PREFACE

Sri Siddhartha Institute of Technology, Tumkur (SSIT), is one of the better performing self financing Institute, offering technical education in the state of Karnataka. The Institute was started with the objective of *'Entrancing Education to reach the unreached'.* Recognizing our potential to grow into a 'Centre of Excellence, World Bank has chosen our Institute under Technical Education Quality Improvement Programme (TEQIP). Financial assistance has been granted to the Institute for the advancement in academics, development of laboratories and other infrastructures required for carrying out research activities. In this direction the Institute has put-up solid foundation for education and research with highly qualified faculty with a vision to groom the leaders of tomorrow.

The Institute offers 09 undergraduate, 07 post graduate and MCA programmes. The Institute has an annual intake of 670 students for undergraduate programme, 126 students for Post graduate and 60 students for MCA.

Considering our academic strength and infrastructure, Govt.Of Karnataka, through Visvesvaraya Technological University(VTU), has accorded us AUTONOMY.

Recognized as a better performing Autonomous institute, UGC conferred us the Deemed-to-be University Status in 2009. We are now a constituent college of Sri Siddhartha Academy of Higher Education (SSAHE), Tumkur.

Deemed University system provides flexibility to institutes to have their own curriculum and syllabus. Taking this opportunity the Institute has designed curriculum and syllabus in consultation with Industries and premier academic institutions to ensure that the young Engineers graduating from the Institute are industry ready.

The academic year is divided into two main semester (odd semester : September to December, Even semester : February to May) and a summer semester. The students are required to follow certain procedures and meet the academic requirements of each semester as stipulated from time to time by the Academic council.

Committees are formed at various levels for monitoring students performance . The Academic Performance Evaluation Committee (APEC) and Departmental Performance Evaluation Committee (DPEC), examines the pace and the Learning capabilities of the students based on their overall performance & academic record and counsels them.

SSIT, takes atmost care to ensure that students get the best and become outstanding engineers.

This booklet gives comprehensive information on the suggested course work for the Second year.

Principal

SRI SIDDHARTHA INSTITUTE OF TECHNOLOGY
TUMKUR

COMMON TO
MECHANICAL ENGINEERING AND
INDUSTRIAL ENGINEERING & MANAGEMENT
DEPARTMENTS

III SEM

SL NO	NAME OF THE SUBJECT	CODE	L	T	P	C
1.	ENGINEERING MATHEMATICS - III	13MA31	4	0	0	4
2	MECHANICAL MEASUREMENTS AND METROLOGY	13ME32	4	0	0	4
3	MECHANICS OF MATERIALS	13ME33	3	2	0	4
4	MANUFACTURING PROCESSES-I	13ME34	3	0	0	3
5	ENGG. THERMODYNAMICS	13ME35	3	2	0	4
6	COMPUTER AIDED MACHINE DRAWING	13ME36	1	0	4	3
7	MECHANICAL MEASUREMENTS & METROLOGY LAB	13MEL37	0	0	3	1.5
8	MANUFACTURING PROCESS LAB	13MEL38	0	0	3	1.5
9	MATHEMATICS (for Lateral Entry)	13MADIP301	4	0	0	0
		Total Credits				**25**
		TOTAL contact hours				**36**

ENGINEERING MATHEMATICS - III

Course code : 13MA31 **Credits : 4 - 0 - 0 - 4**

UNIT I: Fourier Series **10 Hrs**

Periodic functions, Fourier expansions, Half range expansions, Complex form of Fourier series, Practical harmonic analysis, Finite Fourier transforms Finite Fourier Sine and Cosine transforms.

UNIT II: Infinite Fourier Transforms & Z-Transforms **10 Hrs**

Infinite Fourier transforms, Infinite Sine and Cosine transforms, Inverse Fourier transforms.Difference equations Basic definitions, Z-transforms-Definition, Standard Z-transforms, Linearity property, Damping rule, Shifting rule, Initial value theorem, Final value theorem, Inverse Z-transforms. Applications of Z-transforms to solve difference equations.

UNIT III: Partial Differential Equations and Applications **13 Hrs**

Formation of P.D.E solutions of non homogenous P.D.E by direct integration method of separation of variables (First and Second order equations), solutions of Lagrange's linear P.D.E of the type Pp+Qq=R

One dimensional Wave and Heat equations. Solutions of these by the method of separation of variables D'Alembert's solution of Wave equation. Two dimensional Laplace's equations and solutions. Solutions of all these equations with specific boundary conditions (Boundary value problems)

UNIT IV: Numerical Methods **13 Hrs**

Numerical solutions of algebraic and transcendental equations : Newton-Raphson and Regular-Falsi methods. Solutions of linear simultaneous equations: Gauss Elimination and Gauss Jordan methods. Gauss-Seidal iterative method. Definitions of Eigen values and Eigen Vectors, Computation of largest eigen value and corresponding eigen vector by Rayleigh's power method.

Finite differences (Forward and Backward differences) interpolation, Newton's Forward and Backward interpolation formulae, Newton's divided differences formula, Lagrange's interpolation and inverse interpolation formulae. Numerical differentiation using Newton's forward and backward interpolation formulae.

Numerical integration: Simpson's one third and three eight's rule, Weddie's rule (All Formulae / rules without proof)

UNIT V: Calculus of Variations **6 Hrs**

Variation of function and functional, variational problems, Euler's equation, alternate forms of Euler's equations, Standard variational problems: Geodesics, Minimal surface of revolution, Hanging cable. The Brachistochrone problem

Text Book:
- Higher Engineering Mathematics by Dr. B.S. Grewal

Reference Books:
- Advanced Engineering Mathematics by E.Kreyszig
- Higher Engineering Mathematics by B.V Ramana
- Advanced Modern Engineering Mathematics by Glyn James

MECHANICAL MEASUREMENTS AND METROLOGY

Course Code : 13ME32 **Credits : 4 - 0 - 0 - 4**

Course Objectives:
1. To develop awareness ,knowledge and basic skill necessary for the reliable measurement applications
2. To understand measurement applications for tolerance, assessment for measurement quality
3. To understand the principles of autocollimator, optical flats and terminology of screw threads.

