamentals of Thermodynamics – Sonntag, Borgnakke and van wylen, John Wiley & sons (ASIA) Pte Ltd, 7th Edition, 2009.
3. Thermodynamics – An Engineering Approach – YunusCengel& Boles, TMH,7th Edition 2011.
4. Thermodynamics – J.P.Holman, McGrawHill, 2nd Edition company New York 1975.
5. An introduction to Thermodynamics, YVC Rao, Universities press, 2009 Revised Edition,
6. Engineering Thermodynamics – J.B. Jones & R.E.Dugan, PHI ,1st Edition, 2009.

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

II B.Tech I Semester (ME)	L	T	P	[C]
	3	0	0	[3]

(13ME304) BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

Objectives: Because of dependency on electricity in day to day life, a reasonable understanding of the basics of applied electricity is important for every Engineer. The course content enables students to understand the fundamentals of electricity and magnetism, and get a comprehensive idea about circuit analysis and working principles of electrical machines.

UNIT-I:
DC Machines:
DC Generator:
Principle of operation of dc generator, Types of DC generators, EMF equation of a dc generator ,OCC of a DC Shunt Generator(Simple problems).
DC Motor:
Principle of operation of DC motor, Types of DC Motors, back emf, Torque equation, losses & efficiency calculation, Swinburne's test

UNIT-II:
A.C Machines:
Transformers : Principles of operation, Constructional Details, Ideal Transformer and Practical Transformer, EMF equation, Losses, Transformer tests (OC and SC), efficiency and regulation calculations (simple problems)
Three phase induction motor:
Construction and principle of operation, slip and rotor frequency, Slip-torque Characteristics(Simple Problems).

UNIT-III:
Semiconductor Devices: Intrinsic semiconductors-Electron-Hole Pair Generation, Conduction in Intrinsic Semiconductors, Extrinsic Semiconductors-N-Type and P-Type Semiconductors, Comparison of N-Type and P-Type Semiconductors. The p-n Junction – Drift and Diffusion Currents, The p-n Junction Diode-Forward Bias, Reverse Bias, Volt-Ampere Characteristics- Diode Specifications, Applications of Diode, Diode as a Switch. Diode as a Rectifier-Half-wave Rectifier, Full-Wave Rectifier, Full-Wave Bridge Rectifier, Rectifiers with Filters, Zener Diode- Volt-Ampere Characteristics, Zener Diode as Voltage Regulator.

UNIT-IV:
BJT And FET: Bipolar Junction Transistor (BJT) – Types of Transistors, Operation of NPN and PNP Transistors, Input-Output Characteristics of BJT-CB, CE and CC Configurations, Relation between IC, IB and IE. Transistor Biasing- Fixed Bias, Voltage Divider Bias, Transistor Applications- Transistor as an Amplifier, Transistor as a Switch,. Junction Field Effect Transistor (JFET)- Theory and Operation of JFET.
Digital Electronics: Number Systems-Decimal System, Binary System, Octal System, Hexadecimal System, Code Conversions, Binary Arithmetic- Binary Addition, Binary Subtraction, Logic Gates and Truth Tables-NOT, OR, AND, EX-OR, EX-NOR, Universal Gates- NAND, NOR Gates. Boolean algebra and De Morgan's Theorems, Combinational Circuits-Adders and Subtractors

Semiconductor Memories: Introduction, Memory Organization and Operation, Classification and Characteristics Of Memories.

Text Books:

1. T K Nagasarkar, and M.S. Sukhija, Basic Electrical Engineering, Oxford University Press. Second Edition 2007
2. M.S.Naidu and S. Kamakshiah, Basic Electrical Engineering. TMH.3rd Edition 2009
3. Basic Electrical and Electronics Engineering, S.K Bhattacharya, Pearson Education, 2012.
4. Modern Digital Electronics, RP Jain, Tata MC Graw-Hill, 2010

Reference Books:

1. D P Kothari and I.J. Nagrath, Theory and solutions of Basic Electrical Engineering. PHI.2010
2. B.L Theraja&A.K.Theraja, "A Text Book of Electrical Technology", 23rd Revised Edition, S.Chand & Company Ltd., New Delhi, 2005.
3. H Cotton, "Advanced Electrical Technology", AH Wheeler & Co., 1990. Eugene C Lister, "Electric Circuits and Machines", New York, MCGraw-Hill, 1975.
4. V N Mittle & I Arvind Mittal, "Basic Electrical Technology",TMH 2nd edition, 2006. JB Gupta, "A Course in Electrical Technology", S K Kataria& Sons, 2003

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

II B.Tech I Semester (ME)	L	T	P	[C]
	3	0	0	[3]

(13ME305) MACHINE DRAWING

Objectives: To make the students to understand the concepts of I.S. conventions, methods of dimensioning, the title boxes, to draw the machine elements and simple parts. To make the students to understand and draw assemblies of machine parts and to draw their sectional views

UNIT – I:

Machine Drawing Conventions: Need for drawing conventions- introduction to IS conventions. Conventional representation of material, common machine elements and parts such as screws, nuts, bolts, keys, gears, webs, ribs. Parts not usually sectioned. Methods of dimensioning, general rules for sizes and placement of dimensions for holes, Centers curved and tapered features. Title boxes, their size, location and details-common abbreviations & their liberal usage

UNIT – II:

Drawing of Machine Elements and simple parts: Selection of Views, additional views for the Following machine elements and parts with drawing proportions: Popular forms of Screw threads, bolts, nuts, stud bolts, tap bolts, set screws, Keys, cottered joints and knuckle joint.

UNIT – III:

Riveted joints for plates flanged &protected flanged joint. Shaft coupling, spigot and socket pipe joint. Journal and foot step bearings.

UNIT – IV:

Assembly Drawings: Drawings of assembled views for the part drawings of the following. Engine parts- stuffing boxes, cross heads, Eccentrics, Petrol Engine-connecting rod, piston assembly. Other machine parts- Screw jack, Machine Vice, single tool post.
Valves: Steam stop valve, feed check valve. Non return value.

Text Books:

1. Machine Drawing- K.L. Narayana, P.Kannaiah & K.Venkata Reddy, New Age Publishers, 4th Edition, 2012.
2. Machine Drawing- Dhawan, S.Chand Publications, 1st Revised Edition, 1998.

Reference Books:

1. Machine Drawing- P.S. Gill, S.K. Kataria & Sons, 17th Edition, 2012.
2. Machine Drawing- Luzzader, PHI Publishers, 11th Edition.
3. Machine Drawing – Raj put, S. Chand Pub.
4. Textbook of Machine Drawing-K.C.Johns, 2009, PHI learning, 1st Edition.

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

II B.Tech I Semester (ME)	L	T	P	[C]
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(13ME306) MECHANICS OF SOLIDS LAB

Objectives: The experimental work involved in this laboratory should make the student understand the fundamental modes of loading of the structures and also make measurements of loads, displacements and strains. Relating these quantities, the student should be able to obtain the strength of material and stiffness properties of structural elements.

List of Exercises / Tests:

1. Tension test.
2. Bending test on simple support beam.
3. Bending test on continuous beam.
4. Torsion test.
5. Hardness test.
6. Spring test.
7. Compression test on wood or concrete
8. Impact test
9. Shear test
10. Verification of Maxwell's Reciprocal theorem on beams.
11. Use of electrical resistance strain gauges.
12. Continuous beam – deflection test.

List of Major Equipment:

1. UTM for conducting tension test on rods
2. Steel beam for flexure test.
3. Wooden beam for flexure test.
4. Torsion testing machine
5. Brinnel's/ Rocks hardness testing machine.
7. Compression testing machine
8. Izod Impact machine
9. Shear testing machine
10. Beam setup for Maxwell's theorem verification.
11. Continuous beam setup.
12. Electrical Resistance gauges.

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

II B.Tech I Semester (ME)

L	T	P	[C]
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(13ME307) FLUID MECHANICS AND HYDRAULIC MACHINERY LAB

Objective: The object of the course to make the students understand the fluid flow concepts and get familiarity with flow measuring devices, turbines and pumps.

List of Experiments:

1. Venturimeter : Determination of Coefficient of discharge.
2. Orificemeter : Determination of Coefficient of discharge.
3. Determination of friction factor of Pipes.
4. Determination of loss of head in pipes due to bends, sudden contractions and sudden expansion.
5. Verification of Bernoulli's equation.
6. Impact of jet on vanes.
7. Performance test on Pelton wheel turbine.
8. Performance test on Francis turbine.
9. Performance test on kaplan turbine.
10. Performance test on single stage centrifugal pump.
11. Performance test on multi stage centrifugal pump.
12. Performance test on reciprocating pump.

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

II B.Tech I Semester (ME)	**L**	**T**	**P**	**[C]**
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(13ME308) BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LAB

Objectives: To understand the concepts of electric circuits and the performance characteristics of machines. This laboratory course will give a thorough knowledge about the basics of circuit analysis, DC machines and transformers.

List of Experiments:

PART –A: ELECTRICAL LAB

1. Verification of Superposition theorem
2. Verification of Thevenin`s and Norton`s Equivalent circuits and Verification by direct Test
3. Magnetization characteristics of DC Shunt Generator. Determination of critical Resistance.
4. Swinburne`s Test on DC Shunt machine(Predetermination of efficiency of a given DC shunt machine working as motor and generator)
5. Brake Test on DC Shunt Motor. Determination of performance characteristics
6. OC and SC Test on single phase Transformer(Predetermination of efficiency and regulation at given power factors and determination of Equivalent circuit)

PART –B: ELECTRONICS LAB

1. Identification, Specifications and Testing of R, L, C components (colour codes),Potentiometers, Switches (SPDT, DPDT and DIP), Coils, Gang Condensers, Relays, Bread Boards, Identification and Specifications of active devices, Diodes, BJTs, Lowpower JFETs, MOSFETs, LEDs, LCDs, SCR, UJT, Linear and Digital Ics.
2. PN Junction Diode Characteristics (Forward bias, Reverse bias).
3. Zener Diode Characteristics and Zener as regulator.
4. Transistor CE Characteristics (Input and Output).
5. Rectifier with and without Filters (Full wave)
6. Characteristics of SCR

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

II B.Tech II Semester (ME)	L	T	P	[C]
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(13HS117) MATHEMATICS-III

Objectives: The Subject is aimed at developing the basic mathematical skills of engineering students that are imperative for effective understanding of engineering subjects. The topics introduced will serve as basic tools for specialized studies in many engineering fields.

UNIT – I:
Probability:
Sample space and events – The axioms of Probability – Some elementary theorems - Conditional probability – Baye's theorem

UNIT – II:
Random Variables and Probability Distributions:
Discrete and Continuous distributions – Distribution functions – Binomial, Poisson, and Normal distributions.
Population and samples - Sampling distribution of mean (with known and unknown variance), proportion, variances – Special Distributions: Student t - Distribution

Unit – III
Statistics:
Mean , Median , Mode and other measures of Central tendency – Dispersion or variation – The Range – The Mean Deviation – The Semi – interquartile Range - The 10 – 90 Percentile Range – The Standard Deviation – The Variance – Short Methods for computing the Standard Deviation – Properties of Standard Deviation – Moments – Skewness and Kurtosis

UNIT- IV:
Partial Differential Equations:
Formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions - Method of Separation of variables, Solutions of Wave equation, Heat equation and two dimensional Laplace equation under initial and boundary conditions (both Cartesian and Polar forms)

Text Books:

1. B.S.Grewal, Higher Engineering Mathematics, 42 Edition (2012), Khanna publishers.

Reference Books:

1. TKV Iyengar et al, Probability and Statistics, S.Chand Publications.
2. E. Rukmangadachari & E. Keshava Reddy, Engineering Mathematics, Volume - II, 1st Edition (2010) Pearson Publisher.
3. Erwin Kreyszig, Advanced Engineering, Mathematics, 10th Edition (2013),Wiley India.

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

II B.Tech II Semester (ME)	L	T	P	[C]
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(13HS118) MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS

Objectives: To explain the basic principles of managerial economics, accounting and current business Environment underlying business decision making

UNIT- I:
Introduction to Managerial Economics: Definition, Nature and Scope of Managerial Economics– Demand Analysis: Determinants, Law of Demand and its exceptions.
Elasticity of Demand: Types, Measurement and Significance of Elasticity of Demand. Demand Forecasting, methods, (survey methods, statistical methods, expert opinion method, test marketing, controlled experiments, judgmental approach to demand forecasting)

UNIT- II:
Theory of Production: Production Function – Isoquants and Isocosts, MRTS, Least Cost Combination of Inputs, Cobb-Douglas Production function, Laws of Returns, Internal and External Economies of Scale.
Cost Analysis: Cost concepts, Opportunity cost, Fixed vs. Variable costs, Explicit costs Vs. Implicit costs, Out of pocket costs vs. Imputed costs.
Break-Even Analysis: (BEA)-Determination of Break-Even Point (simple problems)
Market: Types of competition, Price-Output Determination in case of Perfect Competition and Monopoly, Monopolistic competition.
Methods of Pricing: Cost, competition, strategy based pricing

UNIT -III:
Business Types: Business, features, Sole Proprietorships, Partnerships, Joint Stock Companies, Public Enterprises and their types.
Capital and Capital Budgeting: Capital and its significance, Types and sources of raising finance. Nature and scope of Capital Budgeting, Features, Methods: Payback Method, Accounting Rate of Return Method (ARR) and Net Present Value Method (simple problems)

UNIT- IV:
Financial Accounting: Double-Entry Book Keeping, Journal, Ledger, Trial Balance- Final Accounts. (Simple Problems)
Financial Analysis through Ratios: Computation, Analysis and Interpretation of Liquidity Ratios (Current Ratio and quick ratio), Capital structure Ratios (Debt- Equity ratio, Interest Coverage ratio), Activity Ratios (Inventory turnover ratio and Debtor Turnover ratio), and Profitability ratios (Gross Profit Ratio, Net Profit ratio, Operating Ratio, P/E Ratio and EPS), (Simple Problems).

Text Books:
1. Aryasri: **"Managerial Economics and Financial Analysis",** TMH,2nd edition, 2005.
2. SA Siddiqui and AS Siddiqui **"Managerial Economics and Financial Analysis"**, New age international publishers.
3. Varshney & Maheswari: **"Managerial Economics"**, Sultan Chand, 2003.

Reference Books:

1. Raghunatha Reddy & Narasimhachary: **"Managerial Economics& Financial Analysis"**, Scitech,2009
2. V. Rajasekaran & R. Lalitha,**" Financial Accounting"**, Pearson Education, New Delhi,2010.
3. Suma Damodaran, **"Managerial Economics"**, Oxford University Press.
4. Domnick Salvatore: **"Managerial Economics In a Global Economy"**, Thomson, 4th Edition.
5. Subash Sharma & M.P. Vittal, "**Financial Accounting for management**"**, Text & Cases**, Machmillan 2008
6. S.N.Maheswari & S.K. Maheswari,**" Financial Accounting"**, Vikas,2008
7. Truet and Truet: **"Managerial Economics:Analysis", Problems and Cases**, Wiley,2009
8. Dwivedi:**"Managerial Economics"**, Vikas, 6th Edition,2009

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

II B.Tech II Semester (ME)	L	T	P	[C]
	3	1	0	[3]

(13ME401) THERMAL ENGINEERING-I

Objectives: The objective of this subject is to impart the knowledge of engine components, working principles of IC engines, auxiliary systems, and the combustion aspects of SI and CI engines in addition to the methods of improving performance. The students shall become aware on the latest developments in the field of IC engines like MPFI, CRDI etc. and also shall become familiar about the working of Reciprocating and Rotary Compressors. The student also shall apply the thermodynamic concepts in IC engines and compressors.

UNIT- I

I.C. Engines: Definition of Engine and Heat Engine, I.C Engine Classification – Parts of I.C.Engines, Working of I.C. Engines, Two Stroke & Four Stroke I.C.Engines SI & CI Engines, Valve and Port Timing Diagrams.

Fuel System: Fuel Supply Systems, carburetor types Air Filters, Mechanical and Electrical Fuel Pump – Filters– Fuel Injection Systems. Cooling & Lubrication Systems: Cooling Requirements, Air Cooling, Liquid Cooling, Thermo Siphon, Water And Forced Circulation System; Lubrication Systems-Flash, Pressurized and Mist Lubrication.

UNIT- II

Ignition System: Function of an Ignition System, Types of Ignition Systems, Battery coil Ignition System, Magneto Coil Ignition System

Combustion in IC Engines (SI and CI Engines): Normal Combustion and Abnormal Combustion – Importance of Flame Speed and Effect of Engine Variables – Type of Abnormal Combustion, Pre-Ignition and Knocking (Explanation) – Fuel Requirements and Fuel Rating, Anti Knock Additives, Combustion Chambers.

