DETAIL SYLLABI
OF
MECHANICAL ENGINEERING
(THIRD SEMESTER TO EIGHTH SEMESTER)
DEGREE (B.E.)

TRIPURA UNIVERSITY
SURYAMANINAGAR

SYLLABI OF DEGREE IN MECHANICAL ENGINEERING
(Third Semester to Eighth Semester)
THIRD SEMESTER

Sl. No.	Name of Subjects	Code No	Periods/ Week			Full Marks	Credits
			L	T	P/S		
Theory							
01.	Applied Thermodynamics - I	BE/ME-301	3	0	0	100	3
02.	Strength of Materials - I	BE/ME-302	3	1	0	100	3
03.	Fluid Mechanics - I	BE/ME-303	3	1	0	100	3
04.	Material Science	BE/ME-304	4	0	0	100	4
05.	Mathematics - III	BE/M-301	3	1	0	100	3
06.	Numerical analysis and Computer Programming	BE/ME-305	3	1	0	100	3
Practical / Sessional							
07.	Mechanical Engg Lab -I	BE/ME-306	0	0	3	100	2
08.	Strength of Materials-I	BE/ME-307	0	0	2	50	1
09.	Fluid Mechanics Lab- I	BE/ME-308	0	0	3	100	2
10.	Workshop Practice -III	BE/ME-309	0	0	3	100	2
11.	Electrical Technology Lab	BE/EE-311	0	0	2	50	1
Total			36			1000	28

(N.B. "L" for "Lecture", "T" for "Tutorial" and "P/S for "Practical / Sessional")

FOURTH SEMESTER

Sl. No.	Name of Subjects	Code No	Periods/ Week			Full Marks	Credits
			L	T	P/S		
Theory							
01.	Applied thermodynamics – II	BE/ME-401	4	0	0	100	4
02.	Strength of Materials-II	BE/ME-402	3	1	0	100	3
03.	Fluid Mechanics - II	BE/ME-403	3	1	0	100	3
04.	Manufacturing Technology - I	BE/ME-404	4	0	0	100	4
05.	Managerial Economics and Management	BE/HU-401	3	0	0	100	3
06.	Industrial Electronics and Instrumentations	BE/EE-408	3	1	0	100	3
Practical / Sessional							
07.	M.E Lab-II	BE/ME-405	0	0	3	100	2
08.	FM Lab - II	BE/ME-406	0	0	2	50	1
09.	Manufacturing Processes - I	BE/ME-407	0	0	3	100	2
10.	Industrial Electronics Lab	BE/EE-409	0	0	3	100	2
11.	Numerical Methods Programming Laboratory	BE/ME-408	0	0	2	50	1
Total			36			1000	28

FIFTH SEMESTER

Sl. No.	Name of Subjects	Code No	Periods/ Week			Full Marks	Credits
			L	T	P/S		
Theory							
01.	Refrigeration & Air conditioning	BE/ME-501	3	1	0	100	3
02.	Machine Design-I	BE/ME-502	4	0	0	100	4
03.	Fluid Machines	BE/ME-503	3	1	0	100	3
04.	Manufacturing Technology – II	BE/ME-504	3	0	0	100	3
05.	I.C. Engine	BE/ME-505	4	0	0	100	4
106.	Kinematics of Machine	BE/ME-506	3	1	0	100	3
Practical / Sessional							
07.	Metrology Lab	BE/ME-507	0	0	3	100	2
08.	Fluid Mechanics Lab-II	BE/ME-508	0	0	2	50	1
09.	Manufacturing Processes - II	BE/ME-509	0	0	3	100	2
10.	Machine Design-I Sessional	BE/ME-510	0	0	2	50	1
11.	I. C. Engine Lab	BE/ME-511	0	0	3	100	2
Total			36			1000	28

SIXTH SEMESTER

Sl. No.	Name of Subjects	Code No	Periods/ Week			Full Marks	Credits
			L	T	P/S		
Theory							
01.	Heat & Mass Transfer	BE/ME-601	3	1	0	100	3
02.	Machine Design-II	BE/ME-602	4	0	0	100	4
03.	Automobile Engg**.**	BE/ME-603	3	0	0	100	3
04.	Mechanical Vibrations	BE/ME-604	3	1	0	100	3
05.	Operation Research	BE/ME-605	3	1	0	100	3
06.	Mechanical Measurement	BEME-606	4	0	0	100	4
Practical / Sessional							
07.	Manufacturing Processes - III	BE/ME-607	0	0	3	100	2
08.	Machine Design-II Sessional	BE/ME-608	0	0	2	50	1
09.	Automobile Lab	BE/ME-609	0	0	2	50	1
10.	Refrigeration & Air conditioning Lab	BE/ME-610	0	0	3	100	2
11.	Mechanical Measurement Lab	BE/ME-611	0	0	3	100	2
Total			36			1000	28

SEVENTH SEMESTER

Sl. No.	Name of Subjects	Code No	Periods/ Week			Full Marks	Credits
			L	T	P/S		
Theory							
01.	Thermal Power – I	BE/ME-701	3	1	0	100	3
02.	Computer Aided Design	BE/ME-702	3	1	0	100	3
03.	Dynamics of Machine	BE/ME-703	4	0	0	100	4
04.	Production Engg. – I	BE/ME-704	3	1	0	100	3
05.	Elective – I	BE/ME-705	4	0	0	100	4
Practical / Sessional							
06.	Machine Design Sessional (CAD)	BE/ME-706	0	0	3	100	2
07.	Heat & Mass Transfer Lab	BE/ME-707	0	0	3	100	2
08.	Elective -I Sessional	BE/ME-708	0	0	3	100	2
09.	Vibration Lab	BE/ME-709	0	0	2	50	1
10.	Preliminaries of Project & Thesis - I	BE/ME-710	0	0	3	100	3
11.	Professional Skill Development-I	BE/GP-2	0	0	2	50	1
Total			36			1000	28

EIGHTH SEMESTER

Sl. No.	Name of Subjects	Code No	Periods/ Week			Full Marks	Credits
			L	T	P/S		
Theory							
01.	Thermal Power – II	BE/ME-801	3	1	0	100	3
02.	Robotics & Numerical control of Machine Tools	BE/ME-802	3	1	0	100	3
03.	Industrial Engg. & Management	BE/ME-803	3	1	0	100	3
04.	Production Engg. – II	BE/ME-804	4	0	0	100	4
05.	Elective – II	BE/ME-805	4	0	0	100	4
Practical / Sessional							
06.	Robotics Sessional	BE/ME-806	0	0	2	50	1
07.	Elective -II Sessional	BE/ME-807	0	0	3	100	2
08.	Thermal Power Lab	BE/ME-808	0	0	3	100	2
09.	Project & Thesis - II	BE/ME-809	0	0	6	100	3
10.	Grand Viva Voce	BE/ME-810	0	0	0	100	2
11.	Professional Skill Development-II	BE/GP-3	0	0	2	50	1
Total			36			1000	28

THIRD SEMESTER

BE/ME-301 APPLIED THERMODYNAMICS-I

IST HALF

1. **Definition:** Thermodynamic system, control volume, Thermodynamic properties, processes, cycles, homogenous and heterogeneous system, thermodynamic equilibrium, quasi-static process. Work Transfer, pdv work, Indicator diagram, free expansion, path function.