UNIT : 1

Standards of measurement: Definition and Objectives of metrology and measurements , Standards of length-International prototype meter, Imperial standard yard, Wave length standard, subdivision of standards, line and end standard, calibration of end bars (Numerical), Slip gauges, Wringing phenomena, Indian Standards (M-87, M-112), Numerical problems on building of slip gauges. **8 Hrs**

UNIT : 2

System of Limits, Fits, Tolerance and Gauging: Definition of tolerance, Specification in assembly, Principle of interchangeability and selective assembly limits of size, Indian standards, concept of limits of size and tolerances, compound tolerances, accumulation of tolerances, definition of fits, types of fits and their designation (IS 919-1963), geometrical tolerance, hole basis system, shaft basis system, classification of gauges, brief concept of design of gauges (Taylor's principles), Wear allowance on gauges, Types of gauges-plain plug gauge, ring gauge, snap gauge, limit gauge and gauge materials, Numerical problems on gauges. **8 Hrs**

UNIT : 3

Comparators and Angular measurement: Introduction to comparators, characteristics, classification of comparators, mechanical comparators-Johnson Mikrokator, sigma comparators, dial indicator, optical comparators-principles, Zeiss ultra optimeter, electric and pneumatic comparators, flow or velocity type, back pressure type, solex pneumatic gauge. Angular

measurements, bevel protractor, principle and use of sine bars, sine centre, use of angle gauges (numerical on building of angles). **8 Hrs**

Interferometry, Screw thread and Gear measurement: Principle of interferometry, autocollimator, optical flats, Terminology of screw threads, measurements of major diameter, minor diameter, pitch, angle and effective diameter of screw threads by 2-wire and 3-wire methods, best size wire, tool makers microscope, gear terminology, use of gear tooth vernier caliper. **4 Hrs**

UNIT : 4

Measurements and Measurement systems: Definition, requirements of measurement, significance of measurement, fundamental methods of measurement, generalized measurement system, definitions and basic concepts of accuracy, precision, calibration, threshold, sensitivity, hysteresis, repeatability, linearity**.** Errors in measurement, classification of errors. **4 Hrs**

Transducers: Introduction to Transducers, transfer efficiency, primary and secondary transducers, mechanical transducers, electrical transducers, electronic transducers, advantages and disadvantages of each type transducers. **4 Hrs**

Intermediate modifying and terminating devices: Mechanical systems, inherent problems, electrical intermediate modifying devices, input circuitry, ballast circuit, electronic amplifiers and telemetry. Terminating devices, mechanical, cathode ray oscilloscope, oscillographs, X-Y plotters. **4 Hrs**

UNIT : 5

Temperature and Strain measurement: Resistance thermometers, thermocouple, law of thermo couple, materials used for construction, pyrometer, optical pyrometer. Strain measurements, strain gauge, preparation and mounting of strain gauges, gauge factor, methods of strain measurement. **6 Hrs**

Measurement of force, torque and pressure: Principle, analytical balance, platform balance, proving ring. Torque measurement, Prony brake, hydraulic dynamometer. Pressure measurements, principle, use of elastic members, Bridgeman gauge, McLeod gauge, Pirani gauge. **6 Hrs**

Text book :

1. ENGINEERING METROLOGY by I.C.Gupta,Dhanpat Rai Publications, New Delhi.

2. MECHANICAL MEASUREMENTS by Beckwith Buck, Marangoni and Lienhard, Pearson Education Asia, 5th ed., 2001

Reference Books:

1. Mechanical measurements by Holman
2. Mechanical measurements by Sirohi and Radhakrishna
3. Mechanical measurements by Doeblin, McGraw Hill Book Co
4. Metrology for engineers by J.F.Galyer and C.R.Shotbolt
5. Industrial intrumentation by Alsutko, Jerry.D.Faulk,Thompson Asia Pvt Ltd,2002 .
6. Engineering metrology by R.K.Jain.Khanna Publishers,1994.

Course Outcomes:

1. The students will have good understanding of role of measurement in production.
2. The students will have knowledge of comparators and angular measurements.
3. The students will learn how to measure force, torque and pressure.

MECHANICS OF MATERIALS

Course Code : 13ME33 **Credits : 3 - 2 - 0 - 4**

Course Objectives:

1. To provide the basic concepts and principles of strength of materials.
2. To give an ability to calculate stresses and deformations of objects under external loadings.
3. To give an ability to apply the knowledge of strength of materials on engineering applications and design problems.

UNIT : I 12 Hrs

Simple Stress and Strain: Introduction, Properties of Materials, stress, strain, Hook's law, Poisson's Ratio, Stress-Strain diagram for ferrous and non ferrous materials, Principles of super position, total elongation of tapering bars of circular and rectangular cross sections. Elongation due to self weight.
Volumetric strain: expression for volumetric strain, elastic constants, relationship among Elastic constants, thermal stresses including compound bars.

UNIT : II 10 Hrs

Bending moment and shear force in beams: Introduction, types of beam loading and supports, shearing force in beams, bending moment, sign convention, relationship between loading shear force and bending moment,

Expressions for shear and bending moment equations, SFD, BMD for cantilever beams, simply supported beams and overhanging beams considering point loads, UDL, UVL, Couple.

UNIT : III **10 Hrs**

Bending stress and shear stress in beams: Introduction, Bending stress in beams, assumptions in simple bending theory and pure bending, modulus of rupture, section modulus, flexural rigidity, beam of uniform strength, expression for horizontal shear stress in beams, shear stress diagram for rectangular, symmetrical I and T section.(fletched beams not included)

Principal stresses and strains: Principal planes, principal stresses and strains, biaxial state of stress combined with shear, concept of Mohr's circle diagram.

UNIT - IV **10 Hrs**

Deflection of beams: Derivation of the relations between curvature, slope, deflection and moment. Assumptions, methods of determining slope and deflections. Determination of deflection of a simply supported beam subjected to concentrated load at centre, subjected to UDL, cantilever beam subjected to point load at free end, and also UDL.

Elastic stability of columns: Introduction, effective length, slenderness ratio, short and long columns, radius of gyration, buckling load, assumptions derivations of Euler's theory, Rankine's formula.

UNIT - V **10 Hrs**

Torsion of circular shafts: Introduction, pure torsion equations of circular shafts, strength and stiffness, Torsional rigidity, torsional flexibility, polar modulus, power transmitted by hallow and hollow circular sections.