UNIT- III

Testing and Performance: Parameters 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- Sankey diagram and pie diagram.

UNIT- IV

Air Compressors: Reciprocating Compressors, Effect of Clearance volume in Compressors, Volumetric Efficiency, Single Stage and Multi Stage Compressors, Effect of Inter cooling and Pressure Drop in Multi - Stage Compressors, Problems Related to Reciprocating Compressors, Working principles of Roots blower, Vane type Blower, Centrifugal Compressor - Axial Flow Compressors – Principle of rotary compressors.

Text Books:

1. Internal Combustion Engines / V. Ganesan- TMH, 4th Edition,2012
2. Thermal Engineering / Rajput / Lakshmi Publications, 9th Edition,2013

Reference Books:

1. IC Engines – Mathur& Sharma – DhanpathRai& Sons, ,2010
2. Engineering fundamentals of IC Engines – Pulkrabek, Pearson, PHI, 2nd Edition,2009
3. Thermal Engineering, Rudramoorthy – TMH, 10th Edition,2010
4. Thermodynamics & Heat Engines, B. Yadav, Central publishing house., Allahabad, 2002
5. I.C. Engines fundamentals, Heywood, McGrawHIll, 1st Edition,2011
6. Thermal Engineering – R.S. Khurmi & J.K.Gupta – S.Chand, 15th Edition,2012

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

II B.Tech II Semester (ME)	L	T	P	[C]
	3	1	0	[3]

(13ME402) KINEMATICS OF MACHINERY

Objectives: The objective of this subject is to cover the kinematics and dynamics of planar single degree of freedom mechanisms. After this course the student should have general mathematical and computational skills to enable the kinematics and dynamics analysis of machine elements including linkages, cams and gears and also becomes familiar with gear terminology and drawing of the cam profiles

UNIT- I:

Mechanisms and Machines: Elements or Links – Classification – Rigid Link, flexible and fluid link. Types of kinematic pairs – sliding, turning, rolling, screw and spherical pairs – lower and higher pairs – closed and open pairs – constrained motion – completely, partially or successfully constrained and incompletely constrained. Mechanisms and machines – classification of mechanisms and machines – kinematic chain – inversion of mechanisms – inversions of quadric cycle chain – single and double slider crank chain. Mobility of mechanisms. Straight Line Motion. Mechanisms- Exact and approximate, copiers and generated types –Peaucellier, Hart and Scott Russel – Grasshopper, Watt, Tchebicheff and Robert Mechanisms. Pantograph.

UNIT – II:

Belt, Rope and Chain Drives : Introduction, Belt and rope drives, selection of belt drive- types of belt drives, materials used for belts and ropes, velocity ratio of belt drives, slip of belt, creep of belt, tensions for flat belt drive, angle of contact, centrifugal tension, maximum tension of belt, Chains-length, angular speed ratio, classification of chains.

Gears: Higher pairs, friction wheels and toothed gears – types – law of gearing, condition for constant velocity ratio for transmission of motion, Forms of tooth- cycloidal and involutes. Profiles-Velocity of sliding – phenomena of interference – Methods to avoid interference. Condition for minimum number of teeth to avoid interference, expressions for arc of contact and path of contact. Introduction to Helical, Bevel and worm gearing.

UNIT – III:

Kinematics: Velocity and Acceleration Diagrams- Velocity and acceleration – Motion of link in machine –Determination of Velocity and acceleration – Graphical method – Application of relative velocity method – Slider crank mechanism, four bar mechanism. Acceleration diagrams for simple mechanisms, Coriolis acceleration, and determination of Coriolis component of acceleration.Kleins construction. Analysis of slider crank mechanism for displacement, velocity and acceleration of slider using analytical method Instantaneous Centre Method: Instantaneous centre of rotation, centrode and axode – relative motion between two bodies – Three centers in-line theorem.

UNIT – IV:

Gear Trains: Introduction –Types of gears – Simple, compound, reverted and Epicycle gear trains. Train value – Methods of finding train value or velocity ratio – Tabular column method for Epicycle gear trains. Torque in epicycle gear trains. Differential gear of an automobile.

Cams: Definitions of cam and follower – uses – Types of followers and cams – Terminology.
Types of follower motion - Uniform velocity – Simple harmonic motion and uniform acceleration. Maximum velocity and maximum acceleration during outward and return strokes. Drawing of cam profiles.

Text Books:

1. Theory of Machines, S.S. Rattan, Tata McGraw Hill Publishers, 3rd Edition,2013.
2. Kinematics and dynamics of machinery, R.L Norton, Tata McGraw Hill Publishers,1st Edition, 2009.

Reference Books:

1. Theory of Machines and Mechanisms, 3rd Edition, J.E. Shiegley et. al, Oxford International Student Edition.
2. Theory of Machines, Thomas Bevan, Pearson (P) 3rd Edition, 2012.

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

II B.Tech II Semester (ME)	L	T	P	[C]
	3	1	0	[3]

(13ME403) MANUFACTURING TECHNOLOGY

Objectives: By this subject the students will understand how manufacturers use technology to change raw materials into finished products, the basic concepts of casting, pattern preparation, gating system and knowledge on basic features of various welding and cutting processes. And also to study the concepts of surface treatment process, their characteristics and applications.

UNIT-I:

Casting: Definition, elements, Steps involved in making a casting– Types of patterns – Patterns and Pattern making –– Materials used for patterns, pattern allowances and their Construction. Principles of Gating, Gating ratio and design of Gating systems, time of filling the cavity. Design of core prints, buoyancy principle. Moulds: definition, mould materials, types of moulds, moulding methods, moulding machines, tests. Solidification of casting – Concept – Solidification of pure metal and alloys, short & long freezing range alloys.

UNIT-II:

Special Casting Processes: Process Mechanics, characteristics, parameters and applications of Centrifugal, Die, and Investment casting. Risers – Types, function and design, casting design considerations, Design of feeding systems i.e., sprue, runner, gate and riser, moulding flasks

Methods of Melting: Crucible melting and cupola operation, steel making processes. Casting inspection and defects.

UNIT-III:

Introduction to Welding: Classification of welding processes, types of welds and welded joints and their Characteristics, Heat affected zones in welding, Design of welded joints, Arc Welding- (Shielded metal arc welding, submerged arc welding, TIG welding, MIG welding, Stud welding, Electro slag welding), Simple problems related to Arc Welding

UNIT-IV:

Gas Welding: Induction Welding, Explosive Welding, Forge welding, Résistance Welding, Ultra sonic welding, Friction Welding, Thermit welding and Plasma (Air and water) welding, Oxy – Acetylene Gas cutting, water plasma. Cutting of ferrous, nonferrous metals, Electron Beam Welding, Laser Beam Welding, Soldering & Brazing and adhesive bonding.

Mechanics: Process parameters, Simple problems related to Gas Welding and Resistance Welding. Welding defects – causes and remedies – destructive and nondestructive testing of welds.

Text Books:

1. Manufacturing Technology, Vol. I P.N. Rao, Tata Mc Graw Hill, 4th Edition, 2013
2. Manufacturing Technology, Kalpakjain, Pearson education, 4th Edition, 2002

Reference books:

1. Production Technology, K.L Narayana, I.K. International Pub, 3rd Edition , 2013
2. Manufacturing Process Vol. I, H.S.Shah Pearson, 2013,
3. Principles of Metal Castings, Rosenthal, Tata Mc Graw Hill, 2nd Edition,2001
4. Welding Process, Par mar.
5. Manufacturing Technology, R.K. Rajput, Laxmi Pub, 1st Edition, 2007
6. Workshop Technology – B.S.RaghuVamshi – Vol I.

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

II B.Tech II Semester (ME)	L	T	P	[C]
	3	0	0	[3]

(13ME404) MATERIAL SCIENCE AND METALLURGY

Objectives: To make the student to understand the basic fundamental of material science and physical metallurgy. The basic concepts to be taught will help for the improvement, proper selection and effective utilization of materials which is essential to satisfy the ever increasing demands of the society.

UNIT-I:

Structure of Metals: Bonds in Solids – Metallic bond - crystallization of metals, grain and grain boundaries, effect of grain boundaries on the properties of metal / alloys – determination of grain size.

Constitution of Alloys: Necessity of alloying, types of solid solutions, Hume Rotherys rules, intermediate alloy phases, and electron compounds.

Equilibrium of Diagrams : Experimental methods of construction of equilibrium diagrams, Isomorphous alloy systems, equilibrium cooling and heating of alloys, Lever rule, coring miscibility gaps, eutectic systems, congruent melting intermediate phases, peritectic reaction. Transformations in the solid state – allotropy, eutectoid, peritectoid reactions, phase rule, relationship between equilibrium diagrams and properties of alloys. Study of important binary phase diagrams of Cu-Ni-, Al-Cu, Bi-Cd, Cu-An, Cus-Sn and Fe-Fe3C.

UNIT-II:

Cast Irons and Steels: Structure and properties of White Cast iron, Malleable Cast iron, grey cast iron, Spheriodal graphite cast iron, Alloy cast irons. Classification of steels, structure and properties of plain carbon steels, Low alloy steels, Hadfield manganese steels, tool and die steels.

Non-ferrous Metals and Alloys: Structure and properties of copper and its alloys, Aluminum and its Alloys, Titanium and its alloys.

UNIT-III:

Heat treatment of Alloys: Effect of alloying elements on Fe-Fe3C system, Annealing, normalizing, Hardening, TTT diagrams, tempering , Harden ability, surface - hardening methods, Age hardening treatment, Cryogenic treatment of alloys.

UNIT-IV:

Ceramic Materials: Crystalline ceramics, glasses, cermaets, abrasive materials, nanomaterials – definition, properties and applications of the above.

Composite Materials: Classification of composites, various types of metal matrix composites. Particle – reinforced materials, fiber reinforced materials, metal ceramic mixtures, metal – matrix composites and C – C composites. Polymer Composites.

Text Books:

1. Introduction to Physical Metallurgy / Sidney H. Avener.
2. Essential of Materials science and engineering/ Donald R.Askeland/Thomson.

Reference Books:

1. Material Science and Metallurgy/kodgire.
2. Science of Engineering Materials / Agarwal
3. Materials Science and engineering / William and collister.
4. Elements of Material science / V. Rahghavan
5. An introduction to material science / W.g.vinas & HL Mancini
6. Material science & material / C.D.Yesudian & Harris Samuel
7. Engineering Materials and Their Applications – R. A Flinn and P K Trojan / Jaico Books.
8. Engineering materials and metallurgy/R.K.Rajput/ S.Chand.

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AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

II B.Tech II Semester (ME)	L	T	P	[C]
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(13ME406) THERMAL ENGINEERING LAB-I

Objectives: To impart practical exposure to the students on the performance evaluation methods of various types of internal combustion engines and compressors.

List of Experiments:

1. Determination of Viscosity – Saybolt Viscometer
2. Calorific value determination by Bomb Calorimeter
3. Calorific value determination by Junker's gas calorimeter.
4. Cloud point and Pour point Apparatus
5. Valve Timing Diagram of Four Stroke CI Engine
6. Port Timing Diagram of Two Stroke SI Engine
7. I.C. Engines Performance Test (4 -Stroke Diesel Engines)
8. To find the Engine Performance Characteristics by applying different loads on 2-Stroke SI Engine
9. Study of Boilers
10. I.C.Engines Air/Fuel Ratio and Volumetric Efficiency

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

II B.Tech II Semester (ME)	L	T	P	[C]
	0	0	3	[2]

(13ME407) PRODUCTION TECHNOLOGY LAB

Objectives: The Engineering Workshop for engineers is a training lab course. It imparts the required knowledge about producing the Products particular joining methods, manufacturing methods among the students through which they will get an idea about shop floor level, a manufacturing section in industry.

1: Trades for Exercises:

(a) Pattern Design and Making

1. Single Piece Pattern
2. Split Piece Pattern

(b) Sand Properties Testing

1. Sieve Analysis
2. Permeability and strength tests

(c) Gas Welding

1. TIG Welding
2. Spot Welding

(d) Plastic Moulding:

1. Injection Moulding
2. Blow Moulding

(e) Press Working Operations

1. Blanking
2. Cup drawing

Reference Books:

1. Engineering Work shop practice, V. Ramesh Babu, VRB Publishers Private Limited, 2009
2. Work shop Manual, P.Kannaiah and K.L.Narayana, SciTech Publishers, 2009
3. Workshop Practice Manual, K. Venkata Reddy, BS Publications,

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

II B.Tech II Semester (ME)	L	T	P	[C]
	0	0	3	[2]

(13ME408) METALLURGY LAB

Objectives: The experimental work involved in this laboratory will make the student to understand the fundamental concepts and possess knowledge on the evaluation of material properties.

List of Exercises:

1. Preparation and study of the Micro Structure of pure metals like Iron, Cu and Al.
2. Preparation and study of the Microstructure of Mild steels, low carbon steels, high – C Steels.
3. Study of the Micro Structures of Cast Irons.
4. Study of the Micro Structures of Non-Ferrous alloys.
5. Study of the Micro structures of Heat treated steels.
6. Hardeneability of steels by Jominy End Quench Test.
7. To find out the hardness of various treated and untreated steels.

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

II B.Tech II Semester (ME)	**L**	**T**	**P**	**[C]**
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(13ME409) TECHNICAL SEMINAR-I

Objectives: To get involved with the latest advancements and developments to enhance communication and presentation skills, exchange of ideas, greater connectivity to develop a research bent of mind.

A Technical Seminar shall have two components, one chosen by the student from the course work as an extension and approved by the faculty supervisor. The other component is suggested by the supervisor and can be a reproduction of the concept in any standard research paper or an extension of concept from earlier course work. A hard copy of the information on seminar topic in the form of a report is to be submitted for evaluation along with presentation. The presentation of the seminar topics shall be made before a committee consisting of Head of the department, seminar supervisor and a senior faculty member. Each Technical Seminar shall be evaluated for 100 marks. Technical Seminar component-I for 50 marks and component-II for 50 marks making total 100 marks. (**Distribution of marks for 50:** 10 marks for report, 10 marks for subject content, 20 marks for presentation and 10 marks for queries).

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

III B.Tech I Semester (ME)

L	T	P	[C]
2	0	0	[2]

(13HS121) QUALITATIVE AND QUANTITATIVE ANALYSIS

Objectives: To determine and measure the one's ability thorough advanced training, some specific set of skills (intellectual, motor and so on), the subject assumes that professional potential and special abilities developed.

UNIT – I:

Simple Arithmetic -Number - H.C.F. & L.C.M. of Numbers – Decimal Fractions – Simplification – Square Root and Cube Root – Average – Problems on Numbers – Problems on Ages – Percentage – Profit & Loss – Ratio & Proportion-Partnership – Chain Rule – Time & Work – Pipes & Cisterns – Time & Distance – Problems on Trains – Boats & Streams – Allegation or Mixture – Simple Interest – Compound Interest – Area Volume & Surface Areas – Volume & Surface Areas – Calendar – Clocks – Races & Games of Skill – Number Series – Tabulation – Pi –Chart – Bar Diagram – Line Graphs.

UNIT– II:

Reasoning (Verbal and Non-Verbal) -Series Completion – Analogy – Coding–Decoding – Classification – Blood Relations – Puzzle test – Sequential output tracing - Direction Sense test – Logical Venn diagrams – Alphabet test – Alpha-Numeric Sequence puzzle – Number, Ranking and time sequence test – Mathematical operations – Logical sequence of words – Arithmetical reasoning – Insert the missing character – Data sufficiency – Eligibility test – Assertion and reason – Situation reaction test – Verification of Truth of the Statement - –Cubes and dice.

UNIT – III:

Logical deductions, Non verbal reasoning

Logic – Statement-Arguments – Statement-Assumptions – Statement-Course of action – Statement-Conclusions – Deriving conclusion from passages – Theme deduction – Cause and effect reasoning

UNIT – IV:

Reading Comprehension- Purpose of reading, reading rates, improving comprehension skills, techniques for good comprehension, skimming, scanning, determining the meaning of words, different styles of worked out problems.

Text Books:

1. RS Agarwal , A textbook on Quantitative Aptitude.
2. RS Agarwal, A textbook on verbal and nonverbal reasoning .
3. Meenakshi Raman and Sangeeth Sarma, Technical Communication.

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

III B.Tech I Semester (ME)	L	T	P	[C]
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(13ME501) THERMAL ENGINEERING -II

Objectives: The objective of this subject is to impart the knowledge of engine components, working principles of boilers, steam nozzles. The students shall become aware on the latest developments in the field of steam turbines; gas turbines etc. and also shall become familiar about the working of jet propulsions and rocket.

