PROPOSED SYLLABI

for

B.Tech. Programme

in

Mechanical Engineering

DEPARTMENT OF
MECHANICAL ENGINEERING

National Institute Of Technology Manipur

Imphal - 795001

India

BTech (Mechanical Engineering) Syllabus

SEMESTER III

MA201	Mathematics III	3	0	0	6
ME201	Engineering Thermodynamics	3	1	0	8
ME203	Strength of Materials	3	0	0	6
ME205	Engineering Materials	3	0	0	6
ME207	Manufacturing Technology I	3	0	0	6
Practical					
ME231	Machine Drawing	0	0	5	5
ME233	Strength of Materials Lab	0	0	3	3
	NSS 1				
	Total	15	1	8	40

SEMESTER IV

MA202	Numerical Methods	3	0	0	6
ME202	Fluid Mechanics	3	1	0	8
ME204	Kinematics of Machinery	2	1	0	6
ME206	Heat and Mass Transfer	3	1	0	8
ME208	Manufacturing Technology II	3	0	0	6
Practical					
ME232	Heat Transfer Lab	0	0	3	3
ME234	Manufacturing Technology Lab	0	0	3	3
	NSS 2				
	Total	14	3	6	40

SEMESTER V

ME301	Mechanical Measurements and Metrology	3	0	0	6
ME303	Turbomachines	3	0	0	6
ME305	Dynamics of Machinery	3	1	0	8
ME307	Thermal Engineering I	3	0	0	6
ME309	Design of Machine Elements I	3	0	0	6
Practical					
ME331	Measurements and Metrology Lab	0	0	3	3
ME333	Fluid Mechanics & Turbomachinery Lab	0	0	3	3
ME335	Dynamics of Machines Lab	0	0	3	3
	Total	15	1	9	41

SEMESTER VI

ME302	Mechatronics	3	0	0	6
ME304	Automobile Engineering	3	0	0	6
ME306	Refrigeration and Air Conditioning	3	0	0	6
ME308	Thermal Engineering II	3	0	0	6
ME310	Design of Machine Elements II	3	1	0	8
Practical					
ME332	Mechatronics Lab	0	0	3	3
ME334	Automobile Engineering Lab	0	0	3	3
ME336	Thermal Engineering Lab	0	0	3	3
	Total	15	1	9	41

SEMESTER VII

HS4XX	HSS Elective	2	0	0	4
ME401	Industrial Engineering and Operations Research	3	0	0	6
ME403	CAD/CAM	3	0	0	6
ME4XX	Departmental Elective I	3	0	0	6
ME4XX	Departmental Elective II	3	0	0	6
Practical					
ME431	CAD/CAM Lab	0	0	3	3
ME433	Project Work I	0	0	3	3
	Total	14	0	6	34

SEMESTER VIII

HS4XX	HSS Elective	2	0	0	4
ME4XX	Departmental Elective III	3	0	0	6
ME4XX	Departmental Elective IV	3	0	0	6
XXXXX	Open Elective	3	0	0	6
Practical					
ME432	Project Work II	0	0	9	9
	Total	11	0	9	31

Credits for I Year	: 80
Credits for Mechanical Engineering (III to VIII Semester)	: 227
Total Credits	: 307

SEMESTER III

ME201 ENGINEERING THERMODYNAMICS (3-1-0-8)

Thermodynamic systems; States, processes, heat and work; Zeroth law; First law; Properties of pure substances and steam, Mollier diagram; Second law, Carnot cycle, entropy, corollaries of the second law; Application of first and second laws to closed and open systems; irreversibility and availability, exergy analysis; Thermodynamic relations; Properties of mixtures of ideal gases; Vapour power cycles - Rankine cycle - Effect of pressure and temperature on rankine cycle -Reheat cycle - Regenerative cycle - Air standard power cycles - Assumptions regarding air standard cycles - Otto , Diesel , dual, Stirling and Brayton cycles. Third Law of Thermodynamics.

Text/References:

1. Sonntag, R.E., Borgnakke, C., and Van Wylen, G.J., Fundamentals of Thermodynamics, 6th Ed., John Wiley, 2003.
2. Cengal, Y.A., and Boles, M.A, Thermodynamics: An Engineering Approach, 5th Ed., McGraw-Hill, 2006.
3. Nag, P.K., Engineering Thermodynamics, 3rd Ed., Tata McGraw-Hill, 2005.
4. J P Howell and P O Buckius, Fundamentals of Engineering Thermodynamics, McGraw Hill, 1992.
5. G F C Rogers and Y R Mayhew, Engineering Thermodynamics Work and Heat Transfer, 4th Ed., Pearson 2003.

ME203 STRENGTH OF MATERIALS (3-0-0-6)

Axial and shear stresses and strains – Elasticity, Hook's law – Lateral strain – Poisson's ratio – Volumetric strain – Elastic constants – Stress in composite bars. Strain energy, impact and suddenly applied loads. Thin cylindrical and spherical shells subjected to internal pressure. Principal stresses and their planes. Plane of maximum shear – Mohr's circle of stresses. Thick cylinders – Lame's equation, shrink fit. Compound cylinders. Shear force and bending moment diagrams for beams subjected to different types of loads – Theory of simple bending and assumptions. Leaf spring, shear stress. Deflection – The moment area method, Macaulay's method – superposition (statically determinate beams only). Torsion of solid and hollow circular shafts – Power transmission, strength and stiffness of shafts. Stress and defection in open helical spring. Introduction to buckling of columns.