Thin and thick cylinders: Thin and thick cylinders subjected to pressure, change in length, diameter, volume, lame's equation(Compound cylinders not included).

Text book :

1. **Strength of materials,** R K Bansal, Laksmi Publications, New Delhi.

Reference Books:

1. **Strength of materials,** S.S. Bhavikatti, Vikas Publications Pvt. Ltd., New delhi
2. **Strength of materials,** B.C. Punmia, Ashok Jain, Lakshmi Publications, New Delhi
3. **Strength of materials,** Timoshenko and Young, East west press.
4. **Strength of materials,** Ramamrutham, Dhanpath Rai publishers, New Delhi

Course Outcomes:

After successful completion of this course, students will be able to do the following:

1. Describe the concepts of normal and shear stress and strain and interpret stress strain diagrams.
2. Solve problems involving the mechanical properties of materials that are subject to various types of loadings (axial load, torsion, bending, transverse shear, combined loadings), and calculate resulting stresses and strains and material deformation.
3. Compute the stress and strain states both analytically and graphically at various orientation angles.
4. Compute the principal normal and maximum shear stresses.
5. Draw the shear force and bending moment diagrams and determine the maximum shear and maximum bending moment for various types of beam loadings.
6. Compute the deflection of beams under various loadings.

MANUFACTURING PROCESSES - I

Course Code : 13ME34 **Credits : 3 - 0 - 0 - 3**

Course Objectives:

1. Exploring the concepts and fundamentals of manufacturing processes.
2. Explain the price cost analysis of different manufacturing processes.
3. Exploring the basic different manufacturing processes.

UNIT : I **7 Hrs**

Introduction: Concept of Manufacturing process, its importance. Classification of Manufacturing processes. Introduction to Casting process & steps involved. Varieties of components produced by casting process. Advantages & Limitations of casting process.

Patterns: Definition, functions, Materials used for pattern, various pattern allowances and their importance. Classification of patterns.

Binder: Definition, Types of binder used in molding sand.

Additives: Need, Types of additives used.

UNIT : II **6 Hrs**

Sand Moulding : Types of base sand, requirement of base sand. Types of sand moulds.

Sand moulds: Moulding sand mixture ingredients (base sand, binder & additives) for different sand mixtures. Method used for sand moulding.

Cores: Definition, Need, Types. Method of making cores, Binders used.

Concept of Gating & Risering, Principle involved and types. Fettling and cleaning of castings. Casting defects.

UNIT - III **7 Hrs**

Moulding machines : Jolt type, squeeze type, Jolt & Squeeze type and Sand slinger.

Special moulding Process :Study of important moulding processes: Green sand, Core sand, Dry sand, Sweep mould, CO_2 mould, Shell mould, Investment mould.

Metal moulds: Gravity die-casting, Pressure die casting, centrifugal casting, Squeeze Casting, Slush casting, Thixocasting and continuous casting processes.

UNIT - IV **13 Hrs**

Welding process: Definition, Principles, Classification, Application, Advantages & limitations of welding.

Arc Welding: Principle, Metal Arc welding **(MAW)**, Flux Shielded Metal Arc Welding **(FSMAW)** , Inert Gas Welding **(TIG & MIG)** Submerged Arc Welding **(SAW)** and Atomic Hydrogen Welding processes. **(AHW)**

Gas Welding: Principle, Oxy Acetylene welding, Reaction in Gas welding, Flame characteristics, Gas torch construction & working. Forward and backward welding.

Special type of welding: Resistance welding - principles, Seam welding, Butt welding, Spot welding and projection welding. Friction welding, Explosive welding, Thermit welding, Laser welding and Electron beam welding.

UNIT : V **7 Hrs**

Metallurgical aspect in welding : Structure of welds, Formation of different zones during welding. Heat affected zone **(HAZ).** Parameters affecting **HAZ**. Effect of carbon content on structure and properties of steel. Shrinkage in welds & Residual stresses. Concept of electrodes, Filler rod and fluxes. Welding defects**.**

Text book :

1. **"Manufacturing & Technology**: Foundry Forming and Welding", P.N.Rao 2nd Ed., Tata McGraw Hill, 2003.
2. **"Manufacturing Process-I",** Dr.K.Radhakrishna, Sapna Book House, 2nd Edition 2007.

Reference Books:

1. **"Manufacturing Technology**", Serope Kalpakjain, Steuen. R.Sechmid, Pearson Education Asia, 5 th Ed. 2006.
2. **"Process and Materials of Manufacturing**:, Roy A Lindberg, 4th Ed. Pearson Edu. 2006.

Course Outcomes:

1. Students will be able to know the knowledge in different basic manufacturing processes.
2. Knowledge of solving related to basic manufacturing processes. Understating the importance of basic manufacturing processes.

ENGINEERING THERMODYNAMICS

Course Code : 13ME35 **Credits : 3 - 2 - 0 - 4**

Course Objectives:

1. To understanding the basic knowledge of thermodynamic properties of the substances.
2. To understanding the basic knowledge of work, heat, energy and First Law of Thermodynamics and its application to open and closed systems.
3. To understanding the basic knowledge of the Second Law of Thermodynamics and its application to open and closed systems.
4. To understanding the basic knowledge of the entropy, energy and conservation of mass and its application to engineering systems.

UNIT : I **11 Hrs**

Basic Concepts: Thermodynamics: definition and applications, Microscopic and Macroscopic approaches, Open & Closed systems, system boundary and control surface, examples, Properties, State, Processes and Cycles, Quasi-static process, Equilibrium of systems, Equality of temperature, Zeroth law of thermodynamics, Temperature scales, Numerical problems on temperature scales.

Pure substance: Definition of a pure substance, phases of a substance, triple point and critical points, sub-cooled liquid, saturated liquid, dryness fraction, vapor pressure, two-phase mixture of liquid and vapor, saturated vapor and superheated vapor states of a pure substance with water as example. Representation of pure substance properties on p-T and p-V diagrams, Steam tables and its use, Numerical problems.

UNIT : II **11 Hrs**

Ideal and perfect gases: Differences between perfect, ideal and real gases, equation of state, evaluation of properties of perfect and ideal gases. Real Gases: Introduction. Vander Waal's Equation of state, Van der Waal's constants in terms of critical properties, law of corresponding states, compressibility factor; compressibility chart.