UNIT-I

Basic Concepts: Rankine cycle - Schematic layout, Thermodynamic Analysis, Concept of Mean temperature of Heat addition, Methods to improve cycle performance – Regeneration & reheating. Combustion: fuels and combustion, concepts of heat of reaction, adiabatic flame temperature, stoichiometry, and Fluel gas analysis.

Boilers : Classification – Working principles – with sketches including H.P.Boilers – Mountings and accessories – Working principles, Boiler horse power, equivalent evaporation, efficiency and heat balance – Draught, classification – Height of chimney for given draught and discharge, condition for maximum discharge, efficiency of chimney – artificial draught, induced and forced.

UNIT-II

Steam Nozzles : Function of nozzle – applications - types, Flow through nozzles, thermodynamic analysis – assumptions -velocity of nozzle at exit-Ideal and actual expansion in nozzle, velocity coefficient, condition for maximum discharge, critical pressure ratio, criteria to decide nozzle shape: Super saturated flow, its effects, degree of super saturation and degree of under cooling - Wilson line.

Condensers: Classifications, air leakage, vacuum efficiency, condenser efficiency and problems.

UNIT-III

Impulse Turbine: Mechanical Details – Velocity Diagram – Effect of friction – Power developed Axial Thrust blade or Diagram Efficiency – Condition for Maximum Efficiency. De-Laval Turbine- its features. Methods to reduce Rotor Speed – Velocity Compounding and Pressure Compounding, Velocity and Pressure variation along the flow – Combined velocity diagram for a velocity compounded Impulse Turbine

Reaction Turbine Mechanical details – principle of operation, thermodynamic analysis of a stage, degree of reaction –velocity diagram – Parson's reaction turbine – condition for maximum efficiency.

UNIT-IV

Gas Turbines : Simple gas turbine plant – Ideal cycle, essential components – parameters of performance– actual cycle – regeneration, inter cooling and reheating –Closed and Semi-closed cycles – merits and demerits, Brief concepts about compressors, combustion chambers and turbines of Gas Turbine Plant.

Jet Propulsion: Principle of Operation –Classification of jet propulsive engines – Working Principles with schematic diagrams and representation on T-S diagram - Thrust, Thrust Power and Propulsion Efficiency – Turbo jet engines – Needs and Demands met by Turbo jet – Schematic Diagram, Thermodynamic Cycle, Performance Evaluation Thrust Augmentation – Methods.

Text Books:

1. Thermal Engineering / R.K. Rajput / Lakshmi Publications
2. Gas Turbines – V.Ganesan /TMH

Reference Books:

1. Thermodynamics and Heat Engines / R. Yadav / Central Book Depot
2. Gas Turbines and Propulsive Systems – P.Khajuria & S.P.Dubey - /Dhanpatrai
3. Gas Turbines / Cohen, Rogers and Saravana Muttoo / Addison Wesley – Longman
4. Thermal Engineering-R.S Khurmi/JS Gupta/S.Chand.
5. Thermal Engineering-P.L.Ballaney/ Khanna publishers.
6. Thermal Engineering-M.L.Marthur & Mehta/Jain bros.

Web References: NPTEL

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

III B.Tech I Semester (ME)	L	T	P	[C]
	3	1	0	[3]

(13ME502) DYNAMICS OF MACHINERY

Objectives: The objective of this subject is to cover the dynamics of planar single degree of freedom mechanisms. After this course the student should have general mathematical and computational skills to enable the dynamics analysis of machine elements including clutches, brakes and governors and also becomes familiar with balancing of reciprocating masses and vibrations.

UNIT-I

Precession: Gyroscopes, effect of precession motion on the stability of moving vehicles such as motor car, motor cycle, aero planes and ships.

Friction: Inclined plane, friction of screw and nuts, pivot and collar, uniform pressure, uniform wear, Friction circle and friction axis: lubricated surfaces, boundary friction, film lubrication

UNIT-II

Clutches: Friction clutches- Single Disc or plate clutch, Multiple Disc Clutch, Cone Clutch, Centrifugal Clutch.

Brakes and Dynamometers: Simple block brakes, internal expanding brake, band brake of vehicle. Dynamometers – absorption and transmission types. General description and methods of Operation.

Turning Moment Diagram and Fly Wheels: Turning moment diagrams for steam engine, I.C. Engine and multi cylinder engine. Crank effort - coefficient of Fluctuation of energy, coefficient of Fluctuation of speed – Fly wheels and their design.

UNIT-III

Governors: Watt, Porter and Proell governors. Spring loaded governors – Hartnell and Hartung governors with auxiliary springs. Sensitiveness, isochronisms and hunting –effort and power of a governor.

Balancing: Balancing of rotating masses - single and multiple – single and different planes.

UNIT-IV

Balancing of Reciprocating Masses: Primary, Secondary and higher balancing of reciprocating masses. Analytical and graphical methods. Unbalanced forces and couples – V, multi cylinder, in -line and radial engines for primary and secondary balancing, locomotive balancing – Hammer blow, Swaying couple, variation of tractive force.

Vibrations: Free Vibration of mass attached to vertical spring – oscillation of pendulums, centers of oscillation and suspension. Transverse loads, vibrations of beams with concentrated and distributed loads. Dunkerly's method, Raleigh's method. Whirling of shafts, critical speeds, and torsional vibrations, two and three rotor systems. Simple problems on forced, damped vibration, Vibration Isolation & Transmissibility.

Text Books:

1. Theory of Machines / S.S Ratan/ Mc. Graw Hill Publ.
2. Theory of machines / Khurmi/S.Chand.

Reference Books:

1. Mechanism and Machine Theory / JS Rao and RVDukkipati / New Age
2. Dynamics of Machinery/Balleney/Dhanpat Rai
3. Theory of Machines / Thomas Bevan / CBS Publishers
4. Theory of Machines / Jagadish Lal & J.M.Shah /Metropolitan.

Web References: NPTEL

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

III B.Tech I Semester (ME)

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(13ME503) MACHINE TOOLS

Objectives: The objective of this subject is to make the student to understand the elementary treatment of metal cutting theory, principle and working of engine lathe, shaping, slotting and drilling, boring machines. Further the student shall be able to understand the principles of working of milling, grinding, honing machines and the design of jigs and fixtures.

UNIT- I

Introduction to Metal Cutting Theory: Elements of cutting process – Geometry of single point tool and angles chip formation and types of chips, its effects, chip breakers. Mechanics of Orthogonal cutting –Merchant's Force diagram, cutting forces – cutting speeds, feed, depth of cut, tool life, economics- machinability, Tool materials, coolants.

Engine lathe – Principle of working, specification of lathe – types of lathes – work holders, tool holders – Box Tools, Taper turning, thread turning and attachments for Lathes. Turret and capstan lathes – collet chucks – other work holders – tool holding devices – box and tool layout. Principal features of automatic lathes – classification – Single spindle and multi-spindle automatic lathes– tool layout and cam design.

UNIT- II

Shaping, Slotting and planning machines – their Principles of working – Principal parts – specification, classification, Operations performed. Kinematic scheme of the shaping slotting and planning machines, machining time calculations.

Drilling and Boring Machines – Principles of working, specifications, types, operations performed – tool holding devices – twist drill – Boring machines – Fine boring machines – Jig Boring machine. Deep hole drilling machine. Kinematics scheme of the drilling and boring machines

UNIT-III

Milling machine – Principles of working – specifications – classifications of milling machines – Principal features of horizontal, vertical and universal milling machines – machining operations, Types and geometry of milling cutters– methods of indexing – Accessories to milling machines.

Grinding machine –Theory of grinding – classification of grinding machine – cylindrical and Surface grinding machine – Tool and cutter grinding machine – special types of grinding machines – Grinding wheel: Different types of abrasives – bonds, specification and selection of a grinding wheel

UNIT-IV

Lapping, Honing and Broaching Machines: Constructional features, Machining time calculations and Applications.

Design of Jigs and fixtures: Classification of Jigs & Fixtures – Principles of location and clamping – Types of clamping & work holding devices. Typical examples of jigs and Fixtures.

Text Books:

1. Production Technology by R.K. Jain and S.C. Gupta.
2. Workshop Technology – B.S.Raghu Vamshi – Vol II

Reference Books:

1. Machine Tools – C.Elanchezhian and M. Vijayan / Anuradha Agencies Publishers.
2. Manufacturing Technology-Kalpakzian- Pearson.
3. Production Technology by H.M.T. (Hindustan Machine Tools).

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

III B.Tech I Semester (ME)	L	T	P	[C]
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(13ME504) DESIGN OF MACHINE ELEMENTS-I

Objectives: To make the students to understand the design consideration and stresses in machine members and the strength of machine elements. To understand the design of bolted joints, cotters and knuckle joints, shafts, keys and couplings.

UNIT - I

Introduction: General considerations of design, design process. Selection of Engineering Materials - properties – Manufacturing considerations in the design. BIS codes of materials. Preferred numbers.
Stresses in Machine Members: Simple stresses – Combined stresses – Torsional and bending Stresses – impact stresses – stress -strain relation – Various theories of failure – Factor of safety – Design for strength and rigidity. Concept of stiffness in tension, bending, torsion and Combined cases.

UNIT - II

Strength of Machine Elements: Stress concentration –notch sensitivity – Design for fluctuating stresses – Endurance limit – Estimation of Endurance strength – Goodman's line – Soderberg's line.
Riveted Joints: Types of riveted joints, design of riveted joints. Boiler shell riveting, eccentric loading.

UNIT -III

Bolted Joints – Forms of Screw threads. Stresses in Screw fasteners. Design of bolts with pre-stresses – Design of joints under eccentric loading– Bolts of uniform strength.
Cotters and Knuckle Joints: Design of Cotter joints: spigot and socket, sleeve and cotter, jib and cotter joints- Knuckle joints.

UNIT - IV

Shafts: Design of solid and hollow shafts for strength and rigidity – Design of shafts for combined bending and axial loads – Shaft sizes – BIS code.
Keys and Couplings: Design of Rigid couplings: Muff, Split muff and Flange couplings Flexible couplings.

Text Books:

1. Machine design / Schaum's Series.
2. Machine design – Pandya & shah.

Reference Books:

1. Machine design- J.E.Shigley
2. Machine design- R S Khurmi and J K Gupta
3. Design of Machine Elements - M.F.Spotts-PHI
4. Machine Design - Kannaiah/ SciTech.

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

III B.Tech I Semester (ME)	L	T	P	[C]
	3	0	0	[3]

(13ME505) PRODUCTION DRAWING

Objectives: To make the students to understand the conventional representation of parts, limits and fits tolerances to draw the machine elements and simple parts. To make the students to understand and draw part drawing of machine parts and to draw their sectional views.

UNIT -I

Conventional representation of Materials – conventional representation of parts – screw joints, welded joints, springs, gears, electrical, hydraulic and pneumatic circuits – methods of indicating notes on drawings.

Limits and Fits: Types of fits, exercises involving selection / interpretation of fits and estimation of limits from tables.

UNIT-II

Form and Positional Tolerances: Introduction and indication of the tolerances of from and position on drawings, deformation of run out and total run out and their indication.

Surface roughness and its indication: Definitions – finishes obtainable from various manufacturing Processes, recommended surface roughness on mechanical components.

UNIT -III

Heat treatment and surface treatment symbols used on drawings

UNIT - IV

Detailed and Part drawings: Drawing of parts from assembly drawings with indications of size, tolerances, roughness, form and position errors etc.

Part drawing using computer aided drafting by CAD software

Text Books:

1. Production and Drawing – K.L. Narayana & P. Kannaiah/ New Age
2. Machine Drawing with Auto CAD- Pohit and Gosh, PE

Reference Books:

1. Geometric dimensioning and tolerancing- James D. Meadows/ B.S Publications
2. Engineering Metrology, R.K. Jain, Khanna Publications

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

III B.Tech I Semester (ME)	L	T	P	[C]
	3	0	0	[3]

(13ME506) INDUSTRIAL ENGINEERING AND MANAGEMENT

Objectives: To make students learn the basic concepts of management and organisation and designing organizational structures. To provide understanding of plant location and work study, material management. To introduce the materials management, PERT/CPM .To impart the knowledge of inspection and quality control techniques.

UNIT -I

Introduction to Management: Definition, Levels of Management, Functions of Management, Role and Importance of Management, Types of Management, Social responsibility of Management – Evolution of Management Thought : Taylor's Scientific Management, Fayol's Principles of Management, Douglas Mc-Gregor's Theory X and Theory Y, Hertzberg's Two Factor Theory of Motivation, Maslow's Hierarchy Of Human Needs – Systems Approach to Management.

UNIT - II

Organizational Structures: Basic concepts related to Organisation - Departmentation and Decentralization, Types of mechanistic and organic structures of organisation (Line organization, Line and staff Organization, functional organization, Committee organization, matrix organization, Virtual Organisation, Cellular Organisation, team structure, boundaryless organization, inverted pyramid structure, lean and flat Organization structure) and their merits, demerits and suitability.

UNIT- III

Plant Location and Plant Layout:: Types of production, Plant location, definition, factors affecting the plant location, comparison of rural and urban sites-methods for Selection of plant. Plant Layout – definition, objectives, types of plant Layout – Principles of material handling.

Function of Production Planning and Control: Phases, Forecasting, Planning, Scheduling, Controlling, Follow up and expediting.

Project Management: Introduction to PERT / CPM, GANTT charts, Uses of Network analysis, Rules for Network Construction, Difference between PERT and CPM, Determination of Critical Path-probability of completing the Project, critical path calculation, Types of floats, introduction to crashing.

UNIT- IV

Introduction to Human Resource Management: Functions of HRM, Job Evaluation, different types of evaluation Methods. Job description, Merit Rating, Performance Appraisal, Wage and Salary Administration, Introduction to Factory Act and Workman Compensation Act.

Marketing Management: Selling, Marketing, Marketing Functions, Centralization and Decentralization, marketing strategies, distribution channels.

Text Books:

1. Amrine, Manufacturing Organization and Management, Pearson, 2nd Edition, 2004.
2. Industrial Engineering and Management O.P. Khanna Dhanpat Rai.
3. Management Science – A.R.Aryasri, TMH.

Reference Books:

1. Stoner, Freeman, Gilbert, *Management*, 6th Ed, Pearson Education, New Delhi, 2005.
2. Panner Selvam, Production and Operations Management, PHI, 2004.
3. Dr. C. Nadha Muni Reddy and Dr. K. Vijaya Kumar Reddy, Reliability Engineering & Quality Engineering,
Galgotia Publications, Pvt., Limited.
4. Ralph M Barnes, Motion and Time Studies, John Wiley and Sons, 2004.
5. Chase, Jacobs, Aquilano, Operations Management, TMH 10th Edition, 2003.
6. L.S.Srinath, PERT / CPM affiliate East-West Press, New Delhi, 2000.
7. Gary Dessler, Human Resource Management, Pearson Education Asia, 2002.
8. Phillip Kotler, Marketing Management, Pearson, 2004.
9. A.R.Aryasri, Management Science for JNTU (B.Tech), Tata McGraw-Hill, 2002.

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

III B.Tech I Semester (ME)	L	T	P	[C]
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(13ME507) THERMAL ENGINEERING LAB-II

Objectives: To impart practical exposure to the students on the performance evaluation of reciprocating air compressor and determination of COP of a refrigeration system.

List of Experiments:

1. Evaluation of Engine friction by conducting Morse test on 4-Stroke Multi cylinder Petrol Engine
2. Conduct retardation test on 4- stroke diesel engine
3. Conduct Heat Balance sheet on 4-stroke diesel engine
4. Performance Test on Variable Compression Ratio Engines, economical speed test.
5. Dis-assembly / Assembly of Engines.
6. Performance Test on Reciprocating Air – Compressor Unit.
7. Performance test on single/two stage reciprocating air compressor.
8. Study of Steam Generators and Turbines.
9. Conduct motoring test on 4-stroke diesel Engine.
10. Measurement of exhaust gas emissions by using gas analyzer.