Texts/References:

1. Timoshenko, S.P., Gere, M.J., Mechanics of Materials, C.B.S., Publishers, 2011.
2. Ramamurtham, S., Strength of Materials, Dhanpat Rai Publications, 2005.
3. Popov, E.P., Engineering Mechanics of Solids, Prentice-Hall, 1999.
4. Timoshenko, S., and Young D.H., "Elements of Strength of Materials", Tata McGraw Hill, 2006.
5. S.B. Junaikar, Mechanics of Structures, Charotar Publishers, 2010.

ME205 ENGINEERING MATERIALS (3-0-0-6)

Atomic Arrangement and Phase Diagrams - Structure of metals and alloys: Phase diagram: phase rules. Phase Diagrams and Ferrous Alloys Fe- FeC diagram, Critical temperature - Plain carbon steel and other steels. Heat Treatment of steel, CCT diagrams, austempering, martempering, ausforrning. Surface hardening process - non - ferrous alloys. Testing of Materials I - Properties evaluated by tensile testing procedure, Engineering stress strain curve vs. true stress-strain curve, stress strain curve for typical materials. Hardness testing. Testing of Materials II - Impact testing, Fracture toughness. Fatigue testing: Creep testing. General classifications, properties and applications of alloy steels, tool steels, stainless steels, cast irons, copper base alloys, Aluminum base alloys, Nickel base alloys, composites, ceramics
and polymers.

Texts/References:

1. Avner, S.H., Introduction to Physical Metallurgy, 2nd Ed., Tata McGraw-Hill, 1997.
2. Dieter, G.E., Mechanical Metallurgy, McGraw-Hill, 1988.
3. Donald S. Clark, and Wilbur R. Varney, Physical Metallurgy for Engineers, East-West Press, 1999.
4. Suriyanarayana, A.V.K, Testing of Metallic Materials, Tata McGraw-Hill, 2001.

5. W.D. Callister, Material Science and Engineering and Introduction, Wiley, 2002.

ME207 MANUFACTURING TECHNOLOGY I (3-0-0-6)

Introduction to manufacturing processes: Moulding materials and their requirements; Patterns: Types and various pattern materials. Casting processes: Various casting methods, viz., sand casting investment casting, pressure die casting, centrifugal casting, continuous casting, thin roll casting; Mould design; Casting defects and their remedies. Metal joining processes: brazing, soldering, welding; Solid state welding methods; resistance welding; arc welding; submerged arc welding; inert gas welding; Welding defects, inspection. Metal forming Processes: Various metal forming techniques and their analysis, viz., forging, rolling, extrusion, wire drawing, sheet metal working, spinning, swaging, thread rolling; Super plastic deformation; Metal forming defects. Powder metallurgy and its applications.

Texts/References:

1. A Ghosh and A K Mallik, Manufacturing Science, Wiley Eastern, 1986.
2. P Rao, Manufacturing Technology: Foundry, Forming and Welding, Tata McGraw Hill, 2008.
3. J S Campbell, Principles of Manufacturing Materials and Processes, Tata McGraw Hill, 1995.
4. F C Flemmings, Solidification Processing, Tata McGraw Hill, 1982
5. P C Pandey and C K Singh, Production Engineering Sciences, Standard Publishers Ltd., 2003.
6. S Kalpakjian and S R Schmid, Manufacturing Processes for Engineering Materials, Pearson Education, 2009.
7. Jain R.K., Production Technology, Khanna Publishers, 2001.
8. Hajra Choudhry, Elements of Workshop Technology, Vol – II, Media Promoters & Publishers, 1994.

ME231 MACHINE DRAWING (0-0-5-5)

Assembly and Part Drawings of simple assemblies and subassemblies of machine parts viz.,couplings, clutches, bearings, gear assemblies, I.C. Engine components, valves, machine tools, etc.; IS/ISO codes; Limits, tolerances and Fits, Surface finish; Symbols for weldments, process flow, electrical and instrumentation units. Introduction to computer aided drafting package to make 2-D drawings. Introduction to solid modellers.

Texts/References:

1. Bhatt, N.D., Machine Drawing, Charotar Publishing House, 2003.
2. Sidheswar, N., Kannaiah, P. and Sastry, V.V.S., Machine Drawing, Tata McGraw Hill, 2000.
3. SP 46: 1988 Engineering Drawing Practice for School and Colleges. Bureau of Indian Standards.
4. Ostrowsky, O., Engineering Drawing with CAD Applications, ELBS, 1995.
5. Kannaiah, P., Production Drawing, New Age International, 2009.
6. V. Lakshmi Narayana and M. L. Mathur, Text Book of Machine Drawing, M/s Jain Brothers, 2010.
7. Dhawan, R.K., A Text Book of Machine Drawing, S. Chand & Company, 1996.