Work and heat: Thermodynamic definition of work; examples, sign convention, Displacement work; Expressions for displacement work-plotting on p-v diagrams, Other forms of work, Free expansion with zero work

transfer. Heat: definition, units and sign convention, Comparison of heat and work, Numerical problems.

UNIT : III **10 Hrs**

First law of thermodynamics: Joule's experiments, equivalence of heat and work, Statement of the First law of thermodynamics, Extension of the First law to non -cyclic processes, Energy, Energy as a property, Modes of energy, Specific heats, Internal energy and enthalpy of ideal gas, Principale of Conservation of mass, Energy balance for steady flow system, Some steady flow engineering devices, Energy balance for unsteady flow processes, Numerical problems.

UNIT : IV **09 Hrs**

Second law of Thermodynamics: Limitations of First Law, Statements of second law, Thermal Energy reservoirs, Equivalence of Kelvin Plank and Clausius Statements, Heat Engines, Energy Conversion efficiencies, Refrigerators and Heat Pumps, Coefficient of performance, Perpetual motion machines, Reversible process, Factors that make a process irreversible, Carnot cycle, Carnot's Heat engine (reversible heat engines), Carnot Principle, Thermodynamic temperature scale, Numerical problems.

UNIT : V **11 Hrs**

Entropy: Clausius inequality; statement, proof, definition, a property, Entropy, Increase of Entropy principle, Entropy generation, entropy as a quantitative test for irreversibility, isentropic process, property diagrams involving entropy, Tds relation, entropy change for liquids, solids, and gases (Ideal),Entropy balance, Numerical problems.

Exergy: Exergy, Reversible and Irreversibility, Second law efficiency, Exergy change of a system, Exergy transfer by heat, work and mass, The decrease of Exergy principle, Exergy destruction, Exergy balance for closed system, Control volumes, Numerical problems.

Text book :

1. Thermodynamics An engineering approach by Yunus.A.Cenegel, Michael .A .Boles Tata McGraw hill, 2002.
2. Basic and Applied Thermodynamics by P.K.Nag Tata McGraw hill, 2002.

Reference Books:

1. Engg Thermodynamics by J.B.Jones and G.A.Hawkins,John Wiley and sons
2. Thermal Engineering by R.K. Rajput, Laxmi Publications,2007
3. Thermodynamics and Heat Engines by Domakundawar

Course Outcomes:

1. To be able to analyze thermodynamic properties of the substances,

state the First Law and to define heat, work, thermal efficiency and the difference between various forms of energy.

2. To be able to identify and describe energy exchange processes in various systems.
3. To be able to apply the steady-flow energy equation or the First Law of Thermodynamics to a system of thermodynamic components to estimate required balances of heat, work and energy flow.
4. To be able to explain the concepts of path dependence/ independence and reversibility /irreversibility of various thermodynamic processes.

COMPUTER AIDED MACHINE DRAWING

Course Code : 13ME36 **Credits : 1 - 0 - 4 - 3**

PART - A

Sections of solids: : **4 Hrs**
sections of regular solids namely prism, pyramid, cylinder & cone in simple positions.(with base in HP) & true shape of sections

Orthographic Views : **4 Hrs**
conversions of pictorial views into orthographic projection of simple m/c parts with sections(B.I.S conventions to be followed for the drawing)

Thread forms: : **10 Hrs**
ISO metric (internal & external), BSW (internal and external), square & Acme.
Fasteners: Hexagonal headed bolt and nut with washer (assembly), square headed bolt and nut, with washer (assembly), simple assembly using stud bolts with nut and lock nut. Flanged nut, slotted nut, taper and split pin for locking, counter sunken, head screw, grub screw, Allen screws.

PART - B

Keys & Joints : **16 Hrs**
parallel key, taper key, feather key, Gib head key, woodruff key
Riveted joints: (using snap head rivet), single and double riveted lap joint, butt joint with single strap(chain and zig zig), cotter joint(socket and spigot joint), knuckle joint (pin type for two roads)
Couplings: protected type flange coupling, pin type flexible coupling, universal coupling, split muff coupling, Oldham's coupling.

PART - C

Assembly drawings: (part drawings should be given) **18 Hrs**

1. Screw jack (bottle type)
2. Tail stock of lathe
3. Steam stop valve
4. Machine vice
5. Petrol engine piston and IC engine connecting rod
6. Plummer block(pedestal bearing)
7. Tool head of shaper

Text book :

1. Machine Drawing: N D Bhat & V M Panchal.
2. A Primer on Computer aided Machine drawing-2007, Published by VTU, Belgaum

Reference Books:

1. Machine drawing: by Sri .K L Narayan , P.Kannaiah & K.Venkat Reddy, New-Age International publications,2001.

2. Machine drawing: Sri K R Gopal Krishna, Subhas publications, Bangalore.

Scheme of Examination: To set 2 questions from each part, the students have to answer one from each part (Questions from Part A and Part B carry 20 marks each, while question from Part C carries 60 marks.)

MECHANICAL MEASUREMENTS & METROLOGY LAB

Course Code : 13MEL37 **Credits : 0 - 0 - 3 - 1.5**

PART - A

MECHANICAL MEASUREMENTS

1. Calibration of Pressure Gauge
2. Calibration of Thermocouple
3. Calibration of LVDT
4. Calibration of Load cell
5. Determination of modulus of elasticity of a mild steel specimen using strain gauges.
6. Calibration of Torque meter.

PART - B

METROLOGY:

1. Measurement using Optical Projector / Tool maker Microscope.
2. Measurement of angle using Sine Center / Sine bar
3. Measurement of alignment using Autocollimator
4. Measurement of Screw thread Parameter using Floating carriage micrometer
5. Measurement of Surface roughness using Surf test Sj301
6. Measurement using Mechanical comparator.
7. Measurement of gear tooth profile using gear tooth vernier / gear tooth micrometer.
8. Calibration of a micrometer using slip gauges.
   Measurement using Optical Flats.

Scheme of Examination:

One question to be set from Part A	:	20 marks
One question to be set from Part B	:	20 marks
Viva-voce	:	10 marks

MANUFACTURING PROCESS LAB

Course Code : 13MEL38 **Credits : 0 - 0 - 3 - 1.5**

1. **Foundry practice:** Use of foundry tools and equipments, Preparations of moulds (ready to pour) using boxes, Use of split pattern, Match plate pattern and cores.

