B. TECH.

MECHANICAL ENGINEERING

Third & Fourth Semester

EVALUATION SCHEME & SYLLABUS

Effective from session (2018-19)



FACULTY OF ENGINEERING UNIVERSITY OF LUCKNOW LUCKNOW

UNIVERSITY OF LUCKNOW FACULTY OF ENGINEERING

Evaluation Scheme for B. Tech.

(Effective from session 2018-19)

Branch: Mechanical Engineering

SEMESTER – III

S.	Subject	Subject Name	L-T-P	Evaluation					Credit
No.	Code			Sessional			ESE	Grand	
				СТ	ТА	Total		Total	
		Theory							
1.	AS - 301	Mathematics – III	310	20	10	30	70	100	4
2.	CE - 301	Fluid Mechanics	310	20	10	30	70	100	4
3.	ME - 301	Strength of Materials	300	20	10	30	70	100	3
4.	ME - 302	Materials Science	300	20	10	30	70	100	3
5.	ME - 303	Engineering Thermodynamics	300	20	10	30	70	100	3
6	AS - 302/	Human Values & Ethics /	30	20	10	30	70	100	3
0.	AS - 303	Environment & Ecology						100	
		Practical							
7.	CE - 351	Fluid Mechanics Lab	002	-	20	20	30	50	1
8.	ME - 351	Strength of Materials Lab	002	-	20	20	30	50	1
9.	ME – 352	Materials Science Lab	002	-	20	20	30	50	1
10.	ME - 353	Machine Drawing Lab	002	-	20	20	30	50	1
11.	GP -301	General Proficiency				50		50	
Total			18-2-8					800	24

UNIVERSITY OF LUCKNOW FACULTY OF ENGINEERING

Evaluation Scheme for B. Tech.

(Effective from session 2018-19)

Branch: Mechanical Engineering

SEMESTER - IV

S.	Subject	Subject Name	L-T-P	Evaluation					Credit
No.	Code			Sessional			ESE	Grand	
				СТ	ТА	Total		Total	
	Theory								
1.	AS - 401	Computer Oriented Numerical Techniques	310	20	10	30	70	100	4
2.	ME - 401	Manufacturing Science & Engineering - I	300	20	10	30	70	100	3
3.	ME - 402	Applied Thermodynamics	310	20	10	30	70	100	4
4.	ME-403	Measurements & Metrology	300	20	10	30	70	100	3
5.	ME - 404	Kinematics of Machines	300	20	10	30	70	100	3
6.	AS - 402/ AS - 403	Human Values & Ethics/ Environment & Ecology	300	20	10	30	70	100	3
	Practical								
7.	ME - 451	Manufacturing Science & Engg Lab I	002	-	20	20	30	50	1
8.	ME – 452	Applied Thermodynamics Lab	002	-	20	20	30	50	1
9.	ME - 453	Measurements & Metrology Lab	002	-	20	20	30	50	1
10.	ME - 454	Numerical Techniques Lab	002	-	20	20	30	50	1
11.	GP - 401	General Proficiency				50		50	
Total			18-2-8					800	24

AS - 301 MATHEMATICS- III

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Unit- I: Sequences and Series

Sequences, Limit of a sequence, Convergence, Divergence and Oscillation of a sequence, Infinite series, Necessary condition for convergence, Standard infinite series, Geometric series and Harmonic series. Tests for convergence and divergence, Comparison test (only for series with positive terms), Cauchy's integral test, D'alembert's ratio test, Cauchy's nth root test, Raabe's test (higher ratio test), Logarithmic test, Demorgan's and Bertrand's tests, Alternating series Leibnitz's theorem (without proof), Absolute convergence and Conditional convergence, Power series.

Unit- II: Function of Complex variable

Analytic function, C-R equations, Harmonic functions, Cauchy's integral theorem, Cauchy's integral formula, Derivatives of analytic functions, Taylor's and Laurent's series, Singularities, Zeroes and Poles, Residue theorem, Evaluation of real integrals of the type $\int_0^{2\pi} f(\cos\theta, \sin\theta) d\theta$ and $\int_{-\infty}^{+\infty} f(x) dx$.

Unit- III: Integral Transforms

Fourier integral, Complex Fourier transform, Inverse transform, Convolution theorem, Fourier sine and cosine transform, Applications of Fourier transform to simple one dimensional heat transfer equations, wave equations and Laplace equations, Z- transform and its application to solve difference equations.

Unit- IV: Statistical Techniques – I

Moments, Moment generating functions, Skewness, Kurtosis, Curve fitting, Method of least squares, Fitting of straight lines, Polynomials, Exponential curves etc., Correlation, Linear, non-linear and multiple regression analysis, Probability theory.

Unit- V: Statistical Techniques – II

Binomial, Poisson and Normal distributions, Sampling theory (small and large), Tets of significations: Chi- square test, t-test, Analysis of variance (one way), Application to engineering, medicine, agriculture etc. Time series and forecasting (moving and semi- averages), Statistical quality control methods, Control charts, \overline{X} , R, p, np and c charts.

Test Books :-

- 1. Peter V. O'Neil, Advance Engineering Mathematics Thomson (Cengage) Learning, 2007.
- 2. J.N. Kanpur, Mathematical Statistics, S. Chand & company Ttd., 2000

Reference Books :-

- 1. R.K. Jain & S.R.K. Iyenger, Advance Engineering Mathematics, Narosa Publication House, 2002.
- 2. Chandika Prasad, Advanced Mathematics for Engineers, Prasad Mudralaya, 1996.
- 3. B. V. Ramana, Higher Engineering Mathematics, Mc Gra Hill Education, 2016.
- 4. E. Kreysig, Advanced Engineering Mathematics, John Wiley & Sons, 2005.
- 5. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 2005.
- 6. S.P. Gupta, Statistical Methods, Sultan and Sons, New Delhi, 2004.
- 7. Devore, Probability and Statistics, Thomson (Cengage) Learning, 2007.
- 8. Walpole, Myers, Myers & Ye, Probability and Statistics for Engineers & Scientists, Pearson Education, 2003.