2. **First Law Of Thermodynamics:** Quantity of energy and its measurement. First Law Energy equation for closed and open loop system under SSSF and USUF condition ; Application of First Law Energy equation to thermodynamic system components such as boiler, turbine, compressor, nozzle, expander, pump, condenser; First Law efficiency; First Law analysis of combustion process.

3. **Second Law Of Thermodynamics :**Quality of energy and its measurements; Reversible and irreversible processes; Entropy and its significance; Principle of increase of entropy of the universe; Carnot cycle; Clausius inequality; Application of second law to various thermodynamic system;

2ND HALF

1. Combination of First and Second Law : First and second law combined, reversible adiabatic work in a steady flow system, unsteady flow, control system analysis, control volume analysis, Entropy and disorder, Availability and irreversibility; Second Law analysis of combustion process

2. Properties of pure substances : Pure substances, p –v; p – t; t – s and h – s diagrams; Steam tables; charts of thermodynamic properties, dryness fraction of liquid vapour mixtures. Reactive mixtures and combustion.

References:

1. Nag, P.K., *Engineering Thermodynamics, 3rd* ed., Tata McGraw-Hill, 2005
2. Van Wyllen , R G Sontag & Claus Borganekke, *Fundamental of Classical Thermodynamics*, 4th Edn, John Wiley & Sons
3. Cengal, Y.A and Boles, M.A, *Thermodynamics: An Engineering Approach, 5th* ed., McGraw Hill, 2006.
4. Ballaney, P.L.,*Thermal Engineering,* Khanna Publishers.

BE/ME-302 STRENGTH OF MATERIALS -I

IST HALF

1. **Simple stresses and strains:** Stress, strain, types of stresses, elastic limit, Hook's law, Analysis of bars of varying sections, law of superposition, composite bar, thermal stress,thermal stresses in composite bars, elongation of bar due to it's own weight, stress-strain diagram.

2. **Elastic constants:** Introduction , longitudinal & lateral strain, Poisson's ratio, volumetric strain for rectangular bar, Bulk Modulus , Principle of complementary shear stress, Relation between various elastic constants .

3. **Principle stresses and strain :** Introduction, Principle planes and principle stresses, methods for determining stresses on oblique section, Analytical method, Graphical method, Mohr's circle, use of Mohr's circle to find Principle stresses.

4. **Strain Energy and Impact Loading:** Introduction, Resilience, proof resilience, Modulus of Resilience, expression for strain energy stored in a body for different loading conditions and shear stress.

2ND HALF

1. **Shear force and Bending moment:** Introduction, different types of beams and loads, S.F & BM diagram for a cantilever, Uniformly distributed load, Simply supported beam for various types of loading, relation between load, shear force and Bending moment diagram.

2. **Torsion of shafts:** Introduction , Basic assumptions, Derivation of shear stress produced in a circular shaft subjected to torsion, Max. torque transmitted by a circular and hollow circular shaft. Polar modulus , strength of a shaft and tensional rigidity, composite shafts, combined bending and torsion. Strength of a shaft of varying cross section.

3. **Thin and Thick cylinder:** Introduction ,Thin cylindrical vessel subjected to internal pressure, expression for circumferential and longitudinal stress in thin cylinder , stresses in thick cylindrical shells, stresses in compound thick cylinder.

References:

1. Ramamurtham, S., "Strength of Materials", Dhanpat Rai & Sons, 1974.
2. Khurmi, R.S., "*Strength of Materials"*, Khanna Publishers.
3. Beer, Johnston., "*Mechanics of Materials"*, Tata McGraw-Hill Publications

BE/ME- 303 FLUID MECHANICS-I

IST HALF

1. **Properties of fluid:** Mass and weight density, specific gravity, specific volume, viscosity and Newton's law of viscosity, Compressibility, Types of fluid, surface tension and capillarity.

2. **Pressure and its measurement:** Fluid pressure at a point and Pascal's law, absolute, gauge and vacuum pressures, pressure variation in a fluid at rest, pressure measurement-Manometers and Mechanical Gauges.

3. **Hydrostatics:** Total pressure and centre of pressure for horizontal, vertical , inclined plane surfaces and curved surfaces submerged in liquid. Total pressure and center of pressure on lock gates.

4. **Buoyancy and flotation:** Buoyancy, center of buoyancy , metacentre and metacentric height and equilibrium of floating bodies, period of oscillation .Kinematics of flow: Types of fluid flow, continuity equation in three dimensions, velocity potential function and stream function, forced and free vortex flow.

2ND HALF

5. **Dynamics of flow:** Euler's equation and Bernoulli's equation ,application of Bernoulli's equation-venturimeter, orifice-meter, and pitot tube.

6. **Orifice and Notches:** Flow through orifices, hydraulic coefficients, time of emptying hemispherical and horizontal cylindrical tank through an orifice at it's bottom. Discharge over rectangular, triangular and trapezoidal notches, velocity of approach.

7. **Laminar flow :** Flow of viscous fluid through circular pipe-velocity distribution and average velocity, Hagen Poiseiulle formula, Kinetic energy correction and Momentum Correction factors , Navier-Stokes equation of motion.

8. **Turbulent Flow:** Reynold's experiment, Loss of head due to friction in pipes, Reynold's expression and Prandtl mixing length theory for turbulent shear stress.

References:

1. Bansal, S.K., *"Fluid Mechanics & Hydraulic Machines"* Laxmi Publications.
2. Cengel, Y.A., *"Fluid Mechanics: Fundamentals & Applications (SI Units)"* Tata McGraw-
   Hill Publications

3. Jain, A.K., "*Fluid Mechanics"* Khanna Publishers.
4. Rajput, R.K., "*Fluid mechanics & Hydraulic machines 2/E "* S. Chand Publications.

BE/ **ME-304 MATERIAL SCIENCE**

IST HALF

1. **Structure of Materials:** Crystalline structure of solids; Concept of unit cell and space lattice; Miller indices; Crystal structure determination by X-ray diffraction ,optical method, Crystal structure of ferrous and non ferrous metals; Crystal imperfection

2. **Plastic Deformation:** Mechanism of plastic deformation; Role of dislocation; Slip and Twinning; Strain hardening and recrystallisation; Elementary cause and treatment of creep fatigue and fracture.

3. **Phase Diagram:** Phase and Phase equilibrium; solidification of pure metals and alloys; Phase diagrams; Eutectic, eutectoid; Peritectic and peritectoid systems; Allotropy of iron and Fe-C diagrams.