2. **Forging models:** Preparing minimum three models involving upsetting, drawing and bending operations.

3. **Foundry sand testing:**
   a. To determine the Grain size , clay content, moisture content of a given Sand mixture

   AND

   b. To determine the various properties using Universal sand testing Machine

Scheme of Examination:

One question to be set from 1 or 2	:	25 marks
One question to be set from 3	:	15 marks
Viva-voce	:	10 marks

MATHEMATICS (For Lateral Entry)

Course code : 13MADIP301 **Credits : 4 - 0 -0 -0**

UNIT I : **6 Hrs**

Trigonometry Complex Numbers:Definitions, complex numbers as an ordered pair, real and imaginary parts, modulus and amplitude of a complex number, equality of a complex number, Addition, Subtraction, Multiplication & division of complex numbers, polar form , Argand Diagram, exponential form, expressing in the form a±ib problems.

UNIT II : **14 Hrs**

Differential Calculus: Differentiation of n^{th} order of standard functions, Leibnitz theorem, (statement only) with examples, polar curves, Taylor's series, Maclauri's series of simple functions for single Variable. Partial Differentiation: Definition, Euler theorem, total differentiation, Differentiation of composite and implicit functions, Jacobians illustrative examples and problems.

UNIT III : **8 Hrs**

Integral Calculus: Reduction formula for functions $\sin^n x$, $\cos^n x$, $\sin^n x \cos^n x$. Double integral, simple Problems, & Triple integral simple problem (with standard limits), β and γ functions, Properties, relation between β and γ functions, simple problems.

UNIT IV : **12 Hrs**

Differential Equations: Solutions of first order, first degree differential equations variable separable methods homogenous equation, Bernoulli's and exact differential equations (without I.F). Differential equations of second and higher orders with constant co-efficient.

TEXT BOOKS:

1. Higher Engineering Mathematics B.S. Grewal
2. Higher Engineering Mathematics H K Dass

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IV SEM

SL NO	NAME OF THE SUBJECT	CODE	L	T	P	C
1.	ENGINEERING MATHEMATICS - IV	13MA41	4	0	0	4
2	MATERIALS SCIENCE & METALLURGY	13ME42	4	0	0	4
3	FLUID MECHANICS	13ME43	3	2	0	4
4	MANUFACTURING PROCESSES - II	13ME44	3	0	0	3
5	KINEMATICS OF MACHINES	13ME45	3	2	0	4
6	MANAGEMENT & ENTREPRENEURSHIP	13IM46	3	0	0	3
7	MACHINING PRACTICE LAB	13MEL47	0	0	3	1.5
8	MATERIAL TESTING & METALLOGRAPHY LAB	13MEL48	0	0	3	1.5
9	MATHEMATICS (FOR LATERAL ONLY)	13MADIP401	4	0	0	0
		Total Credits	**25**			
		TOTAL contact hours	**34**			

ENGINEERING MATHEMATICS- IV

Course code : 13MA41 **Credits : 4 -0 -0 -4**

UNIT I: Numerical Methods **6 Hrs**

Numerical solutions of first order and first degree ordinary differential equations Taylor,s series methods, Modified euler's method, Runge- kutta method of foueth order, Milne's and Adams Bashforth Predictoar and corrector methods (no proofs).

UNIT II: COMPLEX VARIABLES & COMPLEX INTEGRATION 13 Hrs

Function of a complex variable, Limit, Continuity, Differentiability Definitions. Analytic functions, Cauchy- Riemann equations in Cartesians and polar forms, properties of analytic functions, conformal transformations- Definitions. Discussion of transformations: $w=z^2$, $w= e^{z,}$ $w= z+ (1/z)$. Bilinear transformations.

Complex line integrals, Cauchy's theorem, Cauchy's integral formula. Taylor's and Laurent's series (statements only). Singularities, poles, Residues, Cauchy's residur theorem.

UNIT III: Statistical Methods and Probability **13 Hrs**

Curve fitting by the method of least squares: $y= a+bx$, $y=a+bx+cx^{2,}$ $y=a\,x^b$, $Y=a\,b^x$,$y= ae^{bx}$, Correlation and regression.

Probability: Addition rule, Conditional probability, Multiplication rule, Baye's theorem

Random variables (Discrete and Continuous) p.d.f., c.d.f, Binomial, Poisson, Normal and Exponential distributions

UNIT IV: Joint Probability and Sampling Theory **13 Hrs**

Joint Probability distribution, Discrete and Independent random variables, Expectation, Covariance, Correlation coefficient.

Probability vectors, Stochastic matrices, Fixed points, Regular Stochastic matrices, Markov Chains, Higher transition probabilities, Stationary distributions of regular Markov chains and absorbing states.

Sampling, Sampling distribution, Standard error, Testing of Hypothesis for means, confidence limits for means for means, Students T distribution, Chi-square distribution as a test of goodness of fit.

UNIT V: Series Solution of Ordinary Differential Equations and Special Function **7 Hrs**

Series solution Frobenius method, Series solution of Bessel's D.E leading to Bessel function of first kind, Equations reducible to Bessels D.E series solution of Legendre's D.E leading to Legendre's polynomial's Rodirgue's formula.

Text Books:
- Higher Engineering Mathematics by Dr. B.S.Grewal (36th Edition)
- Probability by Seymour Lipschutz (Schaum's series)

Reference Books:
- Advanced Engineering Mathematics by E.Kreyszig.
- Higher Engineering Mathematics by B.V.Ramana.
- Advanced Modern Engineering Mathematics by Glyn James.

MATERIALS SCIENCE & METALLURGY

Course Code : 13ME42 **Credits : 4 - 0 - 0 - 4**

Course Objectives :
1. To gain an understanding of the relationships between the structure, properties, processing and applications of metals
2. To explain the concepts to fracture creep and fatigue mechanism in strengthening the metals
3. To discuss the phase transformations in metals, microstructural and property change in iron carbon alloys.
3. To understand the different thermal processing of metals.

UNIT - I : **10 Hrs**

Crystal Structure: Introduction, structure of crystalline solids, fundamental concepts of crystal geometry, crystal structure of BCC, FCC, and HCP, coordination number, atomic packing factors, crystal imperfections, point defects, line defects and surface defects.