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

III B.Tech I Semester (ME)

L	T	P	[C]
0	0	3	[2]

(13ME508) MACHINE TOOLS LAB

Objectives: To impart knowledge of different machine tools used in machine shop such as Lathe, Drilling Machine, Milling Machine, Shaper, Planing Machine, Slotting Machine, Cylindrical Grinder, Surface Grinder

List of Experiments:

1. Introduction of General Purpose Machines -Lathe, Drilling Machine, Milling Machine, Shaper, Planing Machine, Slotting Machine, Cylindrical Grinder, Surface Grinder and Tool and Cutter Grinder.
2. Step Turning on Lathe Machine
3. Taper Turning on Lathe Machine
4. Thread Cutting and Knurling on -Lathe Machine.
5. Drilling and Tapping
6. Shaping
7. Planing
8. Slotting
9. Boring
10. Milling

11 Cylindrical Surface Grinding

12. Grinding of Tool Angles.

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

III B.Tech I Semester (ME)

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(13HS122) SOFT SKILLS LAB

Objectives: Keeping in mind the previous exposure of the student to English, this lab focuses on improving the student's efficiency in English at all levels. The lab intends to train students to use language effectively, to participate in group discussions, to help them face interviews, and sharpen public speaking skills and enhance the confidence of the student by exposing him/ her to various situations and contexts which he/ she would face in his/ her career.

Activity– 1: Reading Comprehension
Activity– 2: Listening Comprehension
Activity– 3: Technical Report Writing
Activity– 4: Resume Writing
Activity– 5: Group Discussion
Activity– 6: Situation Dialogues
Activity– 7: Interview Skills
Activity– 8: Technical Presentation

Reference Books:

1. Dr.Alex, "Soft Skills" – Know yourself & Know the world.
2. Huckin and Olsen, Technical Writing and professional communication, Tata Mc Graw-Hill 2009.
3. Scott Morgan and Barrett Whitener, Speaking about Science, A Manual for Creating Clear Presentations ,Cambridge University press, 2006
4. Meenakshi Raman & Sangeeta Sharma, Technical Communication, Oxford University Press 2009.
5. M. Ashraf Rizvi, Resume's and Interviews, Tata Mc Graw-Hill, 2008
6. KK Ramachandran and KK Karthick, Form Campus To corporate, Macmillan Publishers, India Ltd, 2010
7. Dr A Ramakrishna Rao, Dr G Natanam & Prof SA Sankaranarayanan, English Language Communication: A Reader cum Lab Manual, Anuradha Publications, Chennai 2008.
8. K R Lakshminarayan and T. Muruguvel , Managing Soft Skills, Sci-Tech Publication, 2010
9. John X Wang, Business Communication, CRC Press, Special Indian Edition, 2008.

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

III B.Tech II Semester (ME)	L	T	P	[C]
	3	1	0	[3]

(13ME601) PRODUCTION AND OPERATIONS MANAGEMENT

Objective: The Objective of the course is to enable students to understand the production Planning and Controlling aspects of a typical production and operations organization. To understand the concepts of work study and Quality management.

UNIT -I:

Introduction to Production Management: Production, Productivity, Methods of production, Production process, Types of Process charts, Productivity Engineering and Management, Total productivity model, Product & Process Development.

UNIT-II

Strategic Management: Corporate Planning process, Principles of Planning, Types of Plans, Environmental Scanning, Environmental analysis, SWOT Analysis.

Materials Management-Objectives, Inventory – functions, types, associated costs, inventory classification Techniques-ABC and VED analysis. Inventory Control Systems-Continuous review system-periodical review System. Stores Management and Stores Records. Purchase management.

UNIT - III

Inspection and Quality control: Types of inspections - Statistical Quality Control-techniques-variables and attributes-assignable and non assignable causes- variable control charts, and R charts, attributes control Charts, p charts and c charts. Acceptance sampling plan- single sampling and double sampling plans.

UNIT-IV

Work study - Definition, objectives, method study - definition, objectives, steps involved- various types of associated charts-difference between micro motion and macro motion studies. Work measurement- definition, Time study, steps involved-equipment, different methods of performance rating- allowances, standard time Calculation. Work Sampling – definition, steps involved and standard time calculations.

Text Books:

1. R.Panneerselvam, "Production and Operations Management" - PHI Learning private Ltd
2. Aswathappa.K - "Production and Operation Management"- Himalaya publishing house, Mumbai

Reference Books:

1. Upendra-Kachru, "Production and operations management" –Excel books, New Delhi
2. S N Chary, "Production and Operations Management" - Tata McGraw Hill, New delhi,2008
3. Chase, Aquilano, Jacobs – "Operations management for competitive advantage" - Tata McGraw Hill
4. Elwood S.Buffa and Rakesh k.Sarin, "Modern production/operations management"- Wiley India
5. Mahadevan, "Operations Management" - Pearson, New Delhi.

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

III B.Tech II Semester (ME)

L	T	P	[C]
3	0	0	[3]

(13ME602) HEAT TRANSFER

Objectives: To make the student to employ the basic knowledge of mechanisms of heat transfer in steady and unsteady flow in thermal system. To analyze the components in a thermal equipment and identify various heat transfer phenomena and develop mathematical models. To provide solutions for altering heat flow in desired manner.

UNIT- I

Introduction: Modes and mechanisms of heat transfer – Basic laws of heat transfer –General applications of heat transfer.

Conduction Heat Transfer: Fourier rate equation – General heat conduction equation in Cartesian, Cylindrical and Spherical coordinates.

Simplification and forms of the field equation – steady, unsteady and periodic heat transfer – boundary and Initial conditions

UNIT-II

One Dimensional Steady State Heat Conduction: in Homogeneous slabs, hollow cylinders and spheres – overall heat transfer coefficient – electrical analogy – Critical radius/thickness of insulation-with Variable Thermal conductivity –with internal heat sources or Heat generation. Extended surface (fins) Heat Transfer – Long Fin, Fin with insulated tip and Short Fin, Application to errors in Temperature measurement.

One Dimensional Transient Heat Conduction: in Systems with negligible internal resistance – Significance of Biot and Fourier Numbers - Chart solutions of transient conduction systems- Problems on semi-infinite body.

UNIT-III

Convective Heat Transfer: Dimensional analysis–Buckingham π Theorem and its application for developing semi – empirical non- dimensional correlations for convective heat transfer – Significance of non-dimensional numbers – Concepts of Continuity, Momentum and Energy Equations.

Forced convection: External Flows: Concepts of hydrodynamic and thermal boundary layer and use of empirical correlations for convective heat transfer for flow over-Flat plates, Cylinders and spheres.

Internal Flows: Division of internal flow through Concepts of Hydrodynamic and Thermal Entry Lengths – Use of empirical relations for convective heat transfer in Horizontal Pipe Flow, annular flow.

Free Convection: Development of Hydrodynamic and thermal boundary layer along a vertical plate – Use of empirical relations for convective heat transfer on plates and cylinders in horizontal and vertical orientation.

UNIT-IV

Heat Transfer with Phase Change: Boiling: Pool boiling – Regimes, determination of heat transfer coefficient in Nucleate boiling, Critical Heat flux and Film boiling.

Condensation: Film wise and drop wise condensation –Nusselt's Theory of Condensation on a vertical plate - Film condensation on vertical and horizontal cylinders

Heat Exchangers: Classification of heat exchangers – overall heat transfer Coefficient and fouling factor – Concepts of LMTD and NTU methods - Problems using LMTD and NTU methods.

Radiation Heat Transfer: Emission characteristics and laws of black-body radiation – Irradiation – total and monochromatic quantities– laws of Planck, Wien, Kirchhoff, Lambert, Stefan and Boltzmann– heat exchange between two black bodies – concepts of shape factor – Emissivity – heat exchange between gray bodies – radiation shields– electrical analogy for radiation networks.

Text Books:

1. Fundamentals of Engg. Heat and Mass Transfer / R.C. Sachdeva / New Age International
2. Fundamentals of Heat and Mass Transfer/M.Thirumaleswar/Pearson Edu.

Reference Books:

1. Heat Transfer – P.K.Nag/ TMH
2. Heat Transfer / Holman .J.P/TMH
3. Heat and Mass Transfer –Cengel- McGraw Hill.
4. Heat and Mass Transfer – R.K. Rajput – S.Chand & Company Ltd.
5. Heat and Mass Transfer-Kondandaraman
6. Fundamentals of Heat Transfer - Incropera & Dewitt / John Wiley Pub.
7. Thermal Engineering Data Book /B.S.Reddy and K.H.Reddy Rev.Edition/I.K.International

Web References: NPTEL

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

III B.Tech II Semester (ME)	L	T	P	[C]
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(13ME603) FORMING TECHNOLOGY

Objectives: This subject will enable the students to acquire a fundamental knowledge on metal forming technology which is necessary for an understanding of industrial processes. To introduce students to the wide range of materials and processes, which are currently used in manufacturing industry. This will also provide methods of analysis allowing a mathematical/physical description of forming processes. To enable the students to identify the processes characteristics, select the main operator parameters, the tool geometry and materials, and determine forces and power required to select the main and auxiliary equipment.

UNIT-I

Theory of Metal Forming: Introduction to cold/hot forming processes: Metallurgical aspects of metal forming –slip-twining mechanics of plastic deformation- effects of temperature, strain rate, microstructure and friction in metal forming, yield criteria and their significance, classification of metal forming processes: slip line field theory**.**

UNIT-II

Forging and rolling processes: Forging principle, classification, equipment, tooling-processes, parameters and calculation of forces and power requirements during forging post forging heat treatment - defects (cause and remedy) & application; Principles of rolling processes, classification, types of rolling mills, ring comparison tests calculation of forces and geometrical relationship in rolling, analysis of rolling load, torque and power, rolling mill control, effects of friction. Form rolling, rolling defects, causes and remedies, problems related forging and rolling.

UNIT-III

Extrusion and Drawing Processes: Classification of extrusion processes-tool, equipment, and principle of these processes, influence on friction-Extrusion force calculation-defects and analysis-rod/wire drawing-tool, equipment and principle of processes defects-Tube drawing and sinking processes-Mannesmann processes of seamless pipe manufacturing, problems related to extrusion and wire drawing operation

Plastics and Glasses Processing Techniques: Injection, blow, extrusion, calendaring, thermo forming, roto moulding and drawing.

UNIT-IV

Sheet metal forming processes: Classification - conventional and HERF processes-presses-types and selection of presses formability of sheet metals- principle, process parameters, equipment and application of the following processes: deep drawing, spinning, stretch forming. Plate bending, spring back, press brake forming, Introduction to forming, electro hydraulic forming, magnetic pulse forming. Introduction to press work – coining, embossing etc., Design of sheet metal dies.

Powder Metallurgy :Introduction to Powder Metallurgy process, preparation of powders, types & function of binders, green compaction, sintering process and its effect on the product, application of powder metallurgy products, advantages of powder metallurgy products. Sintering equipment.

Surface Engineering: Surface treatment processes and their characteristics and applications. (a) Overlay coatings (b) Diffusion coatings (c) Thermal or mechanical modification of surfaces.

Text Books:

1 Serope Kalpakjian, Steven R. Schmid "Manufacturing Engineering and Technology" (4th 19 Editions) Prentice Hall 2000-06-15 ISBN: 0201361310.

2 P.N.Rao "Manufacturing Technology", TMH Ltd 1998(Revised edition) .

3 Dieter "Mechanical Metallurgy", revised edition 1992, McGraw.

Reference Books:

1 E. Paul DeGarmo, J. T. Black, Ronald A. Kohser, "Materials and Processes in Manufacturing", Wiley; 9 editions (December 6, 2002) ISBN: 0471033065.

2 Lindberg, "Processes and Materials of Manufacture ", Prentice Hall of India (p) Ltd.

3 George.E. Dieter, "Engineering design (A materials and processing approach)", McGraw Hill – EditionII 1991.

4 William F.Hosford & Robert M.Caddel "Metal forming".

5 Amitabha Ghosh and Mallik, "Manufacturing Science", East west press pvt ltd.

6 Narayanaswamy. R, "Metal Working Technology", PHI (1997).

7 Nagpal. G.R.,"Metal Forming Processes" Khanna publishers, Delhi 1998.

8 Sinha and Prasad, "Theory of Metal Forming and Metal Cutting", Dhanpat Rai Publication 1999

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

III B.Tech II Semester (ME)	L	T	P	[C]
	3	1	0	[3]

(13ME604) DESIGN OF MACHINE ELEMENTS-II

Objectives: To impart knowledge on basic machine elements used in machine design; design machine elements to withstand the loads and deformations for a given application, while considering additional specifications. To analyze the mechanical properties; and understand, identify and quantify failure modes for mechanical parts. To approach a design problem successfully, taking decisions when there is no unique answer/solution. To provide innovative solutions/improvisation to improve trial designs of complex systems.

UNIT-I

Bearings: Types of Journal bearings – Lubrication – Bearing Modulus–bearing materials – journal bearing design – Ball and roller bearings – Static loading of ball & roller bearings, bearing life –Failure of bearings.

Engine Parts: Pistons, Forces acting on piston – Construction Design and proportions of piston. Cylinder, Cylinder liners,

UNIT-II

Connecting Rod: Thrust in connecting rod – stress due to whipping action on Connecting rod ends – Cranks and Crank shafts, strength and proportions of over hung cranks.

Design of crane Hooks, C –clamps**.**

UNIT-III

Power Transmissions Systems: Design of Flat belt drives, V-belt drives & rope drives. Selection of wire ropes, design procedure for chain drives.

Spur & Helical Gears: Spur gears- Helical gears – Load concentration factor – Dynamic load factor. Surface compressive strength – Bending strength – Design analysis of spur gears – Estimation of centre distance, module and face width, check for plastic deformation. Check for dynamic and wear considerations.

UNIT-IV

Mechanical Springs: Stress and deflections of helical Springs-Springs for fatigue loading – Natural frequency of helical springs-Energy storage capacity- Helical Torsion springs- Leaf springs-Coaxial springs.

Design Of Power Screws: Design of screw, Square ACME, Buttress screws- Efficiency of the screw. Design of nut, compound screw, differential screw, ball screw- possible failures.

Text Books:

1. Machine Design /V.B.Bhandari/TMH
2. Machine Design – R.S. Khurmi & J.S.Gupta / S.Chand Pub.

Reference Books:

1. Mech. Engg. Design - JE Shiegley
2. Data Books: (I) P.S.G. College of Technology (ii) Balaveer Swamy andMahadevan
3. Machine Design by T.V.Sundaramoorthy &N.Shanmugam
4. Machine Design by Kanniah/ SciTech

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

III B.Tech II Semester (ME)	L	T	P	[C]
	3	0	0	[3]

(13ME605) METROLOGY AND MEASUREMENTS

Objective: To make the students to identify the uncertainties in dimensional Metrology by defining measurement standards and use electronic Instrumentation. To analyze the measurement requirement and choose effective methods of measuring straightness, flatness, roundness and profiles of screw threads and gear teeth and such other metrology practices. To employ knowledge in selecting a suitable instrument/ measurement method for a given application. To recognize the importance of accuracy and precision as a mechanical engineer through self motivation for a defect-free Product by using modern tools

UNIT- I

Systems Of Limits And Fits: Introduction, Definitions, fits and their types – unilateral and bilateral tolerance system, hole and shaft basis systems – interchangeability and selective assembly. Indian standard Institution system – International Standard system for plain and screwed work.
Linear Measurement: Length standard, line, ends & wavelength standards slip gauges – calibration of the slip gauges, Dial indicator, micrometers.
Measurement Of Angles And Tapers: Different methods – Bevel protractor – angle gauges – spirit levels – sine bar – Sine plate, rollers and spheres used to determine the tapers.
Limit Gauges: Plug, Ring, Snap, Gap, Taper, Profile and Position gauges. Taylor's principle. Design of Go and No Go gauges.

UNIT -II

Optical Measuring Instruments: Tool maker's microscope – collimators, optical projector – optical flats and their uses, interferometer.
Flatness Measurement: Measurement of flatness of surfaces – straight edges– surface plates – optical flat and auto collimator.
Surface Roughness Measurement: Differences between surface roughness and surface waviness-Numerical assessment of surface finish – CLA, R.M.S Values – Ra , Rz values, Methods of measurement of surface finish-profilograph, Talysurf, BIS symbols for indication of surface finish.

UNIT- III

Comparators: Mechanical, Optical, Electrical, Electronic, Pneumatic comparators and their uses.
Screw Thread Measurement: Elements of measurement – errors in screw threads – measurement of effective diameter, angle of thread and thread pitch- profile thread gauges.
Machine Tool Alignment Tests: Requirements of Machine Tool Alignment Tests, Alignment tests on lathe, milling, drilling machine tools. Preparation of acceptance charts.

UNIT -IV

Gear Measurement: Gear measuring instruments, Gear tooth profile measurement. Measurement of diameter, pitch, pressure angle and tooth thickness.
Coordinate Measuring Machines: Types of CMM and Applications of CMM.