2ND HALF

4. **Heat Treatment** Introduction and purpose of heat treatment; T-T-T curve and micro constituents in steel heat treatment process like hardening, tempering, normalizing, annealing; Electrical, magnetic and optical properties of materials; Surface treatment processes.

5. **Engineering Materials:** Ferrous ;Pig iron ,Blast furnace, Cast iron, Cupola, steel, steel making process, Carbon and alloy steel and their coding; Nonferrous; Aluminum; Copper Nickel; Chromium; Zinc; Lead; Tin; Tungsten etc. and their alloys .Classification; Structure; General properties and application of polymers, Ceramics and composites.

References:

1. Rajendra & Marikani, "*Materials Science"* Tata McGraw-Hill Publications.
2. Hazra Chowdhury, "*Workshop Technology – I "* Media Promoters & Publishers.
3. Donald S.Clark,and Wilbur R. Varney, "*Physical Metallurgy for Engineers*", East-West Press Private limited.

BE/M-301 MATHEMATICS III

1. **Mathematical Series:** Fourier Series; Half- Range series; Harmonic analysis. Solution in Series Differentiation and integration of infinite series; Series solution of differential equations; Bessel and Legendre equations, their series solution, elementary properties of Bessel functions and Legendre polynomials.

2. **Complex Variables:**Functions of complex variables; Exponential; Trigonometric; Hyperbolic and logarithmic function; Differentiation; Analytic function; Cauchy Riemann equations; Conjugate functions; Introduction to two dimensional potential problem; Conformal transformations; Schwartz- Christoffel transformational; Cauchy's integral theorem; Taylor's and Laurent's expansion; Branch points; Zeros; Poles and residues; Simple problem on contour integration.

3. **Boundary Value Problem:** Equations for vibration of strings; Heat flow and electrical transmission lines; Laplace's equation in cylindrical, Cartesian, polar and spherical polar coordinates; Solution by separation of variables.

4. **Integral Transforms:**Fourier integral theorem; Fourier transforms; Convolution theorems; Inversion theorems for Fourier and Laplace transforms; Simple applications of these transforms to one- dimensional problems.

BE/ME-305 NUMERICAL ANALYSIS AND COMPUTER PROGRAMMING

IST HALF

I Numerical Analysis: Approximation and round off errors; Truncation errors and Taylor series.

Determination of roots of polynomials and transcendental equations by Newton-Raphson, Secant and Barstow's method.

Solution of linear simultaneous algebraic equations by Gauss elimination and Gauss-Siedel iteration methods.

Curve fitting; Linear and non-linear regression analysis.

Backward; Forward and central difference relations and their uses in numerical differentiation and integration; Application of different relations in the solution of partial differential equations.

Numerical solution of ordinary differential equations by Euler; modified Euler Runge-Kutta and predictor-corrector method.

2ND HALF

II Computer Programming: Introduction to computer programming in C and C^{++} languages: Arithmetic expressions; Simple programs **(The emphasis should be more on programming techniques rather than the language itself. The C programming language is being chosen mainly because of the availability of the compiler, books and other reference materials.**

Example of some C programs; Dissection of the program line by line; Concept of variables; Program statement and function calls from the library.

C datatypes: int, char, float etc.

C expressions, arithmetic operations, relational and logic operations.

C assignment statements, extension of assignment to the operation; C primitive input output using getchar and putchar; exposure to the scanf and printf function.

C statements; conditional execution using if, else etc.**(Optionally switch and break statements should be mentioned)**

Concepts of loop; Example of loops in C using for-while and do-while**(Optionally continue may be mentioned)**

One dimensional arrays and example of iterative programs using arrays; 2-d arrays; Use in matrix computations.

Concept of sub-programming; Functions; Example of functions; Argument passing mainly for the simple variables.

Pointers, relationship between arrays and pointers; Argument passing using pointers.

Array of pointer; Passing arrays as arguments.

Strings and C string library.

Structure and unions; Defining C structure; Passing structure as arguments **(Program examples)**

File I/O; Use of fopen, fscanf and fprintf routines.

References.

1. Kandasamy, P., Thilagavathy, K., and Gunavathy, S., "*Numerical Methods*", S.Chand

BE/ME-306 M E. LAB. –I

Laboratory work based on the syllabus of ME-301

BE/ME- 307 STRENGTH OF MATERIAL LAB -I

Laboratory work based on the syllabus of ME-302

BE/ME-308 FLUID MECHANICS LAB -I

Laboratory work based on the syllabus of ME-303

BE/ME-309 WORKSHOP PRACTICE -III

Laboratory work based on the syllabus of ME-304

BE/EE-311 ELECTRICAL TECHNOLOGY LAB

Laboratory work based on Electrical Machines essential for Mechanical Engineering.

FOURTH SEMESTER

BE/ME-401 APPLIED THERMODYNAMICS-II

IST HALF

1. Ideal gas , properties of gases and mixtures of gases, enthalpy change of Ideal gas ,specific heat and entropy of gas mixture

2. Air standard cycles ,Otto-cycle, Diesel cycle, Limited pressure cycle, comparison of Otto diesel and dual cycle, Brayton cycle, Stirling cycle and Ericsson Cycle

3. Reciprocating air compressor, single and multistage, Volumetric efficiency

4. Concept of Normal Shock, Fanno line & Rayleigh line on h-s plot.

2ND HALF

1. Maxwells equation T-ds equation, Joule-Kelvin effect, Types of equilibrium.

2. Simple vapour cycles, Rankine cycle, actual Vapour cycle processes, comparison of Rankine and Carnot cycle, Reheat cycle, Regenerative cycle, Binary vapour cycles.

3. Reversed Heat engine cycles and heat pump, Bell Coleman cycle, Simple vapour compression refrigeration cycle, Absorption refrigeration.

4. Properties of atmospheric air, Psychometric chart &processes.

BE/ME-402 STRENGTH OF MATERIALS –II

IST HALF

1. **Bending stresses in Beams:** Introduction , Pure bending ,basic assumptions, expression for bending stress, Neutral axis and moment of resistance, section modulus, bending stresses in symmetrical and unsymmetrical sections, strength of a section, composite beam, bending of curved beam in the plane of loading-crane hooks and chain links.

2. **Shear stresses in Beams :** Introduction shear stresses at a section, shear stress distribution for rectangular, circular, I-section, T-section.

3. **Deflection of beams:** Introduction ,Deflection and slope of a beam subjected to bending Moment, relation between slope ,deflection and radius of curvature deflection of cantilever for various types of loading, deflection of simply supported beam for various types of loading. Conjugate beam method,

2ND HALF

1. **Propped cantilever and beams:** Introduction, conjugate beam method, deflection and slope of simply supported and cantilever beam, relation between actual beam and conjugate beam, Propped cantilever and beams, SF and BM diagram for propped cantilever with various loading conditions.

2. **Columns and struts:** Introduction, failure of a column , basic assumptions, different end conditions, expression for crippling for different end conditions Effective length of a column. Slenderness ratio, Limitations of Euler's formula, Rankine's formula, factor of safety.