Mechanical Behavior: Stress- strain diagrams to show ductile and behavior of materials, linear and non-linear elastic behavior and properties. Mechanical properties in plastic range yield strength, offset yield strength, ductility, ultimate tensile strength, and toughness and yield point phenomena. Plastic deformation of single crystal by slip, dislocation and twinning, deformation of polycrystalline metals.

UNIT - II : **8 Hrs**

Fracture, creep & fatigue: Introduction, Fracture, Types of fracture, Ductile & Brittle fracture, Ductile to Brittle transition, Fatigue, Types of fatigue loading with example, fatigue test, S-N curve, factors affecting fatigue life, fatigue protection methods, Creep, creep test, creep curve, Mechanism of creep, factors affecting creep, creep resistant materials.

Solidification: Mechanism of solidification, Homogenous and Heterogeneous Nucleation, crystal growth. Cast metal structures.

Phase diagram: Solid solutions, Hume Rothary rules, substitution, and interstitial solid solutions, Gibbs phase rule, construction of equilibrium diagrams, equilibrium diagrams involving complete and partial solubility,

lever rule. Numerical on phase diagrams.
Iron Carbon system: Iron carbon equilibrium diagram description of phases, Solidification of steels and cast irons and invariant reactions.

UNIT - III **10 Hrs**
TTT Diagrams: TTT curves, continuous cooling curves, Effect of cooling rate on TTT diagram, effect of carbon and alloying elements on TTT diagram.
Heat treatment of metals: Annealing and its types, Normalizing, Hardening, Tempering, Martempering, Austempering, Hardebnability, surface hardening methods like Carburizing cyaniding, nitrading flame hardening and induction hardening, age hardening of aluminum-copper alloys.

UNIT - IV **12 Hrs**
Introduction to Composite Materials: Definition, Classification, Types of matrices material and reinforcements, Characteristics & selection, Fiber composites, laminated composites, Particulate composites, Prepegs, and sandwich construction.
Manufacturing: Lay-up and curing - open and closed mould processing, Hand lay-Up techniques, spray Lay-up process, Bag moulding and filament winding, Pultrusion, compression moulding, Injection moulding, stir casting, squeeze casting, Cutting, Machining and joining.

UNIT - V **8 Hrs**
Ferrous and Non-ferrous materials: Properties, composition and uses of
a) Grey cast iron, malleable iron, S.G. iron and steels - [AISI & BIS designation of steels]
b) Copper alloys Brasses and Bronzes. - Aluminum alloys- Al-Cu, Al- Si, Al-Zn alloys.

Text book :
1. Materials science and metallurgy for engineers, Dr. V.D. Kodigere, Everest Publishing House, Pune.

Reference Books:
1. Foundations of materials science and engineering- Smith, 3rd Edition McGraw Hill, 1997.
2. Structure and properties of engineering materials- V.S.R Murthy, Tata McGraw Hill, 2003.
3. An introduction to metallurgy- Alan Cottrell, University Press India, Oriental Longman Pvt Ltd, 1974.
4. Physical metallurgy- Lakhtin, Mir Publications.
5. Materials science and engineering- V.Raghavan, PHI, 2002.
6. Elements of materials science and engineering- H. Van vlack, Addision-Wesley EDN., 1998.

Course Outcomes:
After successful completion of this course, students will be able to do the following:

1. The students will realize the concepts of plastic deformation in engineering materials.
2. The students will learn how to improve the properties of steel through heat treatment.
3. The students will learn to draw isothermal transformation diagram, continuous cooling transformation diagram and apply them in finding relative amounts of solid/liquid phase present in it.

FLUID MECHANICS

Course Code : 13ME43 **Credits : 3 -2 - 0 - 4**

Course Objectives :

1. To understand the properties of fluids and analyze the forces on a submerged structure in a static fluid.
2. Using Euler's and Bernoulli's equations to calculate pressure variations in accelerating fluids.
3. To understand surface resistance in laminar and turbulent flows and Evaluate head loss in pipes.

UNIT - I : 8 Hrs
Properties of Fluids: Density, Specific weight, Specific volume, Specific gravity, Viscosity, Kinematic viscosity, Newton's law of viscosity, Variation of viscosity with temperature, Classification of fluids, Compressibility and bulk modulus, Surface tension and capillarity, Vapour pressure and cavitation.

UNIT - II : 12 Hrs
Fluid Statics: Fluid pressure at a point, Pascal's law, pressure variation in a static fluid, Absolute, gauge, atmospheric and vacuum pressures, simple manometers, differential manometers, total pressure and center of pressure, vertical plane surface submerged in liquid, inclined plane surface submerged in liquid, Buoyancy, center of buoyancy, metacenter and metacentric height, conditions of equilibrium of floating and submerged bodies.

UNIT - III : 10 Hrs
Fluid Kinematics: Introduction, Types of fluid flow, continuity equation in three dimensions (Cartesian coordinate system only), velocity and acceleration, velocity potential function and stream function.

Fluid Dynamics: Introduction, equations of motion, Euler's equation of motion Bernoulli's equation from Euler's equation.

UNIT - IV : **14 Hrs**

Fluid flow measurements: Introduction, venturi meter, orificemeter, Pitot tube.

Flow through pipes: Frictional loss in pipe flow, Darcy Equation for loss of head due to friction in pipes, Chezy's equation for loss of head due to friction in pipes, Hydraulic gradient and total energy line.

UNIT - V : **8 Hrs**

Dimensional analysis: Introduction, Dimensions of physical quantities, Dimensional homogeneity, Buckinghams π-theorem, types of forces acting in moving fluids, Dimesionless numbers.

Text book :

1. **Fluid Mechanics** by Dr. Bansal.R.K, Lakshmi Publications, 2004.

Reference Books:

1. **Fluid Mechanics, Fundamental & Applications**, by YunusA, Cenegel John M,Cimbala, Tata MacGraw Hill, 2006.
2. **Fluid Mechanics** by John F.Douglas, Janul and M.Gasiosek and john A. Swaffield, Pearson Education Asia, 5th ed., 2006
3. **Fluid Mechanics and Fluid Power Engineering**, Kumar.D.S., Kataria and Sons., 2004.
4. **Fluid Mechanics and hydraulics**, Dr. Jagadishlal, Metropolitan Book Co-Ltd., 1997.