Text Books:

1. Engineering Metrology, Mahajan, Dhanpat Rai
2. Engineering Metrology, R.K. Jain, Khanna Publishers

Reference Books:

1. BIS standards on Limits & Fits, Surface Finish, Machine Tool Alignment etc.
2. Fundamentals of Dimensional Metrology, Connie Dotson, 4e, Thomson
3. Handbook of Tribology: Materials, Coating, and Surface Treatments, Bharat Bhushan and B.K.Gupta.
4. Surface Engineering with Lasers, Dehosson J.T.
5. Surface engineering for corrosion and wear resistance, JR Davis, Wood head Publishers.

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

III B.Tech II Semester (ME)	L	T	P	[C]
	3	0	0	[3]

(13ME606) CAD/CAM

Objectives: To make the students to know the concepts of CAD/CAM to generate a suitable geometric model of an object. To analyze the features on an object and develop process planning chart/ part program. To use popular drafting packages to develop geometric models of parts and their assemblies. To use computer aided quality control methods to detect manufacturing errors during inspections.

UNIT- I

Computers in Industrial Manufacturing, Product cycle, CAD / CAM Hardware, Basic structure, CPU, Memory types, input devices, display devices, hard copy devices, storage devices.

Computer Graphics & Drafting: Raster scan graphics coordinate system, database structure for graphics modeling, transformation of geometry, 3D transformations, Geometric commands, layers, display control commands, editing, dimensioning.

UNIT -II

Geometric modeling: Requirements, geometric models, geometric construction models, curve representation methods, surface representation methods, modeling facilities desired.

Numerical control: NC, NC modes, NC elements, NC machine tools, structure of CNC machine tools, features of Machining center, turning center, CNC PartProgramming: fundamentals, manual part programming methods, Computer Aided Part Programming.

UNIT - III

Group Tech: Part family, coding and classification, production flow analysis, advantages and limitations, Retrieval type and Generative type, Computer Aided Processes Planning.

Types of manufacturing systems: FMS, Material handling systems, computer control systems, JIT, Human labor in manufacturing systems.

UNIT- IV

Computer integrated production planning: Capacity planning**,** shop floor control, MRP-I, MRP-II, CIMS benefits.

Computer Aided Quality Control: Terminology in quality control, the computer in QC, contact inspection methods, noncontact inspection methods-optical non-contact inspection methods-non-optical computer aided testing, integration of CAQC with CAD/CAM.

Text Books:

1. CAD / CAM, A Zimmer's & P.Groover/PE/PHI
2. CAD / CAM – Principles and applications / P.N. Rao/TMH

Reference Books:

1. Automation, Production systems & Computer integrated Manufacturing, Groover,P.E
2. CAD / CAM / CIM, Radhakrishnan and Subramanian, New Age
3. Principles of Computer Aided Design and Manufacturing, Farid Amirouche, Pearson
4. CAD/CAM Theory and Practice, R. Sivasubramaniam, TMH

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

III B.Tech II Semester (ME)	L	T	P	[C]
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(13ME607) HEAT TRANSFER LAB –I

Objectives: To devise experimentation schemes for estimating heat transfer rates in conduction, convection, radiation heat transfer and to estimate the approximate imbalance in machines and Approximate heat transfer requirements. To provide probable solution for heat transfer. To provide experimentation schemes for sub-systems of a complex machine or thermal equipment to predict the characteristics of a complex system.

List of Experiments:

1. Thermal conductivity of insulating powder material through Concentric Sphere apparatus.
2. Thermal conductivity of insulating material through lagged pipe apparatus
3. Overall heat transfer co-efficient through Composite Slab Apparatus
4. Thermal Conductivity of metal (conductor).
5. Heat transfer in pin-fin
6. Experiment on Transient Heat Conduction
7. Heat transfer coefficient in forced convection.
8. Heat transfer coefficient in natural convection.

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

III B.Tech II Semester (ME)	L	T	P	[C]
	0	0	3	[2]

(13ME608) METROLOGY LAB

Objectives: To make the student to choose correct measurement tools and /or measurement systems in a practical situation. To identify sources of measurement errors and eliminate them. To use common and advanced Metrology and measurement appliances which are commonly used in industrial inspection process and specify a dimension validation process. To measure surface roughness by precision measuring instruments such as SJ 210 roughness tester, Autocollimator and Calibrate instruments and/or measurement systems using known standards.

List of Experiments:

1. Measurement of lengths, heights, diameters by vernier calipers, micrometers etc.
2. Measurement of bores by internal micrometers and dial bore indicators.
3. Use of gear teeth, vernier calipers and checking the chordal addendum and chordal height of spur gear.
4. Alignment test on the lathe.
5. Alignment test on milling machine.
6. Study of Tool maker's microscope and its application
7. Angle and taper measurements by Bevel protractor, Sine bars.
8. Internal Taper measurements by using spheres, cylinders & Spheres..
9. Use of spirit level in finding the flatness of surface plate.
10. Thread measurement by two wire/ three wire method.
11. Surface roughness measurement by Talysurf instrument.
12. Profile measurement by using Profile Projector.

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

III B.Tech II Semester (ME)

L	T	P	[C]
0	0	3	[2]

(13ME609) CAD LAB

Objectives: To teach the students about the drafting of 3D components and analyzing the same using various CAD packages and programming of CNC machines. To train them to use the various sensors

List of Experiments:

1. Drafting: Development of part drawings for various components in the form of orthographic and isometric. Representation of Dimensioning and tolerances scanning and plotting. Study of script, DXE AND IGES FILES.

2. **Part Modeling:** Generation of various 3D Models through Protrusion, revolve, shell sweep. Creation of various features. Study of parent child relation. Feature based and Boolean based modeling surface and Assembly Modeling. Study of various standard Translators. Design simple components.

3. a). Determination of deflection and stresses in 2D and 3D trusses and beams.
   b). Determination of deflections component and principal and Von-mises stresses in plane stress, plane strain and Axisymmetric components.
   c). Determination of stresses in 3D and shell structures (at least one example in each case)
   d). Estimation of natural frequencies and mode shapes, Harmonic response of 2D beam.
   e). Steady state heat transfer Analysis of plane and Axisymmetric components.

Any Six Software Packages from the following:
Use of Auto CAD, Micro Station, CATIA, Pro-E, I-DEAS, ANSYS, NISA, CAEFEM.

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

III B.Tech II Semester (ME)	L	T	P	[C]
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(13ME610) TECHNICAL SEMINAR-II

Objectives: To get involved with the latest advancements and developments to enhance communication and presentation skills, exchange of ideas, greater connectivity to develop a research bent of mind.

A Technical Seminar shall have two components, one chosen by the student from the course work as an extension and approved by the faculty supervisor. The other component is suggested by the supervisor and can be a reproduction of the concept in any standard research paper or an extension of concept from earlier course work. A hard copy of the information on seminar topic in the form of a report is to be submitted for evaluation along with presentation. The presentation of the seminar topics shall be made before a committee consisting of Head of the department, seminar supervisor and a senior faculty member. Each Technical Seminar shall be evaluated for 100 marks. Technical Seminar component-I for 50 marks and component-II for 50 marks making total 100 marks. (**Distribution of marks for 50:** 10 marks for report, 10 marks for subject content, 20 marks for presentation and 10 marks for queries).

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

IV B.Tech I Semester (ME)	L	T	P	[C]
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(13ME701) AUTOMOBILE ENGINEERING

Objectives: The objective of Automobile Engineering is to develop and understand the principles of conversion in design, construction and working of mechanical systems and electronic systems in automobiles.

UNIT - I

Introduction : Components of a four wheeler automobile – chassis and body – power unit –power transmission – rear wheel drive, front wheel drive, 4 wheel drive – types of automobile Engines, engine construction, turbo charging and super charging – oil filters, oil pumps crank case ventilation.
Ignition System: Principle of Electronic Ignition System using contact breaker points, Electronic Ignition using Contact Triggers – Spark Advance and retard mechanism.

UNIT - II

Emissions from Automobiles – Pollution standards National and international – Pollution Control– Techniques – Multipoint fuel injection for SI Engines- Common rail diesel injection Emissions from alternative energy sources– hydrogen, Biomass, alcohols,LPG, CNG - their merits and demerits.
Electrical System : Charging circuit, generator, current – voltage regulator – starting system, Bendix drive, mechanism of Solenoid switch, Lighting systems, Horn, wiper, Fuel gauge – oil pressure gauge, Engine temperature indicator.

UNIT-III

Transmission System: Clutches- Principle- types: cone clutch, single plate clutch, multi plate clutch, magnetic and centrifugal clutches, fluid fly wheel – gear box- types: sliding mesh, constant mesh, synchromesh, epi-cyclic, over drive, torque converter. Propeller shaft – Hotch – Kiss drive, Torque tube drive, universal joint, differential, rear axles.

UNIT-IV

Steering System: Steering geometry – camber, castor, king pin rake, combined angle toe-in, Center point steering. Types of steering mechanism – Ackerman steering mechanism, Davis
Steering mechanism, steering gears – types, steering linkages.
Suspension System: Objects of suspension systems – rigid axle suspension system, torsion bar, shock absorber, Independent suspension system.
Breaking System: Mechanical brake system, Hydraulic brake system, Pneumatic and vacuum brake systems.

Text Books:

1. Automotive Mechanics – Vol. 1 & Vol. 2, Kirpal Singh.
2. Automobile Engineering, William Crouse

Reference Books:

1. Automobile Engineering, R.K.RAJPUT, Laxmi Pub
2. Automobile Engineering, K.K.Ramalingam/SciTech Pub.
3. Automotive engines, Newton, Steeds & Garret.

AUDISANKARA COLLEGE OF ENGINEERING &TECHNOLOGY:GUDUR
(AUTONOMOUS)

IV B.Tech I Semester (ME)	L	T	P	[C]
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(13ME702) INSTRUMENTATION AND CONTROL SYSTEMS

Objectives: To make the students to learn the basic principles of measurement of temperature pressure, speed, acceleration, vibration, acceleration, humidity. To impart the knowledge of elements of control systems.

UNIT - I

Definition - Basic principles of measurement – Measurement systems, generalized configuration and functional descriptions of measuring instruments - examples. Dynamic performance characteristics sources of error, Classification and elimination of error.

Measurement of Displacement: Theory and construction of various transducers to measure displacement - Piezo electric, Inductive, capacitance, resistance, ionization and Photo electric transducers, Calibration procedures.

Measurement of Temperature: Classification – Ranges - Various Principles of measurement - Expansion, Electrical Resistance - Thermistor - Thermocouple - Pyrometers -Temperature Indicators.

UNIT - II

Measurement of Pressure: Units - classification - different principles used- Manometers, Piston, Bourdon pressure gauges, Bellows - Diaphragm gauges. Low pressure measurement - Thermal. Conductivity gauges - ionization pressure gauges, McLeod pressure gauge.

Measurement of Level: Direct method - Indirect methods - capacitative, ultrasonic, magnetic, cryogenic fuel level indicators - Bubbler level indicators.

Flow Measurement: Rotameter, magnetic, Ultrasonic, Turbine flow meter, Hot - wire anemometer Laser Doppler Anemometer (LDA).

UNIT - III

Measurement Of Speed: Mechanical Tachometers -Electrical tachometers - Stroboscope, Noncontact type of tachometer.

Measurement of Acceleration and Vibration: Different simple instruments - Principles of Seismic instruments - Vibrometer and accelerometer.

Stress & Strain Measurements: Various types - electrical strain gauge - gauge factor - method of usage of resistance strain gauge for bending, compressive and tensile strains - usage for measuring torque, Strain gauge Rosettes.

UNIT - IV

Measurement of Humidity: - Moisture content in the gases, sling psychrometry, Absorption psychrometry, Dew point meter.

Measurement Of Force, Torque And Power: Elastic force meters, load cells, Torsion meters, Dynamometers.

Elements of Control Systems: Introduction, Importance - Classification - Open and closed systems Servomechanisms-Examples with block diagrams-Temperature, speed & position control systems

Text Books:

1. Measurement systems: Application and design, Doeblin Earnest. O. Adaptation by Manik and Dhanesh, TMH

2. Mechanical Measurements, Beckwith, Marangoni, Linehard, PHI, PE

3. Instrumentation and Control Systems by K.Narayana Reddy & P.S.Rama Krishna SciTech Publishers

Reference Books:

1. Instrumentation, measurement & analysis, B.C.Nakra & KKChoudhary, TMH
2. Measurement Systems: Applications & design, D.S Kumar.
3. Instrumentation and Control systems, S.Bhaskar, Anuradha Agencies.
4. Mechanical and Industrial Measurements, R.K. Jain, Khanna Publishers.
5. Instrumentation & mech. Measurements, AK. Tayal,Galgotia Publications
6. Mechanical Measurements, Sawhani

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

IV B.Tech I Semester (ME)	L	T	P	[C]
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(13ME703) ROBOTICS

Objectives: To teach the students about the kinematic arrangement of robots and its applications in the area of manufacturing sectors to expose the students to build a robot for any type of application

UNIT - I

Introduction to Industrial Robots: Classification. Robot configurations, Functional line diagram, Degrees of Freedom. Components, common types of arms, joints, grippers.

UNIT - II

Manipulator Kinematics: Homogeneous transformations as applicable to rotation and translation - D-H notation, Forward and inverse kinematics.
Manipulator Dynamics: Differential transformation, Jacobians. Lagrange – Euler and Newton – Euler formations.

UNIT - III

Trajectory Planning: Trajectory planning and avoidance of obstacles, path planning, Skew motion, joint integrated motion – straight line motion.
Robot programming-Types – features of languages and software packages.
Robot actuators and Feedback components: Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors, comparison. Position sensors – potentiometers, resolvers, Encoders – Velocity sensors, tactile sensors, Proximity sensors.

UNIT - IV

Robot Application in Manufacturing: Material Transfer - Material handling, loading and unloading- Processing - spot and continuous arc welding & spray painting - Assembly and
Inspection.

Text books:

1. Automation, Production systems and CIM, M.P. Grover/Pearson Edu.
2. Industrial Robotics - M.P. Grover, TMH.

Reference Books:

1. Robotics, Fu K S, McGraw Hill.
2. An Introduction to Robot Technology, P. Coiffet and M.Chaironze, Kogam Page Ltd. 1983 London.
3. Robotic Engineering, Richard D. Klafter, Prentice Hall
4. Robotics, Fundamental Concepts and analysis – AshitaveGhosal, Oxford Press
5. Robotics and Control, Mittal R K & Nagrath I J, TMH.
6. Introduction to Robotics – John J. Craig, Pearson Edu

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

IV B.Tech I Semester (ME)	L	T	P	[C]
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(13ME704) REFRIGERATION AND AIR CONDITIONING

Objectives: To employ the knowledge of RAC systems to build mathematical models of physical systems to predict their performance. To analyze refrigeration requirements to arrive at an outline configuration of the refrigeration system. To propose probable designs of systems. To assess the safety issues in RAC systems and propose viable solutions

UNIT- I

Introduction to Refrigeration: Necessity and applications – Unit of refrigeration and C.O.P. – Different refrigeration methods - Air Refrigeration: Ideal and Actual cycles, Open and Dense air systems –- problems

Vapour compression refrigeration – Basic cycle – working principle and essential components of the plant – COP – Representation of cycle on T-S and p-h charts – Expander vs. Throttling, effect of sub cooling and super heating – cycle analysis – Actual cycle- Influence of various parameters on system performance – Construction and Use of P-h charts – numerical Problems.

UNIT -II

Refrigerants – Desirable properties – classification of refrigerants used – Nomenclature- secondary refrigerants lubricants – Ozone Depletion – Global Warming- newer refrigerants.

Vapor Absorption Refrigeration System – description and working of NH3 – water system and Li Br – water (Two shell & four shell) System -Calculation of max COP. Principle of operation of three Fluid absorption systems.

UNIT- III

Steam Jet Refrigeration System: Working Principle and Basic Components-estimation of motive steam required. Principle and operation of: (i) Thermo-electric refrigerator (ii) Vortex tube or Hilsch tube.

Introduction to Air Conditioning: Psychometric Properties & Processes – Characterization of Sensible and latent heat loads –– Need for Ventilation, Consideration of Infiltrated air – Heat Load concepts: RSHF, GSHF- Cooling load calculations.

UNIT –IV

Air Conditioning equipment - humidifiers – dehumidifiers – air filters, fans and blowers.

Heat Pump – Heat sources – different heat pump circuits.

Requirements of human comfort and concept of Effective Temperature- Comfort chart –Comfort Air Conditioning- Summer, winter & year round air conditioning simple problems.