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CE - 301**Fluid Mechanics**

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Unit - I		08	
Introduction: Fluid and continuum, physical properties of fluids, rheology of fluids.			

Fluid Statics: Pressure-density-height relationship, manometers, pressure on plane and curved surfaces, centre of pressure, buoyancy, stability of immersed and floating bodies, fluid masses subjected to linear acceleration and uniform rotation about an axis.

Unit - II

Kinematics of Fluid Flow: Continuum and free molecular flows, steady and unsteady, uniform and nonuniform, laminar and turbulent flows, rotational and irrotational flows, compressible and incompressible flows, subsonic, sonic and supersonic flows, sub-critical, critical and supercritical flows, one, two and three dimensional flows, ideal and real flow.

System versus control volume approach, fundamentals of flow visualization, streamlines, streak lines and path lines, continuity equation in Cartesian and polar co-ordinate system, rotation and circulation, stream function and potential function, flow nets.

Dimensional Analysis and Hydraulic Similitude: Rayleigh's method, Buckingham's Pi theorem, important dimensionless numbers and their significance, geometric, kinematics and dynamic similarity, model studies, distorted and undistorted models.

Unit - III

Potential flow: source, sink, doublet and half-body, free and forced vortex flow.

Dynamics of Fluid Flow: Euler's Equation of motion along a streamline and its integration, Bernoulli's equation and its applications- Pitot tube, orifice meter, venturi meter and bend meter, Hot-wire anemometer and LDA, flow through orifices, mouthpieces, notches and weirs, aeration of nappe, momentum equation and its application to pipe -bends, flow through nozzles.

Unit - IV

Laminar Flow: Relation between shear and pressure gradient in laminar flow, introduction toNavier-Stokes equations, Reynolds experiment, equation of motion for laminar flow through pipes, flow between parallel plates, Kinetic energy and Momentum correction factors.

Turbulent Flow: Types of turbulent flow, isotropic, homogenous turbulence, scale and intensity of turbulence, measurement of turbulence, eddy viscosity, Prandtl's mixing length concept and velocity distribution in turbulent flow over smooth and rough surfaces.

Flow through Pipes: Major and minor losses, energy and hydraulic grade lines, combination of pipes, flow through siphon pipes, pipe network, power transmission through pipes, surge tanks, water hammer.

Unit - V

Theory of Boundary Layer: Boundary layer thickness, boundary layer over a flat plate, application of Von-Karman integral momentum equation, laminar sub-layer, boundary layer separation and its control.

Forces on Submerged Bodies: Drag and lift, drag on a sphere and on a cylinder, development of lift on a circular cylinder and an aerofoil, Magnus effect.

Compressible Flow: Thermodynamic relations, basic equations of compressible flow, expression for velocity of sound wave in a fluid.

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Text Books:

- 1. Bansal, R.K., 'Fluid Mechanics and Hydraulics Machines', Laxmi Pub. Ltd., New Delhi
- 2. Cengel&Cinbala,' Fluid Mechanics', TMH, New Delhi.

Reference Books:

- 1. Modi, L.P.N, Seth, S.M., 'Hydraulics and Fluid Mechanics', Std. Book House Pub.
- 2. Ojha, C.S.P., Berndtsson, R., Chandramouli, P.N. 'Fluid Mechanics and Machinery', Oxford University Press.
- 3. R. W. Fox, P. J. Pritchard, A. T Mcdonald, Introduction to Fluid Mechanics, John Wiley
- 4. F. M White, Fluid Mechanics, Tata McGraw Hill Eduction.
- 5. Munsan et.al, 'Fundamentals of Fluid Mechanics', Wilay New York.
- 6. Garde, R.J., 'Fluid Mechanics'.
- 7. Jain, A.K., Fluid Mechanics, Khanna Publishers, New Delhi.

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ME - 301

STRENGTH OF MATERIALS

Unit I

Stresses in Beams: Review of pure Bending. Direct and shear stresses in beams due to transverse and axial loads, composite beams.

Curved Beams: Bending of beams with large initial curvature, position of neutral axis for rectangular, trapezoidal and circular cross sections, stress in crane hooks, stress in circular rings subjected to tension or compression.

Unit II

Unsymmetrical Bending: Properties of beam cross-section, slope of neutral axis, stress and deflection in unsymmetrical bending, determination of shear center and flexural axis (for symmetry about both axis and about one axis) for I-section and channel section.

Deflection of Beams: Equation of elastic curve, cantilever and simply supported beams, Macaulay's method, area moment method Fixed beams. Castigliano's Theorem.

Unit III

Helical and Leaf Springs: deflection of springs by energy method, helical springs under axial load and under axial twist (respectively for circular and square cross sections) axial load and twisting moment acting simultaneously both for open and closed coiled springs, laminated springs.

Unit IV

Columns and Struts: Combined bending and direct stress, middle third and middle quarter rules. Struts with different end conditions, Euler's theory and experimental results, Ranking Gardon Formulae, Examples of columns in mechanical equipments and machines.

Unit V

Thin cylinders & spheres: Hoop and axial stresses and strain. Volumetric strain. Thick cylinders: Radial, axial and circumferential stresses in thick cylinders subjected to internal or external pressures, Compound cylinders Stresses due to interference fits.

Text Books :

- 1. Strength of Materials by G.H. Ryder, Macmillan
- 2. Strength of Materials: Elementary Theory and Problems Vol. I and Vol. II by Stephen Timoshenko, CBS Publishers
- 3. Strength of materials R. K. Rajput, S.Chand Publications

Reference Books:

- 1. Mechanics of Materials by E P Popov, Pearson.
- 2. Mechanics of Materials by Bear Johnston, McGraw Hill
- 3. Advanced Mechanics of Solids by L.S. Srinath, McGraw Hill

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ME - 302 MATERIALS SCIENCE

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Unit I

Introduction: Importance of materials, historical perspective, Future aspects of engineering materials. **Crystal Structure**: Brief description of BCC, FCC and HCP Structures, coordination number and atomic packing factors. Bravais lattices, Miller indices, crystal imperfections-point line and surface imperfections. Atomic Diffusion: Phenomenon, Ficks laws of diffusion, factors affecting diffusion.

Ferrous and non- ferrous materials: Properties, Composition and uses of Grey cast iron, malleable iron, SG iron and steel, copper alloys-brasses and bronzes, Aluminium alloys.

Unit II

Mechanical Behaviour: Stress-strain diagram showing ductile and brittle behaviour of materials, mechanical properties in plastic range, yield strength off set yield strength, ductility, ultimate tensile strength, toughness, Plastic deformation of single crystal by slip and twinning, Hardness Tests.

Fracture, Creep and Fatigue: Fracture: Type I, Type II and Type III. Creep: Description of the phenomenon with examples. Three stages of creep, creep properties, stress relaxation. Fatigue: Types of fatigue loading with examples, Mechanism of fatigue, fatigue properties, fatigue testing and S-N diagram.

Unit III

Solidification: Mechanism of solidification, Homogenous and Heterogeneous nucleation, crystal growth, cast metal structures. Phase Diagram I: Solid solutions Hume Rothery rule, substitutional and interstitial solid solutions, intermediate phases, Gibbs phase rule.

Phase Diagram: Construction of equilibrium diagrams involving complete and partial solubility, lever rule. Iron carbon equilibrium diagram description of phases, solidification of steels and cast irons, invariant reactions.

Unit IV

Heat Treating of Metals: TTT curves, continuous cooling curves, annealing and its types. Normalizing, hardening, tempering, mastempering, austempering, hardenability, surface hardening methods like carburizing, cyaniding, nitriding, flame hardening and induction hardening, age hardening of aluminium-copper alloys. Comparative study of microstructure of various Ferrous, nonferrous metals and alloys.

Unit V

Composite materials: Definition, classification, types of matrix materials & reinforcements, fundamentals of production of FRP's and MMC's advantages and application of composites.

Ceramics: Structure types and properties and applications of ceramics. Mechanical/ Electrical behavior and processing of Ceramics.

Plastics: Various types of polymers/plastics and its applications. Mechanical behaviour and processing of plastics, Future of plastics. Introduction to Smart materials & Nano-materials and their potential applications.

Text Books:

- 1. Callisters Materials Science and Engineering, by William D. Callister, Jr, (Adopted by R. Balasubramaniam), Wiley India Pvt. Ltd.
- 2. Elements of Materials Science & Engineering by L.H. Van Vlack, Pearson

Reference Books:

- 1. Materials Science by Narula, Mcgraw Hill India.
- 2. Materials Science and Engineering A First Course by Raghavan, PHI

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ME - 303 ENGINEERING THERMODYNAMICS

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Unit – I

Fundamental Concepts and Definitions: Introduction and definition of thermodynamics, Dimensions and units, Microscopic and Macroscopic approaches, Systems, surroundings and universe, Concept of continuum, Control system boundary, control volume and control surface, Properties and states, Thermodynamic properties, Pressure and its measurement, Thermodynamic path, process and cycle, Thermodynamic equilibrium, Reversibility and irreversibility, Quasi static process, Energy and its forms, Work and heat, Gas laws, Ideal gas

Zeroth law of thermodynamics: Zeroth law of thermodynamics, Temperature and its' measurement, Temperature scales.

First law of thermodynamics: Thermodynamic definition of work, Thermodynamic processes, Calculation of work in various processes and sign convention, Non-flow work and flow work, Joules' experiment, First law of thermodynamics, Internal energy and enthalpy, First law of thermodynamics applied to open systems, Steady flow systems and their analysis, Steady flow energy equation, Boilers, Condensers, Turbines, Throttling processes such as filling and evacuation of vessels with and without heat transfer, Limitations of first law of thermodynamics, PMM-I.

Unit – II

Second law: Devices converting heat to work, Thermal reservoir, Heat engines, Efficiency, Devices converting work to heat, Heat pump, refrigerator, Coefficient of Performance, Reversed heat engine, Kelvin Planck statement of second law of thermodynamics, Clausius statement of second law of thermodynamics, Equivalence of two statements of second law of thermodynamics, Reversible and irreversible processes, Carnot cycle and Carnot engine, Carnot theorem and it's corollaries, thermodynamic temperature scale, PMM-II.

Entropy :Clausius inequality, Concept of Entropy, Entropy change in different thermodynamic processes, Tds equation, Principle of entropy increase, T-s diagram, Statement of the third law of thermodynamics.

Unit – III

Properties of steam and thermodynamics cycles: Pure substance, Property of steam, Triple point, Critical point, Sub-cooled liquid, Saturation states, Superheated states, Phase transformation process of water, Graphical representation of pressure, volume and temperature, P-T & P-V diagrams, T-s and h-s diagrams, use of property diagram, Steam-Tables & Mollier charts, Dryness fraction and its measurement, processes involving steam in closed and open systems. Simple Rankine cycle.

Unit – IV

Availability and Irreversibility: Available and unavailable energy, Availability and Irreversibility, Second law efficiency, Helmholtz and Gibb's function.

Thermodynamic relations: Mathematical conditions for exact differentials. Maxwell Relations, Clapeyron Equation, Joule-Thompson coefficient and Inversion curve. Coefficient of volume expansion, Adiabatic and Isothermal compressibility. Real gas, Law of corresponding states, Dalton's law, Amagat's law, Property of mixture of gases.

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Unit – V

Fuels and Combustion: Combustion analysis, Heating Values and its measurement, Air requirement, Air/Fuel ratio, Standard heat of reaction and effect of temperature on standard heat of reaction, heat of formation, Chemical Equilibrium, adiabatic flame temperature.

Text Books:

- 1. Thermodynamics by J.P. Holman, McGraw Hill.
- 2. Basic and Applied Thermodynamics by P.K. Nag, McGraw Hill

Reference Books:

- 1. Engineering Thermodynamics by Jones and Dugans, PHI Learning Pvt. Ltd.
- 2. Fundamentals of Thermodynamics by Sonntag, Van Wylen, Borgnakke John Wiley & Sons India Pvt.Ltd.
- 3. Thermodynamics: An engineering approach by Cengel & Boles, McGraw Hill

AS - 302/402 HUMAN VALUES AND ETHICS

Course Introduction

UNIT 1

- 1. Understanding: Why humans are ethical, why they are not;
- 2. Understanding the need, basic guidelines, content and process for Value Education;
- 3. Self Exploration–what is it? It's content and process;
- 4. 'Natural Acceptance' and Experiential Validation- as the mechanism for self exploration;
- 5. Right understanding of Relationship and Physical Facilities- the basic requirements for fulfilment of aspirations of every human being with their correct priority;
- 6. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario;
- 7. Method to fulfil the above human aspirations: understanding and living in **harmony** at various levels

UNIT 2

Understanding of Human Values and Ethics

- 1. Understanding the needs of Self ('I') and Body ('Me');
- 2. Understanding values in human-human relationship;
- 3. Meaning of Co-existence and Mutual Satisfaction;
- 4. Understanding Respect;
- 5. Understanding Comprehensive Human Goals;

UNIT 3

Effects of Holistic Harmony on Professional Ethics

- 1. World as a Nation;
- 2. Definitiveness of Ethical Human Conduct;
- 3. Basis for Humanistic Education and Humanistic Universal Order;
- 4. Competence in professional ethics:
 - a) Ability to utilize the professional competence for augmenting universal human order;
 - b) Ability to identify the scope and characteristics of people-friendly and ecofriendly production systems,;
 - c) Ability to identify and develop appropriate technologies and management patterns for above production system;
- 5. Strategy for transition from the present state to Universal Human Order:
 - a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers;
 - b) At the level of society: as mutually enriching institutions and organizations;

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UNIT 4

Effects of Holistic Personality for Success

- 1. Negotiation as a tool for success;
- 2. Leadership as an attribute of a successful Professional;
- 3. Managing Stress and Time;
- 4. Team Building--creating a harmonious environment with apathy to each other;
- 5. Understanding difference between evolution and revolution;

UNIT 5

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Managing Relationship for Success

- 1. Understanding and valuing Cross-Cultural Ethics;
- 2. Managing Relationships (Networking), Personal Effectiveness and Self Leadership;
- 3. Theory of Constraints;
- 4. A Decision Making Model: Ethics as making decisions and choices;
- 5. Conflicts and Ethical Dilemmas;
- 6. Entrepreneurship and Ethics: A sense of business Ethics;
- 7. Pragmatic Behaviour of Business to its Colleagues/Competitors

Text Books:

- 1. Kazuo Ishiguro, 1989, *The Remains of the Day*, Faber and Faber
- 2. B. L. Bajpai, 2004, *Indian Ethos and Modern Management*. New Royal Book Co., Lucknow. Reprinted 2008;
- 3. Sussan George, 1976, *How the Other Half Dies*. Penguin Press, Reprint 1991;

Reference Books:

- 1. Amitabh Ghosh, 2008, Sea of Poppies. John Murray Publications.
- 2. R. K. Narayan, 1958, *The Guide*, Viking Press.
- 3. P. L. Dhar, R. R. Gour, 1990, *Science and Humanism*, Commonwealth Publishers;
- 4. R. R. Gaur, R. Sangal and G. P. Bagaria, 2010, *A Foundation Course in Human Values and Professional Ethics*, Excel Books.

Relevant movies and documentaries:

- 1. Story of Stuff (Documentary);
- 2. The Remains of the Day (Movie);
- 3. Pursuit of Happyness (Movie);
- 4. Fences (Movie);
- 5. Gifted (Movie)

AS – 303/ AS - 403 ENVIRONMENT AND ECOLOGY

Unit I- Fundamentals of Environment & Ecology

Definition, Scope & Importance and Need for public awareness.

Ecosystem- Definition, Energy flow in ecosystem, Ecological succession and Balanced ecosystem. Effect of human activities on food, Shelter, Economic and social security.

Effect of human activities on environment - Agriculture, Housing, Industry, Mining and Transportation activities.

Basics of Environmental Impact, Assessment and Sustainable development.

Unit II- Natural Resources & Environmental Quality standard

Water resources- Availability and quality aspects. Mineral resources, Material Cycle- Carbon, Nitrogen & Sulphur cycles, DO, BOD and COD.

Modern techniques used in analysis of Pollutants- Determination of disinfectants, Pesticides, Ambient Quality standards, Water quality parameters and standards, Turbidity, pH, Suspended solids and hardness,

Unit III- Environmental Pollution & Current Environmental issues

Environmental Pollution-Definition, Causes, Effects and control measure of:

- 1. Air Pollution
- 2. Water Pollution
- 3. Soil pollution
- 4. Marine Pollution

Current environmental issues of importance: Population growth, Climate change & Global warmingeffects, Urbanization, Cause of global warming, Acid rain. Ozone layer depletion- causes and effects on health, Control measures. Photochemical smog, Solid waste management, Waste water treatment.

Unit IV- Energy-Types , Sources and Uses

Different types of energy, Conventional and nonconventional sources- Hydro-electric, Fossil fuel based, Nuclear, Solar, Biomass, Geothermal energy and Biogas. Hydrogen as alternative future source of energy.

Unit V- Environmental protection

Role of Government, Legal aspects, Environment protection Act, Introduction to ISO 14000, Green building concept.

Text Book-

- 1. Environmental Studies- Dr. D. L. Manjunath, Pearson Education
- 2. Text book of Environment Science and Engineering- M. Anji Reddy- B S Publication
- 3. Elements of Environmental Science and Engineering- Dr. P. Meenakshi- Prentice-Hall of India Pvt Ltd, New Delhi, 2008.
- 4. Environment and Ecology- P.D. Sharma- Rastogi publication 2009.

Reference Books-

- 1. Principle of Environmental Science and Engineering- P. Venugopalan Rao, Prentice Hall of India.
- 2. Environmental studies- R. Rajagopalan- Oxford Publication-2005.

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CE-351 Fluid Mechanics Lab.

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- 1. To verify the momentum equation using the experimental set-up on impact of jet.
- 2. To determine the metacentric height of a ship model experimentally.
- 3. To determine the coefficient of contraction, velocity and discharge of an orifice.
- **4.** To calibrate an orifice meter and study the variation of the co-efficient of discharge with the Reynolds number.
- 5. To calibrate a venturimeter and study the variation of the co-efficient of discharge with the Reynolds number.
- 6. To calibrate a bend meter and study the variation of the co-efficient of discharge with the Reynolds number.
- 7. To verify the Bernoulli's theorem.
- 8. To calibrate and to determine the coefficient of discharge for rectangular and triangular notches.
- **9.** To study the transition from laminar to turbulent flow and to determine the lower critical Reynolds number using Reynolds apparatus.
- **10.** To study the velocity distribution in a pipe and also to compute the discharge by integrating the velocity profile for steady laminar flow..
- 11. To study the variation of friction factor, 'f' for turbulent flow in commercial pipes.
- **12.** To determine the loss coefficients for a sudden enlargement in a pipe.
- **13.** To determine the loss coefficients for a sudden contraction in a pipe.
- 14. To determine the loss coefficients for a pipe bend.

ME – 351 STRENGTH OF MATERIALS LAB

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LIST OF EXPERIMENTS

- 1. To conduct Tensile test of the given specimen on UTM and draw stress-strain diagram.
- 2. To conduct Compression test of the given specimen on UTM.
- 3. To conduct Torsion test of the given specimen.
- 4. To conduct Bend test of the given sample on UTM.
- 5. To conduct impact test of the given sample by Charpy and determine the impact strength of given specimen.
- 6. To conduct impact test of the given sample by Izod and determine the impact strength of given specimen.
- 7. To determine the stiffness of spring.
- 8. To conduct Hardness Test of the given specimen by Brinell's and Rockwell's method.
- 9. To conduct Hardness Test of the given specimen by Vicker's method.
- 10. To determine critical buckling loads for columns with support
- 11. To examine the Euler's theory of buckling.
- 12. To investigate the influence of different material parameters on buckling.

ME – 352 MATERIALS SCIENCE LAB

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LIST OF EXPERIMENTS

- 1. To study models of various crystal structures.
- 2. To prepare a plastic mould for small metallic specimen.
- 3. To prepare specimen for microstructural examination by cutting, grinding, polishing and etching.
- 4. To compare microstructures of different materials (mild steel, gray cast iron, brass, copper and aluminium etc.)
- 5. To conduct experiments on Heat treatment such as annealing, normalizing and to compare hardness before and after heat treatment.
- 6. To conduct experiments on Heat treatment such as quenching (water bath and oil bath) and to compare hardness before and after heat treatment.
- 7. To identify 50 common engineering materials.
- 8. To conduct experiment on Faraday's law of electrolysis.
- 9. To study phenomenon of corrosion and measure weight loss with respect to time.
- 10. To predict creep characteristics of materials by plotting curve of strain vs. time.
- 11. To fabricate different composites and determine mechanical behavior.
- 12. To conduct Jominy test of given specimen.

ME – 353 MACHINE DRAWING LAB

L T P 0 0 2

LIST OF EXPERIMENTS

Introduction (1 drawing sheet) Introduction, classification of machine drawings, principles of drawing, conventional representation of machine components and materials, lines, types of lines, dimensioning types, lines and rules of dimensioning.

Orthographic Projections (3 drawing sheets) Introduction to orthographic projection, concept of first angle and third angle projection, drawing of simple machine elements in first angle projection, missing line problems, principle of visualization of objects, sectional views, full and half sectional views, auxiliary views.

Fasteners (2 drawing sheets) Temporary and permanent fasteners, thread nomenclature and forms, thread series, designation, representation of threads, bolted joints, locking arrangement of nuts, screws, washers, foundation bolts etc., keys, types of keys, cotter and knuckle joints.

Riveted joints (1 drawing sheet) Introduction, rivets and riveting, types of rivets, types of riveted joints, drawing of boiler joints etc.

Assembly drawing (2 drawing sheets) Introduction to assembly drawing, drawing assembly drawing of simple machine elements like rigid or flexible coupling, muff coupling, plummer block, footstep bearing, bracket etc.

Free hand sketching (1 drawing sheet) Introduction, Need for free hand sketching, Free hand sketching of foundation bolts, studs, pulleys, couplings etc.

Computer aided drafting (1 drawing) Introduction to computer aided drafting; advantages and applications of CAD, concepts of computer aided 2D drafting using any drafting software like AutoCAD, Solid Edge, Draft Sight etc., basic draw and modify commands, making 2D drawings of simple machine parts.

AS - 401 COMPUTER ORIENTED NUMERICAL TECHNIQUES

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Unit I

Problem solving on computer, Algorithms and flow charts.

Introduction to numerical computing, approximations and errors in numerical computations, truncation and round off errors, propagation of errors.

Root finding: Bisection method, regula-falsi method, iteration method, Newton Raphson method, Secant method, systems of nonlinear equations. Rate of convergence of iterative methods.

Unit II

Matrix algebra & solution of simultaneous linear algebraic equations: Gauss elimination, Gauss Jordan method, LU Decomposition, Jacobi method, Gauss Seidel method, SOR method, convergence of iterative methods. Tridiagonal systems and Thomas algorithm, Condition of a system and stability issues.

Unit III

Interpolation and Extrapolation: Finite differences, Newton's forward and backward interpolation formula, Lagrange interpolation formula. Divided differences and Newton's formula. Numerical differentiation. Numerical integration: Trapezoidal and Simpson's rules. Newton-Cotes integration formulas, Romberg integration, Gaussian quadrature.

Unit IV

Numerical solution of O.D.E.: Taylor series method, Euler's method, Runge Kutta method. Multistep method: Milne,s method, Adams method, accuracy, convergence criteria, stiffness.

Unit V

Boundary Value problems: Finte difference method, solving eigenvalue problems, polynomial method and power method.

Numerical solution of Partial Differential equations. Elliptic, Parabolic and hyperbolic PDEs.

Text Books :

- 1. Jain, Iyengar and Jain, Numerical Methods for Scientific and Engineering Computation (2003), New Age International, New Delhi.
- 2. Grewal B.S., Numerical Methods in Engineering and Science, Khanna Publishers, Delhi.
- 3. E.Balagurusamy, Numerical Methods, Tata Mc Graw hill.

Reference Books :

- 1. Sastry, S.S. Introductory Methods of Numerical Analysis, 3rd ed. Prentice Hall of India, New Delhi (2002).
- 2. Schaum's Outlines: Numerical Analysis, 2nd ed. Tata Mc Graw Hill Publishing Co. Limited (1968).
- 3. Kandasamy, P. Thialagawathy, K. & Gumawathy, K. Numerical Method, S Chand & Company Ltd., New Delhi (1999)
- 4. Balaguruswanmy, E. Numerical Methods. Tata Mc Graw Hilll Publishing Co. Limited, New Delhi (2001)

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ME - 401 MANUFACTURING SCIENCE AND ENGINEERING-I

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Unit I

Importance of manufacturing towards technological and social economic development. Classification of manufacturing processes. Survey of manufacturing processes. Manufacturing processes for common items, Concepts of Manufacturing Systems

Unit II

Casting: Basic principle & survey of casting processes. Types of patterns and allowances. Types and properties of moulding sand. Elements of mould and design considerations, Gating, Riser, Runner, Core. Solidification of casting, Sand casting, defects & remedies and inspection. Cupola furnace. Die Casting, Centrifugal casting. Investment casting, CO_2 casting and Stir casting etc.

Unit III

Metal Forming Processes: Elastic & plastic deformation, yield criteria. Hot working vs cold working. Analysis (equilibrium equation method) of Forging process for load estimation with sliding friction sticking friction and mixed condition for slab and disc. Work required for forging, Hand, Power, Drop Forging. Analysis of Wire/strip drawing and maximum-reduction, Tube drawing, Extrusion and its application.Condition for Rolling force and power in rolling. Rolling mills & rolled-sections. Design, lubrication and defects in metal forming processes.

Unit IV

Sheet Metal working: Presses and their classification, Die & punch assembly and press work methods and processes. Cutting/Punching mechanism, Blanking vs Piercing. Compound vs Progressive die. Flat-face vs Inclined-face punch and Load (capacity) needed. Analysis of forming process like cup/deep drawing. Bending & spring-back.

Unit V

Powder Metallurgy: Powder metallurgy manufacturing process. The need, process, advantage and applications. Introduction to rapid prototyping and tooling. Manufacturing of Plastic components: Review of plastics, and its past, present & future uses. Injection moulding. Extrusion of plastic section.Welding of plastics. Future of plastic & its applications.

Text Books

- 1. Manufacturing Science by Amitabha Ghosh and A.K. Mallik, Ellis Horwood Ltd.
- 2. Manufacturing Engineering & Technology by Kalpakjian, Pearson Pub.

Reference Books:

- 1. Production Engg. Science by P.C. Pandey and C.K. Singh, Standard Publishers Distributors.
- 2. Production Technology by R.K. Jain, Khanna Publishers.
- 3. Manufacturing Technology by P.N. Rao, TMH
- 4. DeGarmo's Materials and Processes in Manufacturing by J.T. Black and Ronald A. Kohser, Wiley.

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ME - 402

APPLIED THERMODYNAMICS Т Р L 3 1 0 8

Gas power cycles: Air Standard cycles: Carnot, Otto, Diesel, Dual and Stirling cycles, P-V and T-s diagrams, description, efficiencies and mean effective pressures, Comparison of Otto, Diesel and dual cycles.

I.C. Engines: Testing of two stroke and four stroke SI and CI engines for performance related numerical problems, heat balance, Willian's line method, Morse test.

UNIT II

UNIT I

Vapour Power cycles and compressors: Simple steam power cycle, Rankine cycle, actual vapour cycle processes, mean temperature of heat addition, effect of pressure and temperature on Rankine cycle, Reheat cycle, Regenerative cycle, Feed water heaters, Binary vapour cycle, Combined cycles, Process heat and by-product power: Cogeneration plant, single stage reciprocating air compressor, volumetric efficiency and multistage compression

UNIT III

Boilers: Classification and working of boilers, boiler mountings and accessories, draught and its calculations, air preheater, feed water heater, superheater, boiler efficiency, equivalent evaporation boiler trial and heat balance.

Condenser: Classification of condensers, air leakage, condenser performance parameters.

UNIT IV

Steam and Gas Nozzles: Flow through convergent and convergent-divergent nozzles, variation of velocity, area and specific volume, choked flow, throat area, nozzle efficiency, effect of back pressure, shock waves, Rayleigh line and Fanno lines, effect of friction on nozzle, super saturated flow.

Steam Turbines: Classification of steam turbines, Impulse and Reaction turbines, Staging, Stage and Overall efficiency, Reheat factor, Bleeding, Velocity diagram of simple and compound multistage impulse and reaction turbines and related calculations, work done, efficiencies of reaction, Impulse reaction turbines, state point locus, Losses in steam turbines, Governing of turbines, Comparison with steam engine.

UNIT V

Gas Turbine: Gas turbine classification, Brayton cycle, Principles of gas turbine, Gas turbine cycles with intercooling, reheat and regeneration and their combinations, Stage efficiency, Polytropic efficiency. Deviation of actual cycles from ideal cycles

Jet Propulsion: Introduction to the principles of jet propulsion, Turbojet and turboprop engines and their processes, Principle of rocket propulsion, Introduction to Rocket Engine.

Text Books:

- 1. Steam & Gas Turbines by R. Yadav, CPH Allahabad.
- 2. Basic and Applied Thermodynamics by P.K. Nag, MCGRAW HILL INDIA.
- 3. Gas turbine Theory by H. I. H. Saravanamuttoo, G. F. C. Rogers, Henry Cohen, Pearson Education
- 4. Gas Turbines, by V. Ganesan, Tata McGraw Hill Publishers.

Reference Books:

- 1. Theory of Steam Turbine by WJ Kearton
- 2. Thermal Engg. by PL Ballaney, Khanna Publisher

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ME - 403 MEASUREMENTS AND METROLOGY

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Mechanical Measurements: Introduction to measurement and measuring instruments. General concept–Generalized measurement system and its elements-Units and standards measuring instruments: sensitivity, stability, range, accuracy and precision-static and dynamic response-repeatability-systematic, Sources of error, statistical analysis of error and random errors- correction, calibration. Dimensional and geometric tolerance

Sensors and Transducers: Types of sensors, types of transducers and their characteristics.

Unit II

Unit I

Time Related Measurements: Stroboscope, frequency measurement by direct comparison. Measurement of displacement

Measurement of Pressure: Gravitational, direct acting, elastic and indirect type pressure transducers. Measurement of very low pressures (high vacuum).

Strain Measurement: Types of strain gauges and their working, strain gauge circuits, temperature compensation. Strain rosettes, calibration.

Unit III

Flow Measurement: Hot Wire Anemometry, Laser Doppler Velocimetry, Rotameter.

Temperature Measurement: Thermometers, bimetallic thermocouples, thermistors and pyrometers.

Measurements of Force, Torque: Different types of load cells, elastic transducers, pneumatic & hydraulic systems. Seismic instruments

Measurements of Acceleration, and Vibration: Accelerometers vibration pickups and decibel meters, vibrometers.

Unit IV

Coordinate measuring machine (CMM): Need, constructional features and types, Metrology and Inspection: Standards of linear measurement, line and end standards. Interchange ability and standardization. Linear and angular measuring devices and systems

Comparators: Sigma, Johansson's Microkrator. Limit gauges classification, Taylor's Principle of Gauge Design.

Unit V

Limits, Fits & Tolerance and Surface roughness: Introduction to Limits, Fits, Tolerances and IS standards, Limit-gauges, and surface-roughness. Measurement of geometric forms like straightness, flatness, roundness. Tool makers microscope, profile projector, autocollimator.

Interferometry: principle and use of interferometry, optical flat. Measurement of screw threads and gears. Surface texture: quantitative evaluation of surface roughness and its measurement.

Text Books:

- 1. Mechanical Measurements by Beckwith, Pearson
- 2. Mechanical Measurements and Control by D.S. Kumar, Metropoliton Book Company Pvt. Ltd.

Reference Books:

- 1. Experimental Methods for Engineers by Holman, MCGRAW HILL INDIA
- 2. Principles of Measurements Systems by Bentley, Pearson
- 3. Metrology of Measurements by Bewoor and Kulkarni, MCGRAW HILL INDIA
- 4. Measurement Systems, Application Design by Doeblein, MCGRAW HILL INDIA
- 5. Hume KJ, "Engineering Metrology", MacDonald and Co
- 6. Jain, RK, "Engineering Metrology" Khanna Publishers
- 7. Jain, R.K., "Mechanical Measurement" Khanna Publishers
- 8.Gupta SC, Engineering Metrology, DhanpatRai Publications

ME - 404 KINEMATICS OF MACHINES

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Unit I

Introduction: Aims & scope of the course & basic concepts of Mechanisms. Basic definitions, Difference between structure & Machine, Links & their types, Types of constrained motion, Kinematic pair & their classification, Grubler's mobility criteria, Inversion of a kinematic chain and applications, Hooks joint, Devis and Ackermann steering mechanism. An introduction to approximate and exact straight line mechanism.

Unit II

Graphical (vector) method for velocity and acceleration of various mechanisms e.g. slider crank and four bar, Coriolis acceleration. Instantaneous centre method, Kennedy's theorem and Klien's construction

Unit III

Transmission drives: Belt, Rope and Chain drives: Types and materials, Fundamentals of Power transmission Phenomena of slip & creep, centrifugal and initial tensions, Tight side and slack side tensions, Conditions of max. Power transmission.

Unit IV

Brakes and Clutches: Types of braking systems, force and torque analysis for block, band and brake and block brake, disc brakes. Friction clutches: types, uniform pressure and uniform wear theory.

Unit V

Theory of gearing: Classification of gears and terminology, Law of gearing, systems of gear teeth, gear profiles, Interference, and efficiency of gears, epicyclical gear train, Compound gear train, Torque analysis and various applications of complex gear trains.

Text Books

- 1. Theory of Machines by Thomas Beven, Pearson
- 2. Theory of Machines by S. S. Rattan, McGraw Hill

Reference Books:

- 1. Kinematics by HN Tyson, John Wiley and Sons
- 2. Theory of Machines and Mechanisms by Uicker, Pennock and Shigley, Oxford University Press

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ME – 451

MANUFACTURING SCIENCE & ENGG. LAB - I

L T P 0 0 2

LIST OF EXPERIMENTS

- 1. To design and fabricate the pattern for a desired casting (containing hole) with proper allowance.
- 2. To demonstrate extrusion process.
- 3. To make a mould and to perform casting operation.
- 4. To find Grain Fineness Number for a given sample of foundry sand using sand testing
- 5. method (Sieve Shaker)
- 6. To study Forging phenomenon by operation of power hammer.
- 7. To make tube bend on tube bending machine.
- 8. To perform Press working experiments such as blanking/piercing, washer, making etc.
- 9. To perform wire drawing operation on a given material.
- 10. To study of Jigs and Fixture.
- 11. To find shatter index of a given sample of green sand.
- 12. To find green compression and shear strength of a given sample of green sand.
- 13. To perform permeability test on a given sample of foundry sand.
- 14. To determine sheet length and bending force required for forming the given "Z" section

ME – 452 APPLIED THERMODYNAMICS LAB

L T P 0 0 2

LIST OF EXPERIMENTS

- 1. To study fire tube boilers (Cochran, Lancashire Boiler).
- 2. To study water tube boilers (Babcock and Wilcox, Cornish).
- 3. To study velocity compounded steam turbine.
- 4. To study pressure compounded steam turbine.
- 5. To study impulse and reaction steam turbine.
- 6. To study steam engine model.
- 7. To study gas turbine model.
- 8. To find the quality of steam by using separating and throttling calorimeter.
- 9. To study window air conditioner.
- 10. To study domestic refrigerator.
- 11. To study various parts of I.C. engine.
- 12. To determine the calorific value of fuel by bomb calorimeter

ME – 453 MEASUREMENTS AND METROLOGY LAB

L T P 0 0 2

LIST OF EXPERIMENTS

- 1. To study the working of Vernier caliper.
- 2. To study the working of Micrometer.
- 3. To study the working of Tachometer.
- 4. To measure the effective diameter of a screw thread using 3 wire method.
- 5. To measure angle using sine bar.
- 6. To study the working of limit and slip gauges.
- 7. To study the working of dial indicator.
- 8. To make angular measurement by using bevel protector.
- 9. To find adjustment of spark plug gap using feeler gauges.
- 10. To study and understand the concept of limit, fits and tolerances.
- 11. To calibrate the pressure measuring device.
- 12. To study and measure displacement using LVDT.
- 13. To measure speed using stroboscope
- 14. To calibrate thermocouple and plot graph between the temperature and millivolt.
- 15. To measure the screw parameters (external diameter, pitch, flank angle) by using Tool maker's microscope.

ME - 454 NUMERICAL TECHNIQUES LAB

L T P 0 0 2

Note: At least ten programs need to be conducted from section B.

Section A: Introduction to MATLAB (3 slots): Data types and variables, Operators, Flow control,

Functions, Input /Output, Vectors and Matrices, M-File.

Section B:

- 1. WAP to print sum of even and odd numbers from 1 to N numbers.
- 2. Solution of linear equations for under damped and over damped.
- 3. Study of basic matrix operations and verify it manually.
- 4. Determination of Eigen values and eigenvectors of a square matrix.
- 5. Determination of roots of a polynomial.
- 6. Determination of polynomial using method of least square curve fitting.
- 7. Solution of differential equations using 4th order Runga-Kutta method.
- 8. Solution of differential equation using revised Euler method.
- 9. Solution of differential equations.
- 10. Determination of time response for different combinations of R-L-C circuit using unit step input.
- 11. To solve a thermodynamic problem using MATLAB.
- 12. To solve a Strength of Materials problem using MATLAB.
- 13. To solve a Fluid Mechanics problem using MATLAB.