Course Outcomes:

1. Ability to understand the properties of fluids and solve the forces on submerged and floating bodies.
2. Ability to calculate accelerations and associated pressure variations in moving fluids using Euler's and Bernoulli's equations.
3. Ability to analyze laminar and turbulent flows in pipe and over the fixed plates.

MANUFACTURING PROCESSES - II

Course Code : 13ME44 **Credits : 3 -0 - 0 -3**

Course Objectives :

1. To study machine tools and basic machining processes.
2. To know the fundamentals of metal cutting and tool engineering.
3. To know the fundamentals of Non-Traditional Machining Process

UNIT - I : **8 Hrs**

Theory of Metal Cutting:

Introduction, definition of machine, machine tool, type of cutting tools, cutting tool materials, cutting fluids, Machine tool classification, working and auxiliary motions in machine tools. Orthogonal & Oblique cutting. Cutting speed, feed, depth of cut & their selection. Machinability, ISO tool nomenclature. Geometry of single point cutting tool. Merchant analysis. Taylor's equation, Factors affecting tool life

UNIT - II : **8 Hrs**

Lathes:

Overviews of constructional features, Classification of lathes, accessories and attachment, types of lathes operations, taper turning thread cutting, etc., speed feed and depth of cut, calculations for the above, machining time calculation. Capstan and Turret lathes. Constructional feature tool layout, tool holders, work holding devices.

Drilling Machines:

Overviews of constructional features, Classification tool and work holding devices, types of drill bits, nomenclature of twist drill, machining time calculation.

UNIT - III : **8 Hrs**

Shaping, Planing and Slotting Machines:

Overviews of constructional features, Classification, Operations, tool and work holding devices, machining time calculations. Quick return mechanisms for shapers and planers.

Broaching Machines:

Construction, operation and application of broaching machine.

UNIT - IV : **8 Hrs**

Milling Machines:

Overviews of constructional features, Classification features of milling machines. Attachments, milling cutters- types. Cutter nomenclature. Milling operations, Milling fixtures, machining time calculation, work holding devices and applications.

Indexing: Use of dividing head, Simple, angular compound and differential types of indexing, Machining time calculations

UNIT - V : **4 Hrs**

Non-Traditional Machining Processes:
Need for non traditional machining, Principle, equipment & operation of Laser Beam, Plasma Arc Machining, Electro Chemical Machining, Ultrasonic Machining, Abrasive Jet Machining, Water Jet Machining, Electron Beam Machining, Electron Discharge Machining and Plasma Arc Machining.

Text book :
1. Manufacturing Technology metal cutting and machine tools, P.N. Rao, Tata McGraw-Hill publications.

Reference Books:
1. Workshop Technology by Hazra Choudhry,Vol-II,Media Promoters & Publishers Pvt Ltd,2004
2. Production Technology by R.K.Jain,Khanna Publications,2003
3. Production Technology by HMT,TATA McGraw Hill, 2001
4. Materials and Process of Manufacture by Roy.A. Lindberg

Course Outcomes:
Learner should be able to....
1. Understand chip forming processes such as turning, milling, drilling, etc.
2. Understand the design aspects of cutting Tools and Economics of machining.
3. Distinguish between the conventional and modern machine tools.

KINEMATICS OF MACHINES

Course Code : 13ME45 **Credits : 3 -2 - 0 -4**

Course Objectives :
1. To develop skills of designing and analyzing linkages, cams, gears and other mechanisms .
2. To provide a foundation for the study of machine design.
3. To identify the function characteristics of various machine elements

UNIT - I : **8 Hrs**

Introduction: Definitions Link or element, kinematic pairs, Degrees of freedom, Grubler's criterion (without derivation), Kinematic chain, Mechanism, Structure, Mobility of Mechanism, Inversion, Machine.

Kinematic Chains and Inversions: Inversions of Four bar chain; Single slider crank chain and Double slider crank chain.

UNIT - II : **8 Hrs**

Mechanisms: Quick return motion mechanisms-Drag link mechanism, Whitworth mechanism and Crank and slotted lever Mechanism. Straight line motion mechanisms Peaucellier's mechanism and Robert's mechanism. Intermittent Motion mechanisms -Geneva wheel mechanism and Ratchet and Pawl mechanism. Toggle mechanism, Pantograph, Ackerman steering gear mechanism.

UNIT - III : **14 Hrs**

Velocity and Acceleration Analysis of Mechanisms (Graphical Methods): Velocity and acceleration analysis of Four Bar mechanism, slider crank mechanism and Simple Mechanisms by vector polygons: Relative velocity and acceleration of particles .in a common link, relative velocity and accelerations of coincident Particles on separate links- Coriolis component of acceleration. Angular velocity and angular acceleration of links, velocity of rubbing.

Velocity Analysis by Instantaneous Center Method: Definition, Kennedy s Theorem, Determination of linear and angular velocity using instantaneous center method Klein s Construction: Analysis of velocity and acceleration of single slider crank mechanism.

UNIT - IV : **14 Hrs**

Spur Gears: Gear terminology, law of gearing, Characteristics of involute action, Path of contact, Arc of contact, Contact ratio of spur, helical, bevel and worm gears, Interference in involute gears. Methods of avoiding interference, Back lash. Comparison of involute and cycloidal teeth. Profile Modification.

Gear Trains: Simple gear trains, Compound gear trains for large speed reduction, Epicyclic gear trains, Algebraic and tabular methods of finding velocity ratio of epicyclic gear trains. Tooth load and torque calculations in epicyclic gear trains.

UNIT - V : **8 Hrs**

Cams: Types of cams, Types of followers. Displacement, Velocity and, Acceleration time curves for cam profiles. Disc cam with reciprocating follower having knife-edge, roller and flat face follower, Disc cam with oscillating roller follower. Follower motions including SHM, Uniform velocity, uniform acceleration and retardation and Cycloidal motion.

Text book :

1. Rattan S S, " Theory of Machines" Tata McGraw- Hill Publishing , Company ., New Delhi, and 2nd edition-2005.

Reference Books:

1. Sadhu singh, "Theory of Machines" Pearson Education(Singapore) Pvt.Ltd., India Branch, New Delhi, 2nd edition-2006.

2. Theory of Machines by R S Khurmi , J K Gupta , S Chand and Company, New Delhi.

Course Outcomes:

At the completion of the subject, students should be able to :

1. Analyze various types of transmission.
2. Apply balancing in machine systems.
3. Analyze various types of CAMS.
4. Analyze the kinematics mechanisms.