Text Books:

1. Refrigeration and Air Conditioning / CP Arora / TMH.
2. A Course in Refrigeration and Air conditioning / SC Arora & Domkundwar / Dhanpatrai

Reference Books:

1. Refrigeration and Air Conditioning / Manohar Prasad / New Age.
2. Principles of Refrigeration - Dossat / Pearson Education.
3. Refrigeration and Air Conditioning-P.L.Ballaney
4. Basic Refrigeration and Air-Conditioning – Ananthanarayanan / TMH.

Tables/Codes: Thermal Engineering Data Book containing Refrigerant and Psychometric property Tables and charts

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

IV B.Tech I Semester (ME)	L	T	P	[C]
	3	0	0	[3]

(13ME705)UNCONVENTIONAL MACHINING PROCESSES
(Elective-I)

Objectives: To make the student to learn Non-Traditional machining techniques or nontraditional Machining processes to fabricate a part or perform material removal with a given accuracy. To estimate the effects of mechanical and thermal loading when machining metal and Non-metal cutting using a nontraditional machining process. To estimate the material removal rate and cutting force and the surface finish attainable using a non-traditional machining process and suggest a suitable process for a given application. To propose, where possible, environment- friendly and sustainable solutions to suit non-traditional machining processes

UNIT-I

Introduction: Need for non-traditional machining methods- Classification of modern machining processes – considerations in process selection materials, applications.

Ultrasonic Machining: Elements of the process, mechanics of metal removal process parameters, economic considerations, applications and limitations, recent development.

UNIT-II

Abrasive jet machining, Water jet machining and abrasive water jet machine: Basic principles, equipments, process variables, mechanics of metal removal, MRR, application and limitations.

Electro – Chemical Processes: Fundamentals of electro chemical machining, electrochemical grinding, electro chemical honing and deburring process, metal removal rate in ECM, Tools, Surface finish and accuracy economic aspects of ECM – Simple problems for estimation of metal removal rate.

UNIT- III

Thermal Metal Removal Processes: General Principle and applications of Electric Discharge Machining, Electric Discharge Grinding and electric discharge wire cutting processes – Power circuits for EDM, Mechanics of metal removal in EDM, Process parameters, and selection of tool electrode and dielectric fluids, characteristics of spark eroded surface and machine tool selection. Parameters controlling surface finish and machining accuracy, Wire EDM, principle, applications.

Electron Beam Machining: Generation and control of electron beam for machining, theory of electron beam machining, comparison of thermal and non-thermal processes.

Laser Beam Machining: General Principle and application of laser beam machining – thermal features, cutting speed and accuracy of cut.

UNIT -IV

Plasma Machining: Principle, metal removal mechanism, process parameters, accuracy and surface finish, applications.

Chemical Machining: Fundamentals of chemical machining- Principlemaskants –etchants advantages and applications. Magnetic abrasive finishing, Abrasive flow finishing, Electrostream drilling, shaped tube electrolytic machining.

Rapid Prototyping: Classification – Stereo lithography, Selective Laser Sintering, applications.

Text Books:

1. VK Jain advanced machining processes. Allied publishers.

Reference Books:

1. Pandey, P.C. and Shah H.S., Modern Machining Process. TMH.
2. Bhattacharya A, New Technology. The Institution of Engineers, India 1984.
3. Kalpakzian, Manufacturing Technology. Pearson.

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

IV B.Tech I Semester (ME)	L	T	P	[C]
	3	0	0	[3]

(13ME706) TOOL DESIGN
(Elective-I)

Objectives: To impart the knowledge of the basic cutting tool angles. To analyze the cutting tool requirement and specify the material and geometry required for a given tool in a given machining Situation. To design multipoint cutting tools and jigs/fixtures in selected applications. To identify the tooling and other requirements for machining an object with complex geometry.

UNIT-I

Gauge Design: Gauges and gauge design coated tools, ceramic tools.
Design of Single Point Cutting Tools: Single point, cutting tools-various systems of specifications, geometry and their inter, relation, theories of formation of chip and their effect, design of broach.
Design of multipoint Cutting Tools: Drill geometry, Design of Drills, Rake & Relief angles of twist drill, speed, feed and depth of cut, machining time, forces, milling cutters, cutting speeds and feed-machining times-design-form cutters, combination tools, reamers etc.

UNIT-II

Design of Sheet Metal Blanking And Piercing: Fundamentals of die cutting operating, power press types, General press information, Material handling equipment, cutting action in punch and die operation. Die clearance, and types of Die construction. Die design fundamentals-blanking and piercing die construction, pilots, striper and pressure pads presswork material, strip layout, short run tooling for piercing.
Design of Sheet Metal Bending, Forming and Drawings Die: Bending dies, drawing dies, forming dies, drawing operations, variables that effect metal flow during drawing. Determination of blank size, drawing force, single and double action draw dies.

UNIT-III

Design of Jigs And Fixtures: Basic principles of location and clamping, locating, methods and devices, jigs, definitions, types, general consideration in the design of jigs, drills bushing, methods of construction, fixtures-vice fixtures milling, boring, and lathe grinding fixtures.

UNIT-IV

Design of Moulds: Design of single cavity, multi cavity moulds for injection and blowing.
Using plastics as tooling materials: introduction, plastics commonly used as tooling material application of epoxy plastic tools construction methods of plastic tooling metal forming operations with Urethane dies. Calculating forces for urethane pressure pads, and economics of tooling.

Text Books:

1. Donaldson, Lecain and Goold, Tool Design. TMH.
2. A Bhattacharya, Principles of Metal cutting. New Central Book Agency, Calcutta.

Reference Books:

1. Surendra Kenav and Umesh Chandra, Production Engineering Design (Tool Design). Satyaprakashan, New Delhi 1994.
2. Amitabh Bhattacharya and Inyong Ham, Design of Cutting Tools. Use of Metal Cutting Theory. ASTME publication Michigan USA, 1969.
3. RK Singal and Others, Fundamentals of Machining and Machine Tools. I.K. International, 2008.
4. Shaw, Metal Cutting Principles. Oxford Univ. Press.

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

IV B.Tech I Semester (ME)	L	T	P	[C]
	3	0	0	[3]

(13ME707) FINITE ELEMENT METHODS
(Elective-I)

Objectives: To apprise the students about the basics of Finite Element theory, computer implementation of this theory and its practical applications.

UNIT- I

Introduction to Finite Element Method for solving field problems. Stress and Equilibrium. Strain - Displacement relations. Stress - strain relations.

One-Dimensional Finite Element Methods: Bar elements, temperature effects. Element matrices, assembling of global stiffness matrix, Application of boundary conditions, Elimination and penalty approaches, solution for displacements, reaction, stresses, temperature effects, Quadratic Element.

UNIT- II

Trusses: Element matrices, assembling of global stiffness matrix, solution for displacements, reaction, stresses, and temperature effects.

Beams: Element matrices, assembling of global stiffness matrix, solution for displacements, reaction, stresses.

UNIT -III

Two Dimensional Problems: Basic concepts of plane stress and plane strain, stiffness matrix of CST element, finite element solution of plane stress problems.

Iso-Parametric Formulation: Concepts, sub parametric, super parametric elements, 2 dimensional 4 noded iso-parametric elements, and numerical integration.

UNIT -IV

Axi-Symmetric Model: Finite element modeling of axisymmetric solids subjected to axi-symmetric loading with triangular elements.

Heat transfer problems: Heat transfer with conduction, convection, Heat transfer through fins

Dynamic Analysis: Dynamic equations, Eigen value problems and their solution methods, simple problems

Text Books:

1. Tirupathi.R. Chandrapatla and Ashok D. Belagondu, Introduction to Finite elements in Engineering.
2. S Senthil, Introduction of Finite Element Analysis. Laxmi Publications.
3. SMD Jalaluddin, Introduction of Finite Element Analysis. Anuradha Publications.

Reference books:

1. K. J. Bathe, Finite element procedures. PHI.
2. SS Rao, The finite element method in engineering. Butterworth Heinemann.
3. J.N. Reddy, An introduction to the Finite element method. TMH.
4. Chennakesava, R Alavala, Finite element methods: Basic concepts and applications. PHI.

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

IV B.Tech I Semester (ME)	L	T	P	[C]
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(13ME708) RAPID PROTOTYPING
(Elective-I)

Objectives: To make the students to gain the knowledge on how to identify the tools needed to produce a prototype of the product using RPT techniques. To analyze the simulation/prototyping need and select an RPT system in a given situation for economy and rapid results. To use both hardware and software tools to enhance the productivity in an RPT Process.

UNIT – I

Introduction: Need for the compression in product development, History of RP systems, Survey of applications, Growth of RP industry and classification of RP systems,

Stereo Lithography Systems: Principle, Process parameters, Process details, Data preparation, Data files and machine details, Applications.

Selective Laser Sintering: Type of machine, Principle of operation, Process parameters, Data Preparation for SLS, Applications, Fused Deposition Modeling: Principle, Process parameter, Path generation, Applications.

UNIT – II

Solid Ground Curing: Principle of operation, Machine details, Applications. Laminated Object Manufacturing: Principle of operation, LOM materials, Process details, applications.

Concepts Modelers: Principle, Thermal jet printer, Sander's model market, 3-D printer. Genisys Xs printer HP system 5, object Quadra systems.

UNIT – III

Rapid Tooling: Indirect Rapid tooling, Silicone rubber tooling, Aluminum filled epoxy tooling, Spray metal tooling, Cast kirksite, 3Q keltool, Direct Rapid Tooling.

Tooling: Quick cast process, Copper polyamide, Rapid Tool, DMILS, Prometal, Sand casting tooling, Laminate tooling soft Tooling vs. hard tooling.

UNIT – IV

Software for Rp: STL files, Overview of Solid view, magics, imics, magic communicator, etc. Internet based software, Collaboration tools, RAPID.

Manufacturing Process Optimization: Factors influencing accuracy, Data preparation errors, Part building errors, Error in finishing, Influence of build orientation.

Allied Processes: Vacuum, Casting, Surface digitizing, and Surface generation from point cloud, Surface modification - data transfer to solid models.

Text Books:

1. Paul F. Jacobs, Stereo Lithography and Other RP & M Technologies, SME, NY.
2. Fulham D.T & Dinjoy S.S Verlog, Rapid Manufacturing, London.

Reference Books:

1. Terry Wohlers Wohler's Report 2000, *Rapid Prototyping*, Wohler's Association 2000.
2. Gurumurthy, *Rapid Prototyping Materials*, IISc Bangalore.

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

IV B.Tech I Semester (ME)	L	T	P	[C]
	3	0	0	[3]

(13ME709) GEOMETRIC MODELING
(Open Elective)

Objectives: To make the student understand the role of computer graphics in the context of the object representation. To represent and generate points, lines and circles using algorithms. To work with multiple 2-D and 3-D geometrical transformations to represent and solve real engineering problems. To gain experience in design projects involving animation systems

UNIT – I

Introduction: Application area of Computer graphics, overview of graphic system, video- display devices, raster- scan systems, random scan systems, graphics monitors and work stations and input devices.

Output primitives: Points and lines, line drawing algorithms, midpoint circle algorithm, Filled area primitives: scan-line polygon fill algorithm, boundary-fill and flood –fill algorithm.

UNIT-II

2-D geometrical transformations: Translation, scaling, rotation, reflection and shear transformation matrix representations and homogeneous co-ordinates, composite transformations, transformations between coordinates.

2-D viewing: The viewing pipe0line, viewing coordinat4reference frame, window to view –port-co-ordinate transformations, viewing function, Cohen-Sutherland and Cyrus –Beck line clipping algorithms, Sutherland-Hodgeman polygon clipping algorithm.

UNIT-III

3-D object representation: Polygon surfaces, quadric surfaces, spline representation, Hermite curve, Bezier curve and B- spline curve, Bezier and B- spline surfaces, Basic illumination models, shading algorithms.

3-D geometric transformations: Translation, rotation, scaling, reflection and shear transformation and composite transformations.

UNIT – IV

Visible surface detection methods: Classification, back-face detection, depth- buffer, scan- line, depth sorting.

Computer animation: Design of animation sequence, general computer animation functions, raster animation. Computer animation language, key frame system, motion specification.

Text Books:

1. Mathematical Elements for computer graphics, David 1 Rodgers, TMH
2. Computer Graphics and Automation, M.C. Trivedi, Jaico Pub. Pearson Education

Reference Books:

1. CAD/CAM Theory, Ibrahim Zeid, TMH
2. Computer Graphics second edition, Zhigand xiang, Roy Plastock, Schaum's outlines, Tata Mc-Graw Hill edition.
3. Computer Graphics, Steven Harrington, TMH
4. Principles of computer Graphics, Shalini Govil, PHI, 2005, Springer.
5. Computer Graphics Principles & Practice, C.Foley, Vandom, Fesner, Hughes, Pearson Pub. 2/e
6. Computer Graphics C version, Donald Hearn and M.Pauline Baker, Pearson, PHI

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

IV B.Tech I Semester (ME)

L	T	P	[C]
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(13ME710) TRIBOLOGY
(Open Elective)

Objectives: The objective of the subject **is** to apply the basic theories of friction, wear and lubrication to predictions about the frictional behavior of commonly encountered sliding interfaces. Characterize features of rough surface and liquid lubricants as they pertain to interface sliding. Interpret the latest research on new topics in tribology including its application to nanoscale devices and biological systems.

UNIT – I

Study of Various Parameters: Viscosity, flow of fluids, viscosity and its variation -absolute and kinematic viscosity, temperature variation, viscosity index determination of viscosity, different viscometers used.

Hydrostatic Lubrication: Hydrostatic step bearing, application to pivoted pad thrust bearing and other applications, hydrostatic lifts, hydrostatic squeeze films and its application to journal bearing.

UNIT – II

Hydrodynamic Theory Of Lubrication: Various theories of lubrication, petroffs equation, Reynold's equation in two dimensions -Effects of side leakage - Reynolds equation in three dimensions, Friction in sliding bearing, hydro dynamic theory applied to journal bearing, minimum oil film thickness, oil whip and whirl anti - friction bearing

Friction And Power Losses In Journal Bearings: Calibration of friction loss friction in concentric bearings, bearing modulus, Sommerfield number, heat balance, practical consideration of journal bearing design considerations.

UNIT – III

Air Lubricated Bearing: Advantages and disadvantages application to Hydrodynamic journal bearings, hydrodynamic thrust bearings. Hydrostatic thrust bearings. Hydrostatic bearing Analysis including compressibility effect. Study of current concepts of boundary friction and dry friction. Columb's laws of friction, theories of friction

UNIT – IV

Types of Bearing Oil Pads: Hydrostatic bearing wick oiled bearings, oil rings, pressure feed bearing, partial bearings – externally pressurized bearings.

Bearing Materials: General requirements of bearing materials, types of bearing materials, Selection of Bearing materials for various applications, Applications of Bearing materials.

Text Books:

1. Suhas V. Patankar, Numerical heat transfer and fluid flow. Butter-Worth Publ.
2. John. D. Anderson, Computational fluid dynamics, Basics with applications. Mc Graw Hill.

Reference Books:

1. Niyogi, Computational Fluid Flow and Heat Transfer.Pearson Publ.
2. Tapan K. Sengupta, Fundamentals of Computational Fluid Dynamics. Universities Press.
3. Jiyuan and Others, Computational Fluid Dynamics. Elsevier, 2008.

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

IV B.Tech I Semester (ME)	L	T	P	[C]
	3	0	0	[3]

(13ME711)ENTREPRENEURSHIP
(Open Elective)

Objectives: To make the student to assess the risk and reward involved with a business idea. To develop a business plan for expansion and market segmentation. To identify socially relevant mechanical engineering business ideas. To develop a financial plan for a business venture to be submitted to a financing agency.

UNIT-I

Introduction to Entrepreneurship Definition of Entrepreneur, Entrepreneurial Traits, Entrepreneur vs. Manager, Entrepreneur vs. Intrapreneur. The Entrepreneurial decision process. Role of Entrepreneurship in Economic Development, Ethics and Social responsibility of Entrepreneurs. Opportunities for Entrepreneurs in India and abroad. Woman as Entrepreneur. Creating and Starting the Venture, Sources of new Ideas, Methods of generating ideas, creating problem solving, and product planning and development process.

UNIT-II

The Business Plan Nature and scope of Business plan, Writing Business Plan, Evaluating Business plans, Using and implementing business plans. Marketing plan, financial plan and the organizational plan, launching formalities. Financing and managing the new venture, Sources of capital, venture capital, angel investment, Record keeping, recruitment, motivating and leading teams, and financial controls. Marketing and sales controls. E-commerce and Entrepreneurship, Internet advertising.