3. **Theories of failure:** Introduction ,Maximum principal Stress theory, Max shear stress theory, strain energy theory, shear strain energy theory, Max principal strain theory, Graphical representation of 2-d stress system.

BE/ ME-403 FLUID MECHANICS-II

1ST HALF

1. **Dimensional and Model Analysis:** Dimensions of fundamental and derived quantities, Dimensional Homogeneity, Reyleigh's method and Buckingham's of pie-theorem, Simlitude, dimensionless, Model Laws, classification of models.

2. **Flow through Pipes:** Major and minor losses of energies in pipes, Hydraulic gradient and total energy lines, flow through pipes in series, equivalent pipe, Flow through parallel pipes, Power transmission through pipes and nozzles, water hammer.

3. **Flow in open channel:** Uniform flow through open channels, Chezy's formula, Most economical sections of channel. Non-uniform flow-specific energy and specific energy curve, critical depth and critical velocity, minimum specific energy, hydraulic jump.

2ND HALF

1. **Boundary Layer Theory:** Laminar and Turbulent boundary Layer thickness, Vonkarman's momentum equation, Total drag due to Laminar and turbulent layers on flat plate, separation of boundary layer and it's control.

2. **Forces on submerged bodies:** Drag and lift on a stationary body by flowing fluid, expression for drag and lift and dimensional analysis, stream lined and Bluff bodies, Drag on a sphere and cylinder, Terminal velocity of a body, lift on a airfoil.

3. **Compressible flow and Gas dynamics:** Thermodynamic relations, continuity equation, Bernoulli's equation and momentum equation, velocity of sound in fluid, Mach no. propagation of pressure waves in a compressible fluid-Mach angle, zone of action and silence, stagnation properties, Area-velocity relationship for compressible flow, flow of compressible fluid through nozzles-maximum mass flow rate and it's variation, mass flow rate of compressible fluid through venturimeter, pito-static tube. Normal and oblique shock waves.

BE/ME-404 MANUFACTURING TECHNOLOGY – I

1ST HALF

1. **Types of production and production processes:** Product configuration and manufacturing requirements; Casting of ferrous and non-ferrous metals including die casting. Loam moulding, investment casting, centrifugal casting, transfer moulding, etc.

2. **Designing moulds:** risers, sprues and gating system, casting defects,

3. **Joining methods:** welding brazing and soldering: Welding processes like fusion welding, electric arc welding, resistance welding, TIG, MIG submerged arc welding processes, friction welding: welding defect.

2ND HALF

1. **Hot and cold working of metals:** Bending, Wire/Tube Drawing, Deep drawing, spinning flow turning, stretch forming, forging defects etc.

2. **Pattern making and moulding:** types of pattern, pattern materials, pattern making tools and allowances, moulding process, moulding sand properties, hot and cold box moulding.

Managerial Economics and Management(BE/HU-401)

PART-A

1.Basic concepts and functions of management: Planning: Nature, Purpose and Objectives of planning, organizing: Nature and purpose, Authority and Responsibility, Staff Bug, Supply of Human Resources, performance Appraisal, Controlling: System and Process of controlling, control Techniques.

2.Human Resource management & marketing management: Nature and scope of human resource planning, Training and development, Recruitment and selection, career growth, Grievances, Motivation and its types, needs for motivation, Reward and Punishment, Models for motivation, Leaders:Kind of Leader, Leadership styles, Roles and function of leaders, Conflict

management, Kinds and cause of conflict, Settlement of conflict, Group and team working, Organizational design and development.

3.Marketing Environment: Consumer Markets and Buyer behavior marketing Mix, Advertising and Sales promotion, Channels of Distribution

4.Financial Management: Need of Finance, Kind and sources of capital, Shares & debentures, Fixed and working capital, Capital structure of a firm, Operating and Financial Leverage, EBIT, EPS Analysis. Functional ratio Analysis: Uses and nature, Liquidity coverage ratios, Practical problems.

5. Investment decisions and forecasting of working capital:

Kinds of capital budgeting decisions, evaluation of proposal, Capital discounting and non-discounting based method, Practical problem, definition and importance of working capital. Working capital operating cycle, factors affecting working capital,Inventory management introduction to cash and receivables management. Practical problems.

PART-B

6.Cost and cost control: Elements of costs, Types of Costs-direct and indirect, Variable and fixed, labour cost, Material cost, Over head Cost. Cost control techniques, Budgets-meaning, kinds, budgetary control, break-even analysis, practical problems.

7.Basic concepts and economic forecasting: Introduction: Definition, meaning, subject matter and scope of business economics or managerial economics. Demand analysis and forecasting, demand estimation methods.

8.Game theory and pricing: Game theory and strategic behavior, Pricing: Determinants of price, pricing under different market structures, perfect competition monopoly and monopolistic competition, pricing methods in practice, peak load pricing, cost plus or mark up pricing.

9.Risk and Capital Budgeting: Risk and Decision making, Risk Management, Decision Tree Analysis, Capital Budgeting : meaning, process, the cost of capital, mergers and acquisitions, evaluation of investment decisions, Break Even Analysis.

References:

1. M. Y. Khan and P. K . Jain, " Financial Management:, Tata Mcgraw Hill, 1997.
2. Y. K. Bhusan, " Fundamentals Of Business Organizations and Management ", S. Chand and Sons, 1998.
3. Philip Kotler , " Marketing Management" , Prentice Hall Of India, 1997.
4. Chandra Prasanna, " Fundamentals Of Financial Management:, Tata Mcgraw Hill,1994.
5. Fred Luthans, " Human Resource and Management", Tata Mcgraw Hill,1997.
6. Stephen P Rabbins, " Organizational Behavior Concepts, Controversies and Applications:, Prentice Hall, Englewood Cliff, New Jersey1998.
7. Craig H Peterson," Managerial Economics", Pearson Education.

8. Suma Damodaran, " Managerial Economics", Oxford University Press.
9. D. N. Dwivedi's "Managerial Economics", Vikash Publishing House Pvt. Ltd.

BE/EE-408 INDUSTRIAL ELECTRONICS AND INSTRUMENTATION

1ST HALF

Operational Amplifier: Ideal Op-amp, practical OP-amp characteristics , inverting amplifier, non-inverting amplifier, adder, sub tractor, integrator Differentiator, Clipper circuit, A.C. Amplifier, Square wave generator, Triangular and Saw tooth wave generator using Op-amp. SCR: Terminal Characteristics , Static V-I characteristics, SCR turn on methods, Snubber circuit, Different Triggering methods of SCR, GTO type SCR, Half wave-half controlled and full-controlled rectifier using SCR, Full wave half controlled and full-controlled bridge rectifier using SCR. Introduction to DIAC and it's characteristics and applications in industries, introduction to TRIAC and it's characteristics and applications in industries. Industrial electronics in Heating and welding.