MANAGEMENT & ENTREPRENEURSHIP

Course Code : 13IM46 **Credits : 3 -0 - 0 -3**

Course Objectives :

1. To demonstrate an understanding of the functional areas of accounting, marketing, finance, management, and economics.
2. To demonstrate an understanding of the legal and social environment of business.
3. To demonstrate an understanding of the ethical obligations and responsibilities of business.

UNIT - I : **8 Hrs**

MANAGEMENT: Introduction _ Meaning nature and characteristics of Management, Management & Administration Levels of Management, Principles and functions of Management

PLANNING: Nature, importance and purpose of planning process Objectives Types of plans (Meaning Only) Decision making Importance of Planning steps in planning & planning premises

UNIT - II : **8 Hrs**

ORGANIZING: Nature and purpose of organization Principles of organization Types of organization Departmentation Committes Centralization Vs Decentralization of authority and responsibility - Span of control

DIRECTING & CONTROLLING: Meaning and nature of directing Leadership styles, Motivation Theories, Communication Meaning and importance Coordination - Meaning and importance,

UNIT - III : **7 Hrs**

ENTREPRENEUR: Meaning of Entrepreneur, Evolution of the Concept, Functions of an Entrepreneur, Types of Entrepreneur, Intrapreneur. Concept of Entrepreneurship Evolution of Entrepreneurship, Development of Entrepreneurship: stages in entrepreneurial process; Role of entrepreneurs in Economic Development; Entrepreneurship; Entrepreneurship in India; Entrepreneurship its Barriers

UNIT - IV : **8 Hrs**

SMALL SCALE INDUSTRIES: Definition; characteristics; Need and rationale; Objectives; Scope; role of SSI in Economic Development. Advantages of SSI steps to start and SSI Government policy towards SSI; Impact of Liberalization, Privatization, Globalization on SSI Effect of WTO/GATT, Visit to SSI.

UNIT - V : **8 Hrs**

PREPARATION OF PROJECT: Meaning of Project, Project Identification; Project Selection; Project Report; Need and Significance of Report; Contents; Formulation; Guidelines by Planning Commission for Project report; Network Analysis; Errors of Project Report; Project Appraisal.

Text book :

1. Principles of Management -P.C. Tripathi, P.N.Reddy Tata McGraw Hill,
2. Dynamics of Entrepreneurial Development & Management - Vasant Desai Himalaya Publishing House
3. Entrepreneurship Development - Poornima.M.Charantimath Small Business Enterprises Pearson Education 2006 (2 & 4).

Reference Books:

1. Management Fundamentals - Concepts, Application, Skill Development Robers Luiser Thomson
2. Entrepreneurship Development - S.S.Khanks S.Chand & Co.
3. Management - Stephen Robbins Pearson Education / PHI 17 Edition, 2003

Course Outcomes:

1. Create awareness about entrepreneurship
2. Stimulate the potential to develop entrepreneurial orientation through innovation and creativity
3. Understand relationship between business, market, and Society
4. Understand the role of management in creating and maintaining business.

MACHINING PRACTICE LAB

Course Code : 13MEL47 **Credits : 0-0 -3 -1.5**

1. Plain turning, Taper turning, Step turning, Thread cutting, Facing, Knurling.
2. Cutting of gear teeth using Milling machine.
3. Cutting of V-groove/Dovetail/Rectangular groove using Shaping machine.
4. Drilling Operation using Sensitive drilling machine and Radial drilling machine.

Scheme of Examination:

One question to be set from 1 .	:	20 marks
One question to be set from 2,3,4	:	20 marks
Viva-voce	:	10 marks

MATERIALS TESTING & METALLOGRAPHICS LAB

Course Code : 13MEL48 **Credits : 0-0 -3 -1.5**

PART - A

1. Conduction of tensile, shear, compression and bending test of metallic and non metallic specimen using a universal testing machine.
2. Conduction of Izode and Charpy test on mild steel specimen.
3. Experiments on wear studies using ferrous, nonferrous & composite materials for different parameters.
4. Brinell, Rockwell and Vicker's hardness test.
5. Torsion test
6. Fatigue test.

PART - B

1. Preparation of specimen for metallographic examination of different engineering materials. Identification of the microstructure of plain carbon steel, tool steel, grey C.I., S.G iron, and brass, bronze & composite.

2. Heat Treatment: Annealing, normalizing, hardening and tempering of steel. Hardness studies of heat treated samples.

3. Non-destructive test experiments.
   a) Ultrasonic flaw detector
   b) Magnetic crack detector
   c) Dye penetrant testing

Scheme of Examination:

One question to be set from Part A	:	25 marks
One question to be set from Part B	:	15 marks
Viva-voce	:	10 marks

MATHEMATICS (For Lateral Entry)

Course Code : 13MADIP401 **Credits : 4 - 0 - 0 - 0**

UNIT I : **12 Hrs**

Solid Geometry: Distance Formula (without proof), Division formula, Direction cosines and Direction ratios, planes and straight lines, angle between the planes.

UNIT II : **12 Hrs**

Vector Algebra: Vector addition, multiplication (Dot and Cross products), Triple products, Vector Differentiation Velocity, Acceleration of a vector point function, gradient, curl and Divergence, solenoid and irrrotational fields, simple and direct problems.

UNIT III : **16 Hrs**

Laplace transforms: Definitions, Laplace transforms of elementary functions, transforms of derivatives and Integrals .Inverse transforms, Applications Laplace transforms to differential equations.

TEXT BOOKS:

1) Higher Engineering Mathematics B.S. Grewal
2) Higher Engineering Mathematics H K Dass

TIME - TABLE

Timings	9 -10 am	10 - 11 am		11.15 am-12.15 pm	12.15 -1.15 pm		2.15 -3.15 pm	3.15-4.15pm	4.15 - 5.15pm
MONDAY			11.00 - 11.15 am Break			1.15 - 2.15 pm LUNCH BREAK			
TUESDAY									
WEDNESDAY									
THURSDAY									
FRIDAY									
SATURDAY									