UNIT-III

New venture Expansion Strategies and Issues, Features and evaluation of joint ventures, acquisitions, merges, franchising. Public issues, rights issues, bonus issues and stock splits. Choosing location and layout, Issues related to Selection of layout.

UNIT-IV

Production and Marketing Management Thrust of production management, Selection of production Techniques, plant utilization and maintenance, designing the work place, Inventory control, material handling and qualitycontrol.Marketing functions, market segmentation, marketresearch and channels of distribution, Sales promotion and product pricing. Global aspects of Entrepreneurships.

Text Books:

1Entrepreneurship, Robert His rich, & Michael Peters, TMH, 5th Edition
2. Entrepreneurship, Dollinger, Pearson, 4/e 2004.

Reference Books:

1. Dynamics of Entrepreneurial Development and management, Vasant Desai, Himalaya Publishing House, 2004.
2. Harvard Business Review on Entrepreneurship. HBR Paper Back, 1999.
3. Entrepreneurial Management, Robert J.Calvin, TMH, 2004.
4. The Entrepreneurial Connection, Gurmeet Naroola TMH, 2001.
5. Indian Economy. Dutt & Sundaram S. Chand, 2005.
6. Essential of Entrepreneurship and small business management, Thomas W. Zimmerer & Norman M. Scarborough, PHI, 4/e, 2005.
7. Industrial Relations & Labor Laws, Srivastava, Vikas, 2005.
8. Industrial Law, ND Kapoor, Sultan Chand & Sons, 2005

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

IV B.Tech I Semester (ME)	L	T	P	[C]
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(13ME712) CAM LAB

Objectives: To impart hands on practical exposure on and equipment.

List of Experiments:

1. Study of " G" codes and "M" codes.
2. CNC – Milling rectangular pocketing.
3. CNC – Milling circular pocketing.
4. CNC – Simple turning
5. CNC – Step turning.
6. CNC Lathe – Simple Facing.
7. CNC Lathe – Right Hand Taper Turning.
8. CNC Lathe – Left Hand Taper Turning.
9. CNC Lathe – Thread Cutting Operation.

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

IV B.Tech I Semester (ME)	**L**	**T**	**P**	**[C]**
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(13ME713) INSTRUMENTATION AND CONTROL SYSTEMS LAB

Objectives: To make the students to study and calibrate the pressure gauges transducer, thermocouple, rotometer, and anemometer.

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 rotometer for flow measurement.
10. Study and use of a Seismic pickup for the measurement of vibration amplitude of an engine bed at various loads.
11. Study and calibration of Mcleod gauge for low pressure.
12. Study of anemometer

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR

(AUTONOMOUS)

IV B.Tech I Semester (ME)	L	T	P	[C]
	0	0	0	[2]

(13ME714) HEAT TRANSFER LAB-II

Objectives: To devise experimentation schemes for estimating heat transfer rates in conduction, convection, radiation heat transfer and to estimate the approximate imbalance in machines and approximate heat transfer requirements. To provide probable solution for heat transfer. To provide experimentation schemes for sub-systems of a complex machine or thermal equipment to predict the characteristics of a complex system.

List of Experiments:

1. Experiment on Parallel and counter flow heat exchanger.
2. Emissivity of a gray body through Emissivity apparatus.
3. Experiment on Stefan Boltzman Apparatus.
4. Heat transfer in drop and film wise condensation.
5. Experiment on Critical Heat flux apparatus.
6. Study of heat pipe and its demonstration.
7. Study of Two – Phase flow.

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

IV B.Tech I Semester (ME)	L	T	P	[C]
	0	0	2	[2]

(13ME715) PROJECT WORK PHASE-I

The object of Project Work Phase-I is to enable the student to take up investigative study in the broad field of his branch of Engineering, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the department on an individual basis or three/four students in a group under the guidance of a supervisor/ guide. This is expected to provide a good initiation for the student(s) in R&D work.

The assignment normally includes:

- Survey and Study of published literature of on the assigned topic.
- Working out a preliminary approach to the problem relating to the assigned topic.
- Conducting preliminary analysis/ modeling/simulation/experiment/ design/ feasibility.
- Preparing a written report on the study conducted for presentation to the department.
- Final seminar presentation before Project Review Committee.

The supervisor/ guide will evaluate the execution of the project periodically.
Project Work Phase-I is allocated 100 marks with 2 credits. Out of 100, 25 marks are allocated for the supervisor/guide to be awarded based on periodical project reviews and submission of the report on the work done. 25 marks are allocated for the supervisor/guide and head of the department to be awarded based on seminar given by each student on the topic of the project. The other 50 marks shall be awarded on the basis of his presentation on the work done on his project by the Departmental committee comprising of Head of the Department, respective supervisor/ guide and two senior faculty of the department appointed by the Principal.
The candidate is declared to have passed in Project work Phase-I when he gets 40% marks given by the Departmental Committee and 50% marks overall.

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

IV B.Tech II Semester (ME)	L	T	P	[C]
	3	1	0	[3]

(13ME801) OPERATIONS RESEARCH

Objectives: To make use of the below techniques while modeling and solving the engineering problems of different fields.

UNIT-I

Development – Definition– Characteristics and Phases – Types of models – operation Research models– applications.

Allocation: Linear Programming Problem Formulation – Graphical solution – Simplex method – Artificial variables techniques -Two–phase method, Big-M method – Duality Principle-Economic interpretation of duality.

Transportation Problem: Formulation – Optimal solution, unbalanced transportation problem – Degeneracy. Assignment problem – Formulation – Optimal solution – Variants of Assignment Problem-Traveling Salesman problem.

Sequencing – Introduction – Flow –Shop sequencing – n jobs through two machines – n jobs through three machines – Job shop sequencing – two jobs through 'm' machines.

UNIT -II

Replacement: Introduction – Replacement of items that deteriorate with time – when money value is not considered and considered – Replacement of items that fail completely, group replacement.

Theory of Games: Introduction – Minimax (maximin) – Criterion and optimal strategy – Solution of games with saddle points – Rectangular games without saddle points – 2 X 2 games – dominance principle– m X 2 & 2 X n games -graphical method.

UNIT-III

Queuing Theory: Introduction – Terminology, Service channel, Arrival Pattern, Population, Departure Pattern (Service Pattern),Queuing Disciplines, Birth and Death Process, Balking, Reneging Jockeying, Single Channel Models with Poisson arrivals, Exponential Service Times, with finite Queue length and infinite Queue length, Multi channel models with Poisson arrivals, exponential service times with finite Queue length.

Inventory : Introduction – Single item – Deterministic models –Inventory models with price breaks – shortages are not allowed – Stochastic models – demand may be discrete variable or continuous variable– Instantaneous production. Instantaneous demand and continuous demand and no set up cost.

UNIT-IV

Dynamic Programming: Introduction – Bellman's Principle of optimality – Applications of dynamic programming capital budgeting problem – shortest path problem – linear programming problem.

Simulation: Definition – Types of simulation models – phases of simulation– applications of simulation – Inventory and Queuing problems – Advantages and Disadvantages.

Text Books:

1. Introduction to operations Research, Taha, PHI
2. Introduction to O.R, Hiller & Liebermann (TMH).
3. Operations Research by p.srinivasulu and B.Durgaprasad SciTech publications.

Reference Books:

1. Operations Research, A.M.Natarajan, P.Balasubramani, A.Tamilarasi, Pearson Education.
2. Operations Research: Methods & Problems, Maurice Saseini, Arhur Yaspan & Lawrence Friedman
3. Operations Research, R.Pannerselvam, PHI Publications.
4. Operations Research, Wagner, PHI Publications.
5. Operation Research, J.K.Sharma, MacMilan.
6. O.R, Wayne L.Winston, Thomson Brooks, Cole.
7. Operations Research, R.Veerachari and V. RaviKumar, I.K International

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

IV B.Tech II Semester (ME)	L	T	P	[C]
	3	0	0	[3]

(13ME802) ENERGY SYSTEMS
(Elective-II)

Objectives: To impart the students the knowledge of non-conventional energy resources and build mathematical models to predict their performance. To analyze requirements for various non conventional energy conversion systems and propose probable designs for improvement of performance. To present the feasible non-conventional energy conversion systems for the different parts of the society.

UNIT I

Principles Of Solar Radiation: Role and potential of new and renewable source, the solar energy option, Environmental impact of solar power, physics of the sun, the solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data.

Solar Energy Collection: Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.

UNIT II

Solar Energy Storage And Applications: Different methods, Sensible, latent heat and stratified storage, solar ponds. Solar Applications- solar heating/cooling technique, solar distillation and drying, photovoltaic energy conversion.

Wind Energy: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria.

UNIT III

Bio-Mass: Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, I.C.Engines Operation and economic aspects.

Geothermal Energy: Resources, types of wells, methods of harnessing the energy, potential in India.

UNIT IV

Ocean Energy: OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants, and their economics.

Direct Energy Conversion: Need for DEC, Carnot cycle, limitations, and principles of DEC. Thermo-electric generators, Seebeck, Peltier and Joule Thomson effects, Figure of merit, materials, applications, MHD generators, principles, dissociation and ionization, hall effect, magnetic flux, MHD accelerator, MHD Engine, power generation systems, electron gas dynamic conversion, economic aspects. Fuel cells, principles, faraday's law's, thermodynamic aspects, selection of fuels and operating conditions.

Text Books:

1. Renewable energy resources, Tiwari and Ghosal, Narosa.
2. Non-Conventional Energy Sources, G.D. Rai

Reference Books:

1. Renewable Energy Sources, Twidell & Weir
2. Solar Energy, Sukhatme
3. Solar Power Engineering,B.S.Magal Frank Kreith & BJ.F.Kreith.
4. Principles of Solar Energy, Frank Krieth & John FB Kreider.
5. Non-Conventional Energy, Ashok V Desai, Wiley Eastern
6. Non-Conventional Energy Systems, K Mittal, Wheeler.

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

IV B.Tech II Semester (ME)	L	T	P	[C]
	3	1	0	[3]

(13ME803) TOTAL QUALITY MANAGEMENT
(Elective-II)

Objectives: The objectives of this subject is to introduce the main principles of business and social excellence, to generate knowledge and skills of students to use models and quality management methodology for the implementation of total quality management in any sphere of business and public sector.

UNIT - I

TQM – overview, concepts, elements – History-Quality management philosophies-Juran, Deming, Crosby, Feigenbaum, Ishikawa– Stages of Evolution– continuous improvement – Objectives – internal and external customers. Quality standards – Need of standardization - Institutions – bodies of standardization, ISO 9000 series – ISO 14000 series – other contemporary standards – ISO certification process-Third party audit.

UNIT - II

Process management- Quality measurement systems (QMS) – developing and implementing QMS – nonconformance database- TQM tools & techniques- 7 QC tools- 7 New QC tools. Problem solving techniques - Problem Solving process – corrective action – order of precedence – System failure analysis approach – flow chart – fault tree analysis – failure mode assessment and assignment matrix – organizing failure mode analysis – pedigree analysis.

UNIT - III

Quality circles – organization – focus team approach – statistical process control process chart – Ishikawa diagram – preparing and using control charts. Quality Function Development (QFD) – elements of QFD – benchmarking-Types- Advantages & limitations of benchmarking – Taguchi Analysis – loss function - Taguchi design of experiments. Poka-yoke, Kaizen, Deming cycle.

UNIT - IV

Value improvement elements – value improvement assault – supplier teaming. Business process reengineering & elements of Supply chain management. Six sigma approach – application of six sigma approach to various industrial situations.

Text Books:

1. Total Quality Management, Joseph & Susan Berg
2. Total Quality Management, Bester field, Pearson.

Reference Books:

1. Quality management, Howard Giltow-TMH
2. Quality management, Evans.

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

IV B.Tech II Semester (ME)	L	T	P	[C]
	3	1	0	[3]

(13ME804) COMPUTATIONAL FLUID DYNAMICS
(Elective-II)

Objectives: To give the student a working knowledge of a variety of computational techniques that can be used for solving engineering problems.

UNIT – I

Elementary details in numerical Techniques: Number system and errors, Representation of integers, Fractions, Floating point Arithmetic, loss of significance and error propagation, condition and instability, computational methods for error estimation, Convergence of Sequences.

Applied Numerical Methods: Solution of a system of simultaneous Linear Algebraic Equations, iterative schemes. Of Matrix Inversion, Direct Methods for Matrix Inversion, Direct Methods for banded matrices.

UNIT – II

Finite Difference Applications in Heat conduction and Convention - Heat conduction, steady heat conduction in a rectangular geometry, transient heat conduction, and finite difference application in convective heat transfer. Finite Differences, discretization, consistency, stability, and Fundamentals of fluid flow modeling: Introduction, elementary finite difference quotients, implementation aspects of finite difference equations, consistency, explicit and implicit methods.

UNIT – III

Introduction to first order wave equation, stability of hyperbolic and elliptic equations, fundamentals of fluid flow modeling. Conservative property, the upwind scheme. Review of Equations Governing **Fluid Flow and Heat Transfer:** Introduction, conservation of mass, Newton's second law of motion, expanded forms of Navier-stokes equations, conservation of energy principle, and special forms of the Navier-stokes equations.

UNIT-IV

Steady flow, dimensionless form of Momentum and Energy equations, Stokes equation, conservative body force fields, stream function - Vorticity formulation.

Finite Volume Method: Approximation of surface integrals, volume integrals, interpolation and differentiation practices, upwind interpolation, linear interpolation and Quadratic Interpolation.

Text Books:

1. Numerical heat transfer and fluid flow, Suhas V. Patankar, Butter-worth Publishers
2. Computational fluid dynamics, Basics with applications, John. D. Anderson! Mc Graw Hill.

Reference Books:

1. Computational Fluid Flow and Heat Transfer, Niyogi, Pearson Publications
2. Fundamentals of Computational Fluid Dynamics, Tapan K. Sengupta, Universities Press.

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

IV B.Tech II Semester (ME)	L	T	P	[C]
	3	1	0	[3]

(13ME805) MECHANICAL VIBRATIONS
(Elective-II)

Objectives: The objective for this subject is for students to learn terminology, simple harmonic motion, combination of simple harmonic motions, Fourier analysis. Topics included Undamped free vibration and damped vibration, Free and forced vibrations of mechanical systems with lumped inertia, springs, and dampers are the primary emphasis.

UNIT - I

Introduction: Importance and scope ,definition and terminology, simple harmonic motion, combination of simple harmonic motions, Fourier analysis.

Single Degree Freedom Systems-I: Undamped free vibration: Classical method, Energy method, phase plane method, equivalent systems, and torsional systems.

UNIT - II

Single Degree Freedom Systems-Ii: Damped free vibration: Viscous damping, under damping, critical damping, coulomb damping, equivalent damping coefficient

Single Degree Freedom Systems With Forced Vibrations: Steady state forced vibration, sources of excitation, impressed harmonic force, impressed force due to unbalance, motion excitation, transmissibility and isolation, performance of different type of isolators, power absorbed by viscous damping, General theory of seismic instruments, accelerometer and Vibrometer, methods of vibration control, excitation reduction at source, System modification.

UNIT - III

Two Degree Freedom Systems: Natural frequencies and modes of vibration by classical method of spring-mass system, forced vibration, dynamic vibration absorber

Multi Degree Freedom Systems: Influence co-efficient method, damped mass and distributed mass systems, stodola method, Holzer's method, newtons iteration method,
Orthogonality of mode shapes.

UNIT - IV

Vibration In Continuous Systems: Longitudinal vibration of bars, torsional vibrations of circular rods or shafts, lateral vibrations of beams and shafts. Whirling of shafts critical speed of shafts, Rayleigh's upper bound approximation, Dunkerley's lower bound approximation, critical speed of shafts with damping.

Text Books:

1. Mechanical Vibrations, G.K.Grover
2. Theory and practice of mechanical Vibrations, J.S.Rao and K.Gupta

Reference Books:

1. Vibration Theory and Applications, W.T.Thomson
2. Vibration problems in Engineering, Timeoshenko and Young

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

IV B.Tech II Semester (ME)	L	T	P	[C]
	3	1	0	[3]

(13ME806) GAS TURBINES AND JET PROPULSION
(Elective-II)

Objectives: To understand the basic fundamentals of compressible flow concepts, non-dimensional numbers in compressible flow and to solve the simple compressible flow problems and also to understand the effect of compressibility in nozzles and diffusers, design criteria of nozzles and diffusers and solve isentropic compressible flow problems. Propulsive methods, concept of air-craft propulsion system. Performance of ram jet, turbojet, turbofan and turbo prop engines. Concept of rocket propulsion system, ignition and combustion.