2ND HALF

CRO: It's construction, characteristics and it's applications in industries. Different active and passive transducers and their characteristics, Strain Gauge ; it's characteristics and applications in industries. Different temperature sensors like thermistors, AD 590, LM 335, RTD, PT 100 and their applications in industries, LVDT, CVDT-Characteristics and applications in industries, Hall-effect sensors, Speed measurement using magnetic pick-up sensors.

BE/ME-405 MECHANICAL ENGINEERING LAB-II

Laboratory work based on the syllabus of ME-401

BE/ME-406 F.M.LAB-II

Laboratory work based on the syllabus of ME-403

BE/ME-407 MANUFACTURING TECHNOLOGY LAB

Laboratory work based on the syllabus of ME-404

BE/ME-408 NUMERICAL METHODS PROGRAMMING LAB

Laboratory work based on the syllabus of ME-305

BE/EE-409 INDUSTRIAL ELECTRONICS LAB

Laboratory work based on the syllabus of EE-408

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FIFTH SEMESTER

BE/ME –501 REFRIGERATION & AIR CONDITIONING

1ST HALF

1. **Principles of Refrigeration & Refrigeration cycle**: Reversed Carnot Cycle, Steam Jet Refrigeration System, Refrigerants-Designation and trade name, Physical, Chemical & Thermodynamic properties of principal refrigerants. Vapour Compression Refrigeration Cycle. Deviation from actual cycle. Air Refrigeration Systems-Bell-Coleman Cycle, evaporation & bootstrap evaporation type, T-S & p-h diagrams, COP.

2. **Absorption System of Refrigeration**: Electrolux Refrigerator. Refrigeration Equipments—Types of Compressors, Condensers & Evaporators. Flash chamber multi compressor, multi evaporator, production of load, temperature. Electric control. Surface requirements for evaporators & condensers. refrigeration piping, materials, moisture removal.

3. **Refrigeration controls**—liquid refrigerant control automatic & thermostatic expansion valves, float valves, section line controls.

4. **Application of Refrigeration**—ice making, food preservation, household refrigerators, cold storage.

2ND HALF

1. **Psychrometrics:** Atmospheric air, air and humidity, terms and calculation, psychrometric chart, air humidity processes, humidification &dehumidification, By-pass factor, summer and winter air load, housing system.

2. **Comfort air conditioning**: effective temperature, comfort chart, ventilation requirements.

3. **Solar Radiation:** Distribution of solar radiation, direct and diffuse radiation, earth sun angles and their relationships, direct solar radiation on a vertical, horizontal, inclined surface, heat gain through glass, effect of shading devices, heat transfer in building structures through walls and roofs. Empirical methods to evaluate heat transfer through walls and roofs, infiltration, passive heating and cooling of building. Air distribution system, basic theory, air duct losses, design of air duct system, air delivery and distribution.

4. **Air conditioning systems**: unit conditioners, central air conditioning, control of air conditioning apparatus, space cooling load calculation, heat transmission through barriers, solar radiation, infiltration, occupants, electric lights &appliances, product load, outside air and ventilation, SHR By-pass factor, ADP, refrigeration load. Fluid flow and

pressure loss, equivalent length system & duct design, air distribution system, basic control system. Solar heating and cooling, air conditioning through solar system, building designs for air conditioning

References:

1. Arora,C.P.,*"Refrigeration and Air Conditioning",2nd* ed., Tata McGraw-Hill2000.
2. Ananth Narayanan, "Basic Refrigeration & Air Conditioning", Tata McGraw-Hill
3. Khurmi, Gupta, *"Refrigeration and Air Conditioning",* S. Chand Publishers

BE/ME-502 MACHINE DESIGN-I

1ST HALF

1. Introduction – Various considerations in machine design. Assembly drawing, details drawing, working drawing. Common engineering materials, different types of steels. I.S.I. specification on steels, preferred number, standardization.

2. Simple Stresses in Mechanical Parts, load, Stress, strain, stress-strain diagram, proportional limit, elastic limit, upper yield point, lower yield point. Ultimate stress, braking stress, working stress, Factor of safety, selection of factor of safety.

3. Riveted joints: Types of riveted heads, failure of rivet joint. Types of riveted joints, lap joints, But joints, Strength of riveted joints, efficiency of a riveted joints, Chuckling and fullering , Design of lap joints and butt joints, Design of bolt joints, Eccentric loads on riveted joints.

4. Design of pin, cotter, knuckle and keyed joints, screw fastenings subjected to direct stress.

2ND HALF

1. Design of shafts, materials used in shafts, Design of shaft subjected to Twisting moment, Bending moment and combined twisting and bending moment,. Design of shaft on the basis of rigidity (Torsional rigidity and lateral rigidity) . Design of hollow shaft Different types of key. Flange Coupling (Protected and unprotected type). Flexible coupling,

2. Flywheel- Coefficient of fluctuation of speeds, fluctuation of energy, energy stored in flywheel. Stresses on flywheel ring, arms, Design of shafts, hub and Key. Design of flywheel.

References:

1. Shigley, J.E., *Mechanical Engineering Design, 5th* ed., McGraw-Hill, 1989.
2. Bhandari, V.B., "*Design of Machine element*" Tata McGraw-Hill
3. Bhandari, V.B., "*Introduction to Machine Design*" Tata McGraw-Hill
4. Khurmi, R.S., Gupta, J.K., " *A Text book of Machine Design*" S. Chand Publication.

BE/ME-503 FLUID MACHINERY

1ST HALF

1. **Introduction :** Classification- energy transfer between fluid and rotor- flow through machines- ideal and actual slip. Impact of jets

2. **Hydraulic Turbines :** Impulse type-Pelton wheel; Reaction type- Francis, Kaplan and Propeller; principle of operation- regulation and performance- draft tube.

2ND HALF

1. **Hydraulic Pumps:** radial, axial and mixed flow type- reciprocating and centrifugal pumps- performance studies- fluid coupling and torque converter.

2. **Compressors and Blowers:** Radial and axial flow type- reciprocating and centrifugal compressors- applications- characteristics.

References:

5. Bansal, S.K., "*Fluid Mechanics & Hydraulic Machines"* Laxmi Publications.
6. Cengel, Y.A., "*Fluid Mechanics: Fundamentals & Applications (SI Units)"* Tata McGraw-
   Hill Publications
7. Jain, A.K., "*Fluid Mechanics"* Khanna Publishers.
8. Rajput, R.K., "*Fluid mechanics & Hydraulic machines 2/E "* S. Chand Publications.
5. RamaDurgaiah, D., "Fluid Mechanics and Machinery", Eastern Book House.

BE/ME-504 MANUFACTURING TECHNOLOGY II

1ST HALF

1. Classification of metal removing processes and machines.

2. **Mechanics of Metal cutting** : Geometry of single point cutting tool and tool angles. Tool nomenclature in ASA, ORS and NRS And interrelationship. Mechanism of chip formation and types of chips, Chip breakers. Orthogonal and oblique cutting, cutting forces and power required, Theories of metal cutting. Thermal aspects of machining and measurement of chip tool interface temperature. Friction and metal cutting.

3. **Machinability** : Concept and evaluation of machinability, tool life, mechanisms of tool failure, Tool life and cutting parameters, machinability index, Factors affecting machinability.

4. **Cutting Fluid :** Types , Selection and application methods.

5. **General Purpose Machine Tools**: Constructional; details of lathe, drilling, milling, shaping and planning machines. Tooling, attachments and operations performed , selection of cutting parameters, Calculation of forces and time for machining. Broaching operation.

6. **Capstan and turret lathes** single and multiple spindle automates, operations planning and tool layout.

2ND HALF

1. **Abrasive Processes:** Abrasives natural and synthetic , manufacturing nomenclature. Selection of grinding wheels, Wheel mounting and dressing. Machines for surface and cylindrical grinding, their constructional details and processes.

2. **Surface Finishing** Honing Lapping and superfinishing, polishing and buffing processes.

3. Screw threads and gear manufacturing methods.

4. **Non- Conventional machining:** Benefits, general applications and survey of non-conventional machining processes. Mechanisms of metal removal, tooling and equipments, process parameters, surfacre finishing obtained, and specific application of EDM, LBM,EBM,ECM,USM,AJM processes.

References:

1. Jain R.K., *Production Technology*, Khanna Publishers, 2001
2. Hajra Choudhry, *Elements of Workshop Technology***,** Vol – II Dhanpat Rai & Sons, 1992.
3. *HMT Production Technology*, Tata Mc Graw-Hills Publishing Co. Limited, 1994.
4. Chapman, W.A.J., *Workshop Technology***,** Vol - II, Oxford & IBH Publishing Co. Ltd., 1986.

BE/ME-505 I.C ENGINE

1ST HALF

1. Basic types of engines, air standard cycle, fuel air cycles, actual cycles, losses in actual engine operation, MEP, thermal efficiency. Desirable characteristics of fuels for I.C. engines. Octane number, Cetane number, performance numbers. Properties of air-petrol mixtures.

2. Elementary carburetor, complete carburetor, petrol injection.

3. Diesel injection system, fuel pump, fuel injectors and nozzles.

4. Battery ignition system, Magneto injection system, Electronic ignition system using contract breaker, ignition system and spark advance.

2ND HALF

1. Theories of combustion in S.I and C.I. engine, methods of reduction of detonation and knock.

2. Combustion chamber types in S.I. and C.I. engine, Supercharging, Scavenging of I.C. engines, two stroke S.I and C.I. engines.

3. Lubrication of I.C. engines, properties of lubricating oils, lubricating systems, cooling of I.C engines, air and water cooling systems.

4. Fundamentals of free piston and rotary engines, performance and testing of I.C. engines, Pollutant emission- formation and control.

References:

1. Ganesan, V., "*Internal Combustion Engines", 2nd* ed., Tata McGraw-Hill, 2003.
2. Sharma, Mathur,. "*Internal Combustion Engines*", Dhanpat Rai & Sons.
3. Crouse, Anglin., "*Automotive Mechanics*" Tata McGraw-Hill
4. Kirpal Singh, *Automotive Engineering,* Vol. I & **II,** Standards Publishers, New Delhi, 2002.

BE/ME-506 KINEMATICS OF MACHINE

1ST HALF

1. **Machine and mechanism:** Definition, Mechanism and Machine, Link, Kinematic Pair, Degrees of freedom, Kinematic chain, Various types of joints, Degrees of freedom for plain Mechanism, Inversion, Different types of kinematic chain and their inversions.

2. **Velocity and acceleration in mechanism** Analysis of Reciprocating Engine mechanism and Four bar mechanism; Relative velocity method; Velocity and acceleration in Four bar, Slider crank Mechanism; Instantaneous center Method, Kennedy's Theorem, Mechanical Advantage, Corioli's Acceleration Component, Synthesis of Mechanism, Pantograph, Scott-Russel indicator diagram, Daris and Ackermenn steering mechanism, Hook'sjoint.

3. **Belt, Rope and Chain drive.**

2ND HALF

1. **Brakes and Dynamometers** Introduction, Types of Brakes (Simple Block, Band, Band &Block brake), Breaking of a Vehicle, Dynamometer, Absorption and transmission Dynamometer.
2. **Gears and Gear Train** Introduction, Gear classification and Terminology, Law of Gearing, Velocity of sliding, Forms of teeth, length of Arc & path of contact, Interference, Minimum number of teeth required to avoid interference, Types of Gear Train, Velocity ratio in different Gear train arrangement, Epicyclic Gear train, compound Epicyclic Gear train.
3. **Cams:** Introduction; Types of followers; Cam profile Nomenclature; various types of motion of the follower-Uniform motion, Simple Harmonic, Uniform Acceleration and Retardation, Cycloidal; Cam profile construction for various types of followers.

References:

1. Shigley, J.E., Vicker Jr., J.J., *Theory of Machines and Mechanisms*, McGraw-Hill, 1995.
2. Rao, J.S. and Dukkipati, R.Y., *Mechanism and Machine Theory, 2nd* ed., Wiley Eastern Ltd., 1995.
3. Rattan, S.S., "*Theory of Machine"* Tata McGrawHill Publications.
4. Khurmi, R.S., Gupta, J.K., "*Theory of Machine"* S. Chand.

BE/ME –507 Laboratory work based on syllabus of Metrology.
BE/ME- 508 Laboratory work based on syllabus of **ME-503**
BE/ME- 509 Laboratory work based on syllabus of **ME –504**
BE/ME- 510 Sessional work based on syllabus of **ME –502**
BE/ME -511 Laboratary work based on syllabus of **ME –505**

SIXTH SEMESTER

BE/ME-601 HEAT AND MASS TRANSFORMATION

1ST HALF

1. **Introduction :**Various methods of heat transfer, Fourier's, Newton's and Stefan Boltzman's Law. Combined modes of heat transfer, thermal diffusivity, overall heat transfer coefficient.

2. **Conduction :**The thermal conductivity of solids, liquids and gases, factor influencing conductivity, measurement. The general differential equation of conduction. One dimensional steady state conduction, linear heat flow through a plane and composite wall, tube and sphere, critical thickness of insulation. Effect of variable thermal conductivity. Conduction with heat sources, heat transfer from rods heated at one both ends. Heat transfer from fins of uniform cross-section. Errors of measurement of temperature in thermometer wells.

3. **Convection (Forced) :**Introduction, laminar boundary layer equations on a flat plate and in a tube, laminar forced convection on a flat plate and in a tube, simple Reynold's analogy. Dimensional analysis of forced convection, empirical relationship for forced convection.

4. **Convection (Natural) :**Dimensional analysis of natural convection; empirical relationship for natural convection. Convection with phase change. Description of condensing flow. A theoretical model of condensing flow. Boiling heat transfer, Empirical relationships for convection with phase change.

2ND HALF

1. **Heat Exchangers :**Different types of heat exchangers; Determination of heat exchanger performance, Heat exchanger transfer units, Analysis restricted to parallel and counter flow heat exchanger. Effectiveness, NTU.

2. **Thermal Radiation :**Introduction, absorption and reflection of radiant energy, Emission, Radiosity and irradiation, Black and non-black bodies, Krichoff's law; intensity of radiation, radiation exchange between black surface, geometric configuration factor, grey body relation exchange between surfaces of unit configuration factors. Grey body relation exchange between surfaces of unit configuration factors. Electrical analogy to simple problems. Non-luminous gas radiation. Errors in temperature measurement due to radiation.

3. **Introduction to Mass Transfer :** Mass and mole concentrations, molecular diffusion, eddy diffusion, Molecular diffusion from an evaporating fluid surface, Introduction to mass transfer in laminar and turbulent convection, Combined heat and mass transfer, the wet and dry bulb thermometer.

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 Tran5fe"r, 9th* ed., McGraw-Hill, 2004.
3. Ozisik, M.N., "*Heat Tran5fer - A Basic Approach"*, McGraw-Hill, 1985.
4. Cengel, Y.A., "*Heat Tran5fer - A Practical Approach"*, McGraw-Hill, 1998.
5. Rajput, R.K., "*Heat & Mass Transfer"* Khanna Publishers.

BE/ME-602 MACHINE DESIGN II

1ST HALF

1. **Fatigue consideration in design :** Variable load, Loading pattern. Endurance stresses; influence of size, surface finish notch sensitivity & stress concentration. Goodmann line, Soderberg line; Design of machine members subjected to combined steady & alternating stresses. Design of finite life.

2. **Design of gear tooth :** Lewis and Buckingham equations; wear and dynamic load consideration. Design and force analysis of spur, helical, bevel & warm gears. Bearing reactions due to gear tooth forces. Detailed design to the fixed ratio gear boxes.

2ND HALF

1. **Design sliding & journal bearing :** method of lubrication, hydrodynamic, hydrostatic, boundary etc. Minimum films thickness &thermal equilibrium.

2. **Design of various elements :** Design of fly wheels plate clutches, brakes, crank shafts, cam shaft & connecting rod. Design of helical springs. Design of crane hook, C-clamp, machine frame etc.

References:

5. Shigley, J.E., *Mechanical Engineering Design, 5th* ed., McGraw-Hill, 1989.
6. Bhandari, V.B., "*Design of Machine element*" Tata McGraw-Hill
7. Bhandari, V.B., "*Introduction to Machine Design*" Tata McGraw-Hill
8. Khurmi, R.S., Gupta, J.K., " *A Text book of Machine Design*" S. Chand Publication.

BE/ME-603 AUTOMOBILE ENGINEERING

1ST HALF

1. **The Automobile :** History of development, Automobile industries in India and abroad, testing of Automobiles; resistance to motion and power requirement for propulsion.

2. **Automobile Engines :** Requirement and classification, materials, constructional details and manufacturing processes of engine components. Exhaust manifolds- types, necessity, maintenance problem, materials used.

3. **Frame :** Layout of a chassis; types of chassis frames and bodies, their constructional features, loading points, testing of frames and materials.

4. **Transmission System :** Necessity of clutch in automobile, types of clutch, clutch material, clutch lining, fluid coupling, over running clutch, necessity and field application. Gear boxes, necessity of gear box, constructional details of sliding mesh, constant mesh, syncromesh and epicyclic gear boxes. Automatic transmission system; Hydraulic torque converter.

5. **Drive Line and Rear Axle :** Propeller shaft, universal joints, Rear axle drives, torque reactions, driving thrust , overdrive, Hotchkiss and torque tube drivers, rear axle types and construction, principle and types of differential.

6. **Wheels and tires :** Types, Tire construction, functions of tires, solid and pneumatic tires, tire inflation pressure, tire wear and their causes, repair of tire and tube.

2ND HALF

1. **Steering System :** Steering wheel and steering column, steering boxes, stering linkages, steering mechanisms, under and over steering, front axle, steering geometry, wheel balancing and center point steering, power steering.

2. **Suspension System :** Objects and requirements, types of suspension system, suspension spring, front and rear suspension system, independent suspension system, shock absorber.

3. **Brakes :** Necessity, theory of brake shoe, classification and function, self energizing brakes, lining materials, factors influencing operation of brakes such as operating temperature using area etc.

4. **Storage battery:** Charging, discharging and testing of battery, capacity and efficiency, method of charging from DC and AC mains.

5. **Starter Motor :** Battery motor starting system, series motor and its characteristics, consideration in selecting size of motor, types of drives, starting and generating circuits, solenoid switches, wiring diagram of typical wiring systems.

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,** Standards Publishers, New Delhi 2002
4. Crouse, Anglin., "*Automotive Mechanics*" Tata McGraw-Hill

BE/ME-604 MECHANICAL VIBRATION

1ST HALF

1. Undamped free vibration of single degree of freedom system, damped free vibration, forced vibration of single degree of freedom system, resouance, forced vibration with constant harmonic excitation, forced vibration with rotating and reciprocating unbalance.

2. Forced vibration with excitation of support, forced vibration with coulomb damping& viscous, damping. Determination of equivalent viscous damping from frequency-response curve. Vibration isolation and transmissibility.

2ND HALF

1. Two degrees of freedom system. Transverse vibration of shafts.

2. Critical speed of shaft.

3. Torsional vibration- Single rotor, two rotor, and three rotor system.

4. Forced torsional vibration with a geared system. Vibration measuring instruments-seiosmometer, accelerometer.

References:

1. Grover, G.K., "*Mechanical Vibrations"*

2. Rattan, S.S., "*Theory of Machine"* Tata McGrawHill Publications.

3. Khurmi, R.S., Gupta, J.K., "*Theory of Machine"* S. Chand.

4. Rao, J.S. and Gupta, K., *Introductory Course on Theory and Practice of Mechanical Vibration,* New Age International Pvt. Ltd., 1984.

5. Thomson, W.T., *Theory of Vibration with Applications,* CBS publishers, New Delhi, 1990.

BE/ME-605 OPERATION RESEARCH

1ST HALF

1. **Introduction to Operations Research :** Basics of operation research-development of OR, definition of OR, characteristics of OR, scientific method of OR, necessity of OR in industry, scope of OR, OR & decision making, phases of OR, types of OR models, types of mathematical OR models, construction of OR models, approximation of OR models, difficulties of OR, limitations of OR.

2. **Linear programming**: Linear programming models, assumptions of L.P problem formulation (LP),graphical methods for two variables L.P. problems, simplex method of solving L.P. problems, elementary concepts of duality theory, sensitivity analysis of L.P. problems, limitation of L.P. problem, advantages of L.P. problems.

3. **Integer Programming :** Transportation model-example on the application of transportation model, introduction of transportation model, formulation & solution of transportation models. Unbalance in transportation, sensitivity analysis in transportation problem.

2ND HALF

1. **Dynamic programming :** Bellman's principle of optimality, examples on the application of routing problem, inventory problem, simplex problem, marketing problem.

2. **Assignment models**: example on the application of assignment of assignment model, matrix technology, definition of assignment model, comparison with transportation problem, mathematical representation of assignment model, formulation & solution of assignment model.

3. **Integer programming**: branch & bound techniques, traveling salesman problem, introduction to queuing theory, single & multi server waiting line models, theory of games, two persons zero sum games, mini-max & maximum strategies, saddle points, solution method for games.

BE/ME-606 MECHANICAL MEASUREMENT

1ST HALF

1. Introduction : Introduction to measurement and measuring instruments, Generalised measuring system and functional elements, units of measurement,

Static and dynamic performance characteristics of measurement devices, Calibration , concept of error, sources of error, statistical analysis of errors.

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

3. Measurement of displacement and angular velocity

4. **Measurement of pressure :** Gravitational, Directing acting, elastic and indirect type pressure transducers, Measurement of very low pressure.

5. **Strain Measurement :** Types of strain gauges and their working, strain gauge circuits , Temperature compensation, Strain rosettes

2ND HALF

1. **Temperature Measurement:** By thermometers, bimetallic, Thermocouples, thermistors and pyrometers.

2. **Measurement of Flow :** Obstruction meters, Variable head meters, Hot wire and magnetic meters, Ultrasonic flow meters etc.

3. **Vibration and Noise measurement :** Seismic Instruments, Vibration pick ups and decibel meters .

4. **Data acquisition system :** Introduction to data acquisition systems, single and multi channel systems , Microprocessors and PC based data acquisition systems. Input output devices Signal transmission and processing: devices and systems.

BE/ME-607 Laboratory work based on manufacturing processes

BE/ME-608 Laboratory work based on syllabus of **ME-602**

BE/ME-609 Laboratory work based on syllabus of **ME-603**

BE/ME-610 Laboratory work based on syllabus of Refrigeration & Air condition.

BE/ME-611 Laboratory work based on syllabus of Mechanical Measurement.

SEVENTH SEMESTER

BE/ME-701 THERMAL POWER-I

IST HALF

GENERATORS

1. Combustion equipment for burning coal, fuel bed combustion, mechanical strokers, pulverized coal firing system-its advantages & disadvantages-burners & furnaces. Fluidized bed combustion.

2. Boiler-mounting & accessories, fire tube boilers, water tube boilers-La Mont boiler, Loeffler boiler-Benson Boiler. Drum internals, steam drum separation, water wall, air preheater, economizer, super-heater & electrostatic precipitators, steam generator, losses & heat balance.

3. Principle of circulation-natural forced circulation, drafts-natural, forced, induced & balanced drafts, pressurized fluidized bed boiler. Flow through nozzle, nozzle shape, critical pressure ratio, maximum flow, effect of friction in nozzle flow under-expansion & over-expansion in nozzle, super saturated flow through nozzle.

2ND HALF

STEAM TURBINE

1. Principles of action of turbines, classification. Flow through impulse turbine blading, velocity diagram, blade efficiency, optimum velocity ratio, multistage & its advantages, velocity compounded impulse, reheat factor, internal efficiency. State point locus.

2. Flow through reaction turbine blading, velocity diagram, degree of reaction, blade work, blade height. Stage efficiency, optimum velocity ratio, axial thrust in reaction turbine, number of parallel exhausts.

3. Back pressure turbines, pass-out turbines, mixed-press turbine. Losses in turbines, principles of turbine governing.

BE/ME-702 COMPUTER AIDED DESIGN

1ST HALF

1. Computer graphics hardware- interactive input and output devices, graphics software, output primitives and their attributes, line drawing and ellipse generating algorithms, interactive picture generation techniques,

2. 2D geometric transformations, window, viewport and clipping,

3. 3D display methods, 3D object representation- Bezier curves and splines,

4. 3D geometric and modeling transformations, 3D viewing, wire frame, surface and solid modeling, kinematic analysis of open and closed loop mechanisms.

2ND HALF

1. Purpose application of optimum design, formulation and classification of optimization problems, linear programming- simplex method, one dimensional minimization based on elimination and interpolation, unconstrained optimization-direct search and descent methods, constrained optimization-penalty function method

2. Introduction to geometric, dynamic, integer and quadratic programming, computer aided optimum design of machine elements like gears, bearings, shafts and springs.

BE/ME-703 DYNAMICS OF MACHINE

1ST HALF

1. **Inertia Force Analysis In Reciprocating Parts :** Introduction , D-Alembert's principle, Velocity and Acceleration of the piston- Analytical & graphical, Torque in the crankshaft neglecting inertia and friction; Various forces acting on the reciprocating part considering friction and inertia but neglecting weight of the connecting rod , Correction couple ,Dynamically Equivalent system , Torque on crankshaft considering weight of connecting rod .

2. **Gyroscope:** Principle of gyroscope couple; Effect of gyroscope couple and centrifugal force on vehicle taking a turn ; Stabilization of sea vessels .

2ND HALF

1. **Turning Moment Diagram and Flywheel:-** Turning moment diagram for different types of Engines Fluctuation of energy and speed ;Flywheel; Flywheel Rim dimensions ; Operation of flywheel in punching press .

2. **Governor:** Simple functioning of a Governor, porter, Proell, Hartnell and spring controlled , governor effect ,Power stability ; Inertia effects .

3. **Balancing:** Balancing of rotating masses in the same and different planes ; Static & Dynamic balancing ; Balancing of masses; Sawing couple ; Hammer blow , tractive force , Primary and secondary balancing of a Locomotive and Internal combustion Engine; Balancing of V-Engines ; Balancing machines .

BE/ME-704 PRODUCTION ENGINEERING-I

1ST HALF

1. **Manufacturing costs**- Types of costs, Break even charts-Economic Batch Quantity, Economics of metal removal, economics of material utilization, estimating standard times.

2. .**Ergonomics**- Principles of Motion Economic related to the work place-Motion economic related to the design of tools & equipments.

3. **Jigs & Fixtures**-differences between a jig & fixtures-uses-principles of jigs & fixture designs-principles of location-principles of clamping-method of location-design features of jigs & fixtures, welding fixture ,design study principles of jig & fixtures. Design study for milling & broaching fixture.

4. **Machine tools used for quality production**-semi automatic multi-tool center lathes, auto lathes, turret type single spindle automatics, sliding head type head single spindle automatics, multi spindle automatics, internal broaching, external broaching, centreless grinding, internal centerless grinding.

5. **Moulding processes using metal moulds**-permanent mould, or gravity die casting, pressure die casting, centrifugal casting, continuous casting, principles & application of metal moulding process.

2ND HALF

1. **Special machining process**-electrical machining-electro discharge machining, electrochemical machining, electrochemical grinding, abrasive jet machining, ultrasonic machining, electron beam machining, plasma arc machining, high energy rate forming, hot machining, electro hydraulic forming, chemical forming, magnetic pulse forming