ME233 STRENGTH OF MATERIALS LAB (0-0-3-3)

Study of Stress-Strain characteristics of Steel - Tension test - Compression Test - Strain measurement - Ductility Tests - Shear Test - Hardness Tests - Torsion Test - Bending Test – Impact Test - Test on Spring.

SEMESTER IV

ME202 FLUID MECHANICS (3-1-0-8)

Basic concepts - Fluid properties - Basic hydrostatic equation - Manometry - Submerged and floating bodies. Pressure at a point - Hydrostatic equations for incompressible and compressible fluids Manometers - Hydrostatic force on a submerged plane and curved surfaces - Buoyancy and equilibrium of floating bodies - Metacentre - Fluid in rigid motion bodies. Fluid dynamics; integral and differential formulations - Continuity equation - Navier-Stokes equations. Laminar and turbulent flows - Some exact solutions of Navier-Stokes equations – Flow through pipes. Fluid rotation and deformation - Stream function - Condition of irrotationality -

Governing equations of potential flow - Laplace equation. Boundary layer concept - Prandtl's equation - Drag on flat plates - Buckingham π-theorem - Dimensionless numbers.

Text/References:

1. Fox, R.W. and McDonald, A.T., Introduction to Fluid Mechanics, 6th Ed., John Wiley, 2003.
2. White, F.M., Fluid Mechanics, 5th Ed., McGraw-Hill, 2003.
3. Y. A. Cengel and J.M. Cimbala, Fluid Mechanics, Tata McGraw-Hill, 2006.
4. B.R. Munson, D.F. Young and T.H. Okhiishi, Fundamentals of Fluid Mechanics, 5th Ed., Wiley India Edition, 2002.
5. J.F. Douglas, J.M. Gasiorek, J. A. Swaffield and L.B. Jack, Fluid Mechanics, Pearson Education, 2008.

ME204 KINEMATICS OF MACHINERY (2-1-0-6)

Mechanisms - classification of mechanisms, Kinematic inversions - Grashoff's law -Inversions of slider crank mechanism, Coupler curves, spatial mechanisms - Straight-line generators. Slider crank mechanisms and four bar mechanism; Velocities of points on a rigid body -relative velocity - velocity polygon Acceleration of points on a rigid body - relative acceleration - acceleration polygon - Coriolis acceleration - analytical method . Chebyshcv spacing for precision positions - Structural error - Overlay method – Complex curve synthesis - Roberts Chebyshev theorem - Frudenstine's equation; Analytical synthesis using complex algebra; synthesis of dwell mechanism. Classification of cam and follower - displacement diagrams - Graphical layouts of cam profiles. Derivatives of follower motion. High speed cams standard motions. Plate cams with flat face and roller followers. Terminology and definitions - law of gearing - profile for gears - Involute gearing -Interchangeability - Interference and undercutting. Contact ratio. Standard and stub gear teeth. Contact ratio. Gear trains - types - Parallel axis gear trains. Epicyclic gear trains.

Texts/References:

1. J. J Uicker (Jr), G. R Pennock and J. E Shigley, Theory of Machines and Mechanisms, 3rd Ed., Oxford International Student Edition, 2009.
2. J. S. Rao, R. V. Dukkipat, Mechanism and Machine Theory, 2nd Ed., New Age International, 2008.
3. K. J, Waldron and G. L Kinzel, Kinematics, Dynamics and Design of Machinery, 2nd Ed., Wiley Student Edition, 2004.
4. A. Ghosh and A. K. Mallik, Theory of Mechanisms, and Machines, 3rd Ed., East West Press Pvt. Ltd, 2009.
5. S. S. Rattan, Theory of Machines, 3rd Ed., Tata McGraw Hill, 2009.
6. R. L. Norton, Kinematics and Dynamics of Machinery, Tata McGraw Hill, 2009.
7. A. G. Erdman and G. N. Sandor, Mechanism Design, Analysis and Synthesis Volume 1, PHI, Inc., 1997.
8. T. Bevan, Theory of Machines, CBS Publishers and Distributors, 1984.

ME206 HEAT AND MASS TRANSFER (3-1-0-8)

Modes of heat transfer; Conduction: 1-D and 2-D steady conduction; 1-D unsteady conduction-Lumped capacitance and analytical methods; Fins. Convection: fundamentals, order of magnitude analysis of momentum and energy equations; hydrodynamic and thermal boundary layers; dimensional analysis; free and forced convection; external and internal flows; heat transfer with phase change. Radiation: Stefan-Boltzmann law; Planck's law; emissivity and absorptivity; radiant exchange between black surfaces. Heat exchangers: LMTD and e − NTU methods; heat transfer enhancement techniques. Mass transfer: molecular diffusion; Fick's law; analogy between heat and mass transfer; evaluation of mass transfer coefficients by dimensional analysis.

Texts/References:

1. Incropera, F.P. and Dewitt, D.P., Fundamentals of Heat and Mass Transfer, 5th Ed., John Wiley, 2002.
2. Holman, J.P., Heat Transfer, 9th Ed., Tata McGraw-Hill, 2004.
3. Ozisik, M.N., Heat Transfer - A Basic Approach, McGraw-Hill, 1985.
4. Cengel, Y.A., Heat Transfer - A Practical Approach, McGraw-Hill, 1998.
5. Bejan, A., Convective Heat Transfer, 3rd Ed., John Wiley and Sons, 2004.
6. Kreith F., and Von, M. S., Principles of Heat Transfer, 6th Ed., Brook and Cole Publication, 2001.

ME208 MANUFACTURING TECHNOLOGY II (3-0-0-6)

Metal Cutting: Mechanics, tools (material, temperature, wear, and life considerations), geometry and chip formation; surface finish and machinability; optimization; Machine tool: Generation and machining principles; Setting and Operations on machines: lathe, milling (including indexing), shaping, slotting, planing, drilling, boring, broaching, grinding (cylindrical, surface, centreless), thread rolling and gear cutting machines; Tooling: Jigs and fixtures, principles of location and clamping; Batch production: CNC machines; Finishing: Micro finishing (honing, lapping, super finishing); Unconventional methods: electro-chemical, electro-discharge, ultrasonic, LASER, electron beam, water jet machining etc.; Rapid prototyping and rapid tooling.

Texts/References:

1. A Ghosh and A K Mallik, Manufacturing Science, Wiley Eastern, 1986.
2. G K Lal, Introduction To Machining Science, New Age International Pvt. Ltd., 2007.
3. Production Technology, HM T Publication, Tata McGraw Hill, 1980.
4. M C Shaw, Metal Cutting Principles, MIT Press, 2004.
5. P K Mishra, Nonconventional Machining, Narosa Publishing House, 1997.
6. R.K. Jain, Production Technology, Khanna Publishers, 2001.
7. Hajra Choudhry, Elements of Workshop Technology, Vol – II, Media Promoters & Publishers, 1994.

ME232 HEAT AND MASS TRANSFER LAB (0-0-3-3)

Experiments in conduction, free and forced convection, radiation and heat exchangers.

ME234 MANUFACTURING TECHNOLOGY LAB (0-0-3-3)

Introduction to machine tools and machining processes; Types of cutting tools; Selection of cutting speeds and feed; Lathe – Simple / Step / Taper Turning, Thread Cutting, Drilling and Boring. Shaping – V – Cutting Milling – Job requiring Indexing. Hobbing – Spur Gear Cutting Grinding – Surface / Cylindrical grinding CNC Lathe – Simple Turing, Step Turning, Thread Turing Machining Center – A typical job production.

SEMESTER V

ME301 MECHANICAL MEASUREMENTS AND METROLOGY (3-0-0-6)

Standards - Errors in measurements - Calibration - Basic electrical transducers, force, torque, strain, speed, pressure, flow, temperature and heat flux measurement, pollution measurement – Metrology; Length measurements; Vernier caliper and vernier height gauge - Angle measurements; Sine bar, clinometers, angle gauges, vernier bevel protector - Comparators; Their types, relative merits and limitations, use of comparators, construction of Mechanical, electrical & optical comparators - Limits, fits and tolerances - Interferometry - Surface finish; terminology and measurements - Optical measuring instruments. Measurement of screw thread and gear elements - Acceptance test for machines.

Texts/References:

1. Holman, J.P., Experimental Methods for Engineers, Tata McGraw Hill Book Company, New Delhi, 2010.
2. Thomas G. Beckwith and Lewis Buck, Mechanical Measurements, Narosa Publishing House, 2009.
3. Ernest O. Doeblin, Measurement Systems - Applications and Design, Tata McGraw Hill Book Company, New Delhi, 2011.
4. Jain R K, "Engineering Metrology", 3rd Ed., Khanna Publishers, Delhi (1998).
5. Figliola, Richard S, & Beasley, Donald E, Theory and Design for Mechanical Measurements, 3rd Ed., John Wiley & Sons Inc.
6. American Society of Tool and Manufacturing Engineers, Handbook of Industrial Metrology, Prentice Hall of India Pvt. Ltd.
7. T.G. Beckwith, R.D. Marangoni and J.H. Lienhard, Mechanical Measurements, 5th Ed., Addison Wesley, 1993.

ME303 TURBOMACHINES (3-0-0-6)

Introduction - Classification - Dimensional analysis - Specific speed - Basic laws and equations. Hydraulic turbines; Pelton, Francis, and Kaplan turbines - Turbine efficiencies - Cavitation in turbines. Centrifugal pumps;

theory, components, and characteristics - Cavitation - Axial flow pumps - Pump system matching. Centrifugal and axial flow compressors; slip, surging and chocking. Steam Turbine: impulse and reaction stage, degree of reaction, velocity triangle, velocity and pressure compounding, efficiencies, reheat factor, governing, nozzles - Gas turbine; basic cycle and multi-staging - Power and efficiency calculations. Combustion Chambers; Jet Propulsion.

Texts/References:

1. Dixon, S.L., Fluid Mechanics and Thermodynamics of Turbomachines, 5th Ed., Butterworth-Heinemann, 2005.
2. Sayers, A.T., Hydraulic and Compressible Flow Turbomachines, CBLS, 2003.
3. Ganesan, V., Gas Turbines, 2nd Ed., Tata McGraw-Hill, 2003.
4. H.I.H Saravanamuttoo, G.F.C. Rogers and H. Cohen, Gas Turbine Theory, 4th Ed., Pearson, 2003.
5. Lakshminarayana, B., Fluid Dynamics and Heat Transfer of Turbomachinery, Wiley-Interscience, 1995.
6. F. M. White, Fluid Mechanics, 6th Ed., Tata McGraw-Hill, 2008
7. R.W. Fox, A.T. McDonald and P.J. Pritchard, Introduction to Fluid Mechanics, 6th Ed., John Wiley, 2004
8. B.R. Munson, D.F. Young, and T.H. Okhiishi, Fundamentals of Fluid Mechanics, 5th Ed., Wiley India Edition, 2002
9. J. D. Anderson (Jr.), Modern Compressible Flow, McGraw-Hill International Ed., 1990.
10. Y. A. Cengel and J.M. Cimbala, Fluid Mechanics, Tata McGraw-Hill, 2006.

ME305 DYNAMICS OF MACHINERY (3-1-0-8)

Static and dynamic force analysis of mechanisms - Flywheel function and design. Balancing of rotating masses in one and in several planes - Balancing of reciprocating masses – Single and multi-cylinder engines. Governors; gravity and spring controlled governors - Gyroscopic effect. Vibration; free and forced vibrations - Single degree and multi-degree freedom systems. Vibration control - Passive and active control.

Texts/References:

1. J. J Uicker (Jr), G. R Pennock, and J. E Shigley, Theory of Machines and Mechanisms, 3rd Ed., Oxford International Student Edition, 2009.
2. J S Rao and R V Dukkipat, Mechanism and Machine Theory, 2nd Ed., New Age Intl., 2008.
3. S. S. Rattan, Theory of Machines, 3rd Ed., Tata McGraw Hill, 2009.
4. T. Bevan. Theory of Machines, CBS Publishers and Distributors, 1984.
5. L. Meirovitch, Elements of Vibration Analysis, McGraw Hill, 1998.
6. W. T. Thomsom and M.D. Dahleh, Theory of Vibration with Applications, 5th Ed., Pearson Education, 1999.
7. Norton, R.L., Design of Machinery - An introduction to the Synthesis and Analysis of Mechanisms of Machines, McGraw Hill International Editions, 2nd Ed., 2000.

ME307 THERMAL ENGINEERING I (3-0-0-6)

Vapour Power Cycles: Carnot cycle, Rankine cycle, reheat cycle, regenerative cycle, steam cycles for nuclear power plant, back-pressure and extraction turbines and cogeneration, low-temperature power cycles, ideal working fluid and binary/multi-fluid cycles; Steam Generator: subcritical and supercritical boilers, fluidized bed boilers, fire-tube and water-tube boilers, mountings and accessories; Condenser; Cooling Tower: hygrometry and psychrometric chart.

Texts/References:

1. G.F.C Rogers and Y. R. Mayhew, Engineering Thermodynamics Work and Heat Transfer, 4th Ed., Pearson, 2003.
2. T.D. Eastop and A. McConkey, Applied Thermodynamics for Engineering Technologists, 5th Ed., Pearson, 2003.
3. M.J. Moran and H N Shapiro, Fundamentals of Engineering Thermodynamics, 3rd Ed., John Wiley, 1995.
4. M.M. El Wakil, Power Plant Technology, McGraw Hill International, 1992.
5. P.K. Nag, Power Plant Engineering, 2nd Ed., Tata McGraw Hill, 2002.
6. W.A. Vopat, B.G.A. Skrotzki, Power Station Engineering and Economy, Tata McGraw Hill, New Delhi, 1999.
7. R.K. Rajput, Thermal Engineering, Laxmi Publications, New Delhi, 2006.

ME309 DESIGN OF MACHINE ELEMENTS I (3-0-0-6)

Mechanical engineering design - Design considerations - Material selection - Modes of failure - Theories of failure - Endurance limit - Stress concentration - Factor of safety. Design of shafts and couplings - Design of cotter and knuckle joints. Helical and leaf springs. Fasteners and keys - Design of welded joints - Fillet and butt welds - Design of riveted joints. Design of sliding contact bearings - Selection of rolling contact bearings.

Text/References:

1. Sundararajamoorthy, T.V. and Shanmugam, N., Machine Design, Anuradha Agencies, 2003.
2. Shigley, J.E., Charles, R.M. and Richard, G.B., Mechanical Engineering Design, 7th Ed., McGraw-Hill, 2004.
3. Bhandari, B., Design of Machine Elements, 3rd Ed., Tata McGraw Hill, New Delhi, 2009.
4. Norton, R.L., Machine Design: An Integrated Approach, 2nd Ed., Pearson, 2004.

ME331 MEASUREMENTS AND METROLOGY LAB (0-0-3-3)

Calibration of LVDT, thermocouple, pressure gauges, Strain Gauges and flow meters. Use of various metrological tools like slip, angle gauge, feeler, taper, fillet, thread gauges, estimation of internal dimensions Measurements on precision instruments; sine bar, CMM - Universal measuring microscope, Profile projector - Electronic comparator, optical flat, surface roughness - Gear tooth thickness - MAAG gear tester.

ME333 FLUID MECHANICS & TURBOMACHINERY LAB (0-0-3-3)

Determination of pipe friction. Calibration of venturimeter, orifice-meter and water-meter. Determination of discharge coefficients for notches and weirs. Determination of viscosity of fluid. Determination of minor losses. Determination of discharge coefficients for mouthpiece and orifice. Flow through helical coils. Determination of metacentric height. Laminar and turbulent flow; Application of momentum equations.
Performance Tests of Pumps and turbines.

ME335 DYNAMICS OF MACHINES LAB (0-0-3-3)

Balancing. Measurement of moment of inertia of rigid bodies. Gyroscope. Jump speed of a cam. Mechanical vibrations: Bifilar, trifilar, compound pendulums. Damping: damping and critical damping coefficients, logarithmic decrement, coulomb damping, Natural frequencies of coupled pendulum.

SEMESTER VI

ME302 MECHATRONICS (3-0-0-6)

INTRODUCTION: Introduction to Mechantronics-Systems-Measurement Systems-Control Systems-Mechatronics Approach. SENSORS AND TRANSDUCERS: Introduction-Performance, Terminology-Displacement, Position and Proximity-Velocity and Motion Fluid Pressure-Temperature Sensors-Light Sensors-Selection of Sensors-Signal Processing. 8085 MICROPROCESSOR: Introduction-Architecture-Pin Configuration-Instruction set-Programming of Microprocessors using 8085 instructions-Interfacing input and output devices-Interfacing D/A converters and A/D converters-Applications- Temperature control-Stepper motor control-Traffic light controller. PROGRAMMABLE LOGIC CONTROLLERS: Introduction-Basic structure-Input/Output Processing-Programming-Mnemonics-Timers, Internal relays and counters-Data handling-Analog Input/Output-Selection of a PLC. DESIGN AND MECHATRONICS: Stages in Designing mechatronic systems - Traditional and Mechatronic design -Possible design solutions-Case studies of mechatronic systems - Pick and place robot - automatic car park system -engine management system.

Texts/References:

1. W. Bolton, Mechatronics, Longman, Second Edition, 1999.
2. Michael B. Histand and David G. Alciatore, "Introduction to Mechatronics and Measurement Systems", McGraw Hill International Editions, 1999.
3. HMT Ltd., "Mechatronics", Tata McGraw Hill Publishing Co. Ltd., 1998.
4. Dan Necsulescu, "Mechatronics", Pearson Education Asia, 2002 (Indian reprint).
5. Devdas Shetty and Richard, A. K., Mechatronics System Design, Vikas Publishing House Private Ltd., New Delhi, 2002.

ME304 AUTOMOBILE ENGINEERING (3-0-0-6)

General classification of vehicles - Power unit - All components of power unit. Steering systems - Power steering - Wheel and suspension systems - Transmission system; clutches, couplings, gear boxes, and torque converters. Axles - Differentials - Mechanical, hydraulic, and pneumatic brakes - Power brakes – Four wheel drive. Electrical systems; construction, operation, and maintenance of batteries - Starter motors. Lighting and electrical accessories - Panel board instruments - Automobile air conditioning - troubleshooting.

Texts/References:

1. Heitner, J. Automotive Mechanics Principle and Practice, 2nd Ed., Affiliated East-West Press Ltd., 1974.
2. Newton, K., Steeds, W., and Garrett, T.K., The Motor Vehicle, Butterworths, 1989.
3. Kirpal Singh, Automotive Engineering, Vol. I & II, Standard Publishers, New Delhi, 2002.

ME306 REFRIGERATION AND AIR CONDITIONING (3-0-0-6)

Introduction about Refrigeration – Definitions of various terms. Methods of refrigeration. Air refrigeration system. Bell – Coleman cycle. Introduction about Air-craft Air Conditioning. Analysis of Vapour compression cycle, Modifications to basic cycle. Multi pressure systems. Multi-evaporator system and Cascade systems. Properties of refrigerants. Selection of refrigerants. Discussion of components of V.C system, Servicing. Vacuumizing and charging of refrigerant. Introduction to cryogenics. Psychrometry – Definitions for properties. Introduction to cooling load calculations. Comfort conditions. Effective temperature concept. Air-conditioning systems – discussion about the central plant with direct evaporator and chiller applications, Ice plant, refrigerators. Food preservation, IQF technique and freeze drying etc. Cold storage and thermal insulation.

Texts/References:

1. Arora, C. P., Refrigeration and Air-conditioning, 3rd Edition, Tata McGraw Hill Publications, New Delhi, 2008.
2. Roy, J. Dossat, Principles of Refrigeration, 4th Edition, Pearson. 2010.
3. Stoecker and Jones, Refrigeration and Air-Conditioning, Tata McGraw Hill Publications, New Delhi, 2008.
4. Manohar Prasad, Refrigeration and Air Conditioning, New Age International, 2004.

ME308 THERMAL ENGINEERING II (3-0-0-6)

Reciprocating air compressors - types - construction - work of compression without clearance - effect of clearance – Multistaging - optimum intermediate pressure for perfect inter cooling - Compressor efficiencies and mean effective pressure. Working of two and four stroke engines - valve and port timing diagrams - Deviation of engine indicator diagram from air standard cycles - Fuel air cycles and their analysis, Comparison of air standard and fuel air cycles - Losses in actual cycles. I.C. engines fuels and rating -SI engine air fuel mixture requirements - Performance curve of an automobile carburetor - Diesel injection systems - types - Jerk type pump – Injection pump governors. Types of nozzles - Introduction to petrol injection. Battery Ignition - magneto ignition and transistorized coil ignition - Combustion in SI engines - Knock in SI engines - effect of engine variable on knock - Combustion in CI engines - knock in CI engines - combustion chambers for SI and CI engines. I.C. Engine testing - Measurement of friction power - Indicated power - Electronic Indicator- Brake power - dynamometers - Instruments for measuring emission of NOx , CO, Unburnt HC and smoke - engine efficiencies - Heat balance - Scavenging in two stroke engines.

Texts/References:

1. G. F. C. Rogers and Y. R. Mayhew, Engineering Thermodynamics Work and Heat Transfer, 4th Ed., Pearson, 2001.
2. H. I. H Saravanamuttoo, G. F. C. Rogers and H. Cohen, Gas Turbine Theory, 4th Ed., Pearson, 2003.
3. T. D. Eastop and A. McConkey, Applied Thermodynamics for Engineering Technologists, W. W. Pulkrabek, Engineering Fundamentals of the Internal Combustion Engine, PHI, 2002.
4. C. R. Fergusan and A. T. Kirkpatrick, Internal Combustion Engines, John Wiley & Sons, 2001.
5. R.K. Rajput, Thermal Engineering, Laxmi Publications, New Delhi, 2006.

ME310 DESIGN OF MACHNE ELEMENTS II (3-1-0-8)

Introduction to transmission elements - Positive and friction based drives. Importance of friction based drives - Design of flat and V-belts - Design of rope and chain drives. Design of brakes and clutches. Design of spur and helical gears based on contact and beam strength. Design of bevel and worm gears. Design of multi-speed gearbox - Preparation of ray diagram and kinematic arrangement diagram for multi-speed gearbox.

Texts/References:

1. Sundararajamoorthy, T.V. and Shanmugam, N., Machine Design, Anuradha Agencies, 2003.
2. Shigley, J.E., Mechanical Engineering Design, 5th Ed., McGraw-Hill, 1989.
3. PSG Design Data Book, PSG Book Depot, 2010.
4. Bhandari, B., Design of Machine Elements, 3rd Ed., Tata McGraw Hill, New Delhi, 2009.
5. Norton, R.L., Machine Design: An Integrated Approach, 2nd Ed., Pearson, 2004.

ME332 MECHATRONICS LAB (0-0-3-3)

Verification of basic specifications of operation amplifier from data sheet; OP-amp Ck1amplifier (inverting and Non-inverting) P-amp Ck2 wave form generation (square wave, triangular wave); OP-amp Ck3 Integrator, Differentiator; OP-amp Ck4 V-I converter & I-V converter. Study of transducers: RTD + Signal Conditioning Circuit; Study of LVDT with accessory chip; Study of Digital Gates - SOP realization. Study of Microprocessor instruction set; Simple programs using 8085 microprocessor -Addition, Use of functions, Peripheral chips, Waveform generation. Usage of interrupts, Stepper motor control, Key board interface, Heater control; Study of PLC; Study of tools such as PSPICE; Usage of simulators (any other microprocessor)

ME334 AUTOMOBILE ENGINEERING LAB (0-0-3-3)

Study on engine components. Fuel systems. Ignition systems - Transmission systems - Steering systems. Suspension and braking systems. Wheel Alignment and Wheel Balancing of automobile vehicle. Layout of electrical wiring - Light and heavy vehicles.

ME336 THERMAL ENGINEERING LAB (0-0-3-3)

Property determination for fuels and lubrication oil. Study and performance testing of IC engines. Study and performance testing of air compressor. Emission measurements.
Study and performance tests on refrigeration.
Study and performance tests on air conditioning test rig.

SEMESTER VII

HS401 INDUSTRIAL ECONOMICS (2-0-0-4)

Demand and Supply – Forecasting techniques – Cost and Revenues. Competitive nature of the firms – Keynesian economics – National income. Trade cycle – Inflation – Index numbers – Capital budgeting – Cash flow analysis – Balance sheet. Risk and Decision Making – Technological Change in Global Economy – Locating the Firm in a global economy – Taxes and Decision Making. Exchange Rate determination –

Marketing – Product life cycle – Marketing research – Branding – Personality – Motivation – Leadership – Working in Teams.

Texts/References:

1. Adhikary Manab, Business Economics, Excel Books, 2004.
2. Dwivedi, D.N., Macro Economics Theory & Policy, Tata McGraw-Hill, 2005.
3. Aczel D. Amir, Soundarapandian Jayavel, Complete Business Statistics, Tata McGraw-Hill, 2005.
4. Robins P. Stephen, Organizational Behaviour, Prentice-Hall, 2002.

ME401 INDUSTRIAL ENGINEERING AND OPERATIONS RESEARCH (3-0-0-6)

Introduction, Production Planning and Control, Product design, Value analysis and value engineering, Plant location and layout, Equipment selection, Maintenance planning, Job, batch, and flow production methods, Group technology, Work study, Time and motion study, Incentive schemes, Work/job evaluation, Inventory control, Manufacturing planning: MRP, MRP-II, JIT, CIM, Quality control, Statistical process control, Acceptance sampling, Total quality management, Taguchi's Quality engineering. Forecasting, Scheduling and loading, Line balancing, Break-even analysis. Introduction to operations research, linear programming, Graphical method, Simplex method, Dual problem, dual simplex method, Concept of unit worth of resource, sensitivity analysis, Transportation problems, Assignment problems, Network models: CPM and PERT, Queuing theory.

Texts/References:

1. S. L. Narasimhan, D. W. McLeavey, and P. J. Billington, Production, Planning and Inventory Control, Prentice Hall, 1997.
2. J. L. Riggs, Production Systems: Planning, Analysis and Control, 3rd Ed., Wiley, 1981.

A. Muhlemann, J. Oakland and K. Lockyer, Productions and Operations Management, Macmillan, 1992.

3. H. A. Taha, Operations Research - An Introduction, Prentice Hall of India, 1997.
4. J. K. Sharma, Operations Research, Macmillan, 1997.

ME403 CAD/CAM (3-0-0-6)

Principles of Computer Aided Design (CAD): Computer configuration for CAD applications, Computer peripherals for CAD. Fundamentals of Computer Graphics: Two dimensional transformation, three dimensional transformation and projections. PLANE CURVES AND SPACE CURVES: Surface description and generation. Hidden line algorithms for wire frame modeling. Solid modeling. Introduction to Computer Aided Drafting and Analysis Softwares such Auto CAD, PRO ENGINEER, ANSYS, etc. CAD System utilization and application.
Computer Aided Manufacturing (CAM): Introduction; Numerical control of machine tools, nomenclature, types, features, MCU. Transducers: Tooling for N.C. Machines, ISO G & M Codes, N.C. part programming, tool setting, cutter compensation, parametric programming, APT language structure, APT Geometry, motion commands, post processor commands, repetitive programming, compilation and control commands. Introduction to Computer Aided Process Planning; Introduction to Flexible Manufacturing Systems.

Texts/References:

1. Ibrahim Zeid and Sivasubramanian, R., CAD/CAM Theory and Practice, Tata McGraw Hill Publications, New Delhi, 2009.
2. Yoram Koren, Computer Control of Manufacturing Systems, McGraw Hill Student edition, 2005.
3. Rao, P.N., CAD / CAM Principles and Applications, McGraw Hill Publishers, New Delhi, 2010.
4. Rogers David F. and Alan Adams J., "Mathematical Elements for Computer Graphics", McGraw Hill, 1990.
5. Kundra T. K., Rao P. N. and Tewari M. K., "Numerical Control and Computer Aided Manufacturing", Tata McGraw Hill, 1990.
6. Groover M.P., "Automation, Production Systems & Computer Integrated Manufacturing." Prentice Hall, 1989.
7. Krishnamoorthy C.S. and Rajeev S., "Computer Aided Design", Narosa Publishing House, 1991.
8. Groover M.P. and Zimmers E.W., "Computer Aided Design and Manufacturing", Prentice Hall India, 1997.
9. Elanchezhian C, Selwyn Sunder T and Shanmuga Sundar G., "Computer Aided Manufacturing", Laxmi Publications, New Delhi, 2006.

10. Sinha S. K., “CNC Programming”, Galgotia Publications, 2004.

ME431 CAD/CAM LAB (0-0-3-3)

1. Drafting practice using drafting package for drawing option.
2. Drafting practice using drafting package for modify option.
3. Drafting practice using drafting package for dimensional approach.
4. Programming practice for a given problem.
5. Programming practice for graphic application.
6. Practice for data exchange from draft package.
7. Drafting of design component
8. Demonstration of 3D modeling using CAD Packages.
9. Demonstration of stress analysis using FEA package.

SEMESTER VIII

HS402 MANAGEMENT PRINCIPLES AND CONCEPTS (3-0-0-6)

Introduction to management –Evolution of scientific management, modern management, Principles- Elements of management planning, organizing, staffing, directing, coordinating, reporting, budgeting. Financial management, objectives, scope, Techniques of investment analysis, Payback period, sources of financing, technology management, product design, and plant layout. Inventory management, project management, PERT, CPM- Applications. Significance of Human resources management, HR Planning, Job evaluation, recruitment and selection. Placement and induction, training, Performance appraisal, compensation, Industrial relations.

Texts/References:

1. Prasad, L.M., Principles and practice of Management, Sultan Chand & Sons, 2006.
2. Gupta, R.N., Principles of Management, Sultan Chand & Co, 2001.