UNIT- I

Gas Turbine Operating Cycles: Simple open cycle gas turbine or air standard Brayton cycle, Actual Brayton cycle, the cycle air flow rate, the cycle work ratio, optimum pressure ratio or Maximum cycle thermal efficiency, means of improving the efficiency and the specific output of simple cycle. Gas Turbines; gas turbine applications, gas turbine advantages & disadvantages, energy flow & back work, deviation from ideal cycle, gas turbine with regeneration, thermal efficiency of gas turbine with & without regenerator, gas turbine engines, intercooling & reheating, turbojet engine, turbofan engine, turboprop engine.

UNIT-II

Jet propulsion: Historical sketch- reaction principle- essential features of propulsion devices- Thermal jet engines, classification of – energy flow, thrust, thrust power and propulsion efficiency need for thermal jet engines and applications. Turboprop and turbojet – thermodynamic cycles, plant layout, essential components, and principles of operation – performance evaluation – thrust augmentation and Thrust reversal – contrasting with piston engine propeller plant.

UNIT-III

Ram jet- Thermo dynamic cycle, plant lay out, essential components – principle of operation – performance evaluation – comparison among atmospheric thermal jet engines- serqujet and Pulse jet, elementary treatment.

Rocket Engines: Need for, applications- basic principle of operation and parameters of performance – classification, solid and liquid propellant rocket engines, advantages, domains of application – propellants – comparison of propulsion systems.

UNIT-IV

Rocket Technology: Flight mechanics, application thrust profiles, acceleration- staging of rockets, need for – feed systems, injectors and expansion nozzles – rocket transfer and ablative cooling. Testing & instrumentation - need for Cryogenics – advanced propulsion systems, elementary treatment of Electrical nuclear and plasma Arc Propulsion.

Text Books:

1. Gas Turbines, V. Ganesan TMGH
2. Gas Dynamics & Jet Propulsion, Dr. S.L. Somasundaram.

Reference Books:

1. Gas turbines, Cohen, Rogers & Sarvana Muttoo, AddisionWiley & Longman
2. Thermodynamics of propulsion, Hill & Paterson.
3. Rocket Propulsion, Sutton.
4. ElementofGaSTurbinespropulsion, JackDMatingly,MGH.

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

IV B.Tech II Semester (ME)	L	T	P	[C]
	3	0	0	[3]

(13ME807) POWERPLANT ENGINEERING
(Elective-III)

Objectives: To understand the basic working principles of stream, hydel, Diesel, as turbine power plant and boilers, various ash and fuel handling equipments, equipments for burning the fuel, mechanical strokers, draught, and condenser types, geothermal and other power plant ,also comparison of all power plants and economics of various power plants.

UNIT-I

Introduction to the Sources of Energy – Resources and Development of Power in India.
Steam Power Plant: Plant Layout, Working of different Circuits, Fuel and handling equipments, types of coals, coal handling, and choice of handling equipment, coal storage, and Ash Handling systems.
Steam Power Plant: Combustion Process: Properties of coal – overfeed and underfeed fuel beds, traveling grate stokers, spreader stokers, retort stokers, and pulverized fuel Burning system and its components, combustion needs and draught system, cyclone furnace, design and construction, Dust collectors, cooling towers and heat rejection. Corrosion and feed water treatment.

UNIT-II

Internal Combustion Engine Plant: Diesel Power Plant: Introduction – IC Engines, types, construction– Plant layout with auxiliaries – fuel supply system, air starting equipment, lubrication and cooling system – super charging.
Gas Turbine Plant: Introduction – classification - construction – Layout with auxiliaries – Principles of working of closed and open cycle gas turbines. Combined Cycle Power Plants and comparison.

UNIT-III

Hydro Electric Power Plant: Water power – Hydrological cycle / flow measurement – drainage area characteristics – Hydrographs – storage and Pondage –
Classification of dams and spill ways.
Hydro Projects and Plant: Classification – Typical layouts – plant auxiliaries – plant operation pumped storage plants.
Power From Non-Conventional Sources: Utilization of Solar- Collectors- Principle of Working, Wind Energy – types – HAWT, VAWT -Tidal Energy.
Direct Energy Conversion: Solar energy, Fuel cells, Thermo electric and Thermo ionic, MHD generation.

UNIT-IV

Nuclear Power Station: Nuclear fuel – breeding and ertile materials – Nuclear reactor – reactor operation.
Types of Reactors: Pressurized water reactor, Boiling water reactor, sodium-graphite reactor, fast Breeder Reactor, Homogeneous Reactor, Gas cooled Reactor, Radiation hazards and shielding – radioactive waste disposal.
Power Plant Economics and Environmental Considerations: Capital cost, investment of fixed charges, operating costs, general arrangement of power distribution, Load curves, load duration curve. Definitions of connected load, Maximum demand, demand factor, average load, load factor,

diversity factor – related exercises. Effluents from power plants and Impact on environment – pollutants and pollution standards –Methods of Pollution control.

Text Books:

1. A Text Book of Power Plant Engineering, Rajput, Laxmi Publications
2. Power Plant Engineering, P.C.Sharma, S.K.Kataria Pub.

Reference Books:

1. Power Plant Engineering, P.K.Nag, II Edition, TMH.
2. Power plant Engineering, Ramalingam, SciTech Publishers
3. A Course in Power Plant Engineering, Arora and S.Domkundwar.

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

IV B.Tech II Semester (ME)	L	T	P	[C]
	3	0	0	[3]

(13ME808) NANO TECHNOLOGY
(Elective-III)

Objectives: To expose the students to the evolution of Nano systems, to the various fabrication techniques. Also to impart knowledge to the students about nano materials and various nano measurements techniques.

UNIT - I

General Introduction: Basics of Quantum Mechanics, Harmonic oscillator, magnetic Phenomena, band structure in solids, Mossbauer and Spectroscopy, optical phenomena bonding in solids, Anisotropy.

Silicon Carbide: Application of Silicon carbide, nano materials preparation, Sintering of SiC, X-ray Diffraction data, electron microscopy sintering of nano particles,

Nano particles of Alumina and Zirconia: Nano materials preparation, Characterization, Wear materials and nano composites,

UNIT- II

Mechanical properties: Strength of nano crystalline SiC, Preparation for strength measurements, Mechanical properties, Magnetic properties,

Electrical properties: Switching glasses with nanoparticles, Electronic conduction with nano particles

Optical properties: Optical properties, special properties and the coloured glasses

UNIT - III

Process of synthesis of nano powders, Electro deposition, important nano materials

Investigating and manipulating materials in the nanoscale: Electron microscopic, scanning probe Microscopic, optical microscopic for nano science and technology, X-ray diffraction.

UNIT - IV

Nanobiology: Interaction between bimolecules and naoparticle surface, Different types of inorganic materials used for the synthesis of hybrid nano-bio assemblies, Application of nano in biology, naoprobes for Analytical Applications-A new Methodology in medical diagnostics and Biotechnology, Current status of nano Biotechnology, Future perspectives of Nanobiology, Nanosensors.

NanoMedicens: Developing of NanoMedicens Nanosytems in use, Protocols for nanodrug Administration, Nanotechnology in Diagnostics applications, materials for used in Diagnostics and Therapeutic applications, Molecular Nanomechanics, Molecular devices, Nanotribology, studying tribology at nanoscale, Nanotribology applications.

Text Books:

1. Nano Materials- A.K.Bandyopadhyay/ New Age Publishers.
2. Nano Essentials- T.Pradeep/TMH

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

IV B.Tech II Semester (ME)	L	T	P	[C]
	3	0	0	[3]

(13ME809) ADVANCES IN CASTING AND WELDING PROCESSES
(Elective-III)

Objectives: To study the metallurgical concepts and applications of casting and welding process. To acquire knowledge in CAD of casting and automation of welding process.

UNIT-I

CASTING DESIGN: Heat transfer between metal and mould –– Design considerations in casting – Designing for directional solidification and minimum stresses - principles and design of gating and risering.

CASTING METALLURGY: Solidification of pure metal and alloys – shrinkage in cast metals – progressive and directional solidification –– Degasification of the melt-casting defects – Castability of steel , Cast Iron, Al alloys , Babbit alloy and Cu alloy.

UNIT-II

RECENT TRENDS IN CASTING AND FOUNDRY LAYOUT: Shell moulding, precision investment casting, CO2 moulding, centrifugal casting, Die casting, Continuous casting, Counter gravity low pressure casting, Squeeze casting and semisolid processes. Layout of mechanized foundry – sand reclamation – material handling in foundry pollution control in foundry –– Computer aided design of casting.

UNIT-III

WELDING METALLURGY AND DESIGN : Heat affected Zone and its characteristics – Weldability of steels, cast iron, stainless steel, aluminum, Mg , Cu , Zirconium and titanium alloys – Carbon Equivalent of Plain and alloy steels Hydrogen embrittlement – Lamellar tearing – Residual stress – Distortion and its control . Heat transfer and solidification - Analysis of stresses in welded structures – pre and post welding heat treatments – weld joint design – welding defects – Testing of weldment.

UNIT-IV

RECENT TRENDS IN WELDING: Friction welding, friction stir welding – explosive welding – diffusion bonding – high frequency induction welding – ultrasonic welding – electron beam welding – Laser beam welding –Plasma welding – Electroslag welding- narrow gap, hybrid twin wire active TIG – Tandem MIG- modern brazing and soldering techniques – induction, dip resistance, diffusion processes – Hot gas, wave and vapor phase soldering. Overview of automation of welding in aerospace, nuclear, surface transport vehicles and under water welding.

Text Books:

1. ASM Handbook, Vol 15, Casting, 2004
2. ASM Handbook vol.6, welding Brazing & Soldering, 2003

Reference Books:

1. Jain P.L., Principles of Foundry Technology, Tata McGraw Hill Publishers, 2003
2. Parmer R.S., Welding Engineering and Technology, Khanna Publishers,2002
3. Srinivasan N.K., Welding Technology, Khanna Tech Publishers, 2002
4. Heineloper & Rosenthal, Principles of Metal Casting, Tata McGraw Hill, 2000
5. Carrry B., Modern Welding Technology, Prentice Hall Pvt Ltd., 2002
6. Cornu.J. Advanced welding systems – Volumes I, II and III, JAICO Publishers, 1994.
7. Iotrowski – Robotic welding – A guide to selection and application – Society of mechanical Engineers, 1987.
8. Schwariz, M.M. – Source book on innovative welding processes – American Society of Metals (OHIO), 1981
9. Lancaster.J.F. – Metallurgy of welding – George Alien & Unwin Publishers, 1980

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

IV B.Tech II Semester (ME)	L	T	P	[C]
	3	0	0	[3]

(13ME810) MECHATRONICS
(Elective-III)

Objectives: To create knowledge in Mechatronics systems and impart the source of concepts and techniques, which have recently been applied in practical situation. It gives the frame work of knowledge that allows engineers and technicians to develop an interdisciplinary understanding and integrated approach to engineering.

UNIT-I

Introduction: Definition – Trends – Control Methods: Stand alone, PC Based (Real Time Operating Systems, Graphical User Interface, Simulation) - Applications: SPM, Robot, CNC, FMS, CIM.

Signal Conditioning : Introduction – Hardware - Digital I/O , Analog input – ADC , resolution , speed channels Filtering Noise using passive components – Resistors, capacitors - Amplifying signals using OP amps –Software - Digital Signal Processing – Low pass , high pass , notch filtering

UNIT-II

Precision Mechanical Systems: Pneumatic Actuation Systems - Electro-pneumatic Actuation Systems - Hydraulic Actuation Systems - Electro-hydraulic Actuation Systems - Timing Belts – Ball Screw and Nut - Linear Motion Guides - Linear Bearings - Harmonic Transmission -Bearings- Motor / Drive Selection.

Electronic Interface Subsystems: TTL, CMOS interfacing - Sensor interfacing – Actuator interfacing – solenoids, motors Isoation schemes- opto coupling, Buffer IC's - Protection schemes – circuit breakers , over current sensing, resettable fuses , thermal dissipation - Power Supply - Bipolar transistors/ mosfets

UNIT-III

Electromechanical Drives: Relays and Solenoids - Stepper Motors - DC brushed motors – DC brushless motors - DC servo motors - 4-quadrant servo drives , PWM's - Pulse Width Modulation – Variable Frequency Drives, Vector Drives - Drive System load calculation.

Microcontrollers Overview: 8051Microcontroller , micro processor structure - Digital Interfacing - Analog Interfacing - Digital to Analog Convertors - Analog to Digital Convertors - Applications. Programming –Assembly, C (LED Blinking, Voltage measurement using ADC).

UNIT-IV

Programmable Logic Controllers: Basic Structure - Programming: Ladder Diagram -Timers, Internal Relays and Counters - Shift Registers - Master and Jump Controls - Data Handling -Analog input / output - PLC Selection -Applications.

Programmable Motion Controllers: Introduction - System Transfer Function - Laplace transform and its application in analyzing differential equation of a control system - Feedback Devices :Position , Velocity Sensors - Optical Incremental encoders – Proximity Sensors : Inductive , Capacitive ,Infrared - Continuous and discrete processes - Control System Performance & tuning - Digital Controllers- P , PI , PID Control - Control modes – Position , Velocity and Torque - Velocity Profiles – Trapezoidal- S. Curve - Electronic Gearing - Controlled Velocity Profile - Multi axis Interpolation , PTP , Linear ,Circular – Core functionalities – Home, Record position , Go to Position -Applications : SPM, Robotics.

Text Books:

1. Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering, W Bolton, Pearson Education Press, 3rd edition, 2005.
2. Mechatronics, M.D.Singh, J.G.Joshi, PHI.

Reference Books:

1. Mechatronics Source Book, Newton C Braga, Thomson Publications, Chennai.
2. Mechatronics, N. Shanmugam, Anuradha Agencies Publishers.
3. Mechatronics System Design, Devdas shetty, Richard, Thomson.

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

IV B.Tech II Semester (ME)	L	T	P	[C]
	0	0	0	[2]

(13ME811) COMPREHENSIVE VIVA-VOCE

There shall be a Comprehensive Viva-Voce in IV B.Tech II Semester. The comprehensive Viva-Voce shall be evaluated in the topics covering the core aspects of the concerned discipline in which the candidate is likely to get graduated. The marks can be awarded based on the performance in viva-voce examination conducted by a committee consisting of **i)** Head of the Department **ii)** Two Senior Faculty members of the department **iii)** External Examiner appointed by the Principal. The comprehensive Viva-Voce shall be conducted for 100 marks. Of the 100 marks, 25 marks are allocated to each member of the committee.

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR
(AUTONOMOUS)

IV B.Tech II Semester (ME)	L	T	P	[C]
	0	0	0	[10]

(13ME812) PROJECT WORK PHASE-II

The Project work Phase-II will be an extension of Phase-I project work. The object of Project work phase-II is to enable the student to extend further the investigative study taken up as the project in Phase-I under the guidance of the supervisor/ guide from the department.

The assignment normally includes:

- Preparing an action plan for conducting the investigation including the team work.
- In depth study of the topic assigned.
- Review and finalization of the approach to the problem relating to the assigned topic.
- Final development of product/process, testing, results, conclusions and further direction.
- Preparing a paper for conference presentation/ publication in journal if possible.
- Preparing a dissertation in the standard format for being evaluated by the department.
- Final presentation of the work done before the Project Review Committee (PRC).

Internal: Project Work Phase-II is allocated 50 internal marks. Out of 50, 25 marks are allocated for the supervisor/guide and head of the department to be evaluated based on two seminars given by each student on the topic of the project. The other 25 marks shall be evaluated on the basis of his presentation on the work done on his project by the Departmental Committee comprising of Head of the Department, respective supervisor/ guide and two senior faculty of the department appointed by the Principal.

External: The semester end examination for project work done during IV B.Tech I semester and IV B.Tech II semester for 150 marks shall be conducted by a Project Review Committee (PRC). The committee comprises of an External Examiner appointed by the Principal, Head of the Department and Project Guide/Supervisor. The evaluation of project work shall be conducted at the end of the II Semester of IV B.Tech. The above committee evaluates the project work report with weightages of 50% of the marks (50 marks) awarded by external examiner, 20% of marks (20 marks) awarded by HOD & 30% of the marks (30 marks) by Project Guide/Supervisor respectively for a total of 100marks. Of the 50 marks for Presentation & Viva-Voce examination, HOD evaluates for 10 marks and external examiner for 40 marks. The evaluation of 150 marks is distributed as given below:

A candidate shall be declared to have passed in project work phase-II if he secures a minimum of 50% aggregate marks (100 marks) (Internal marks + External project marks), subject to a minimum of 40% marks (60 marks) in the project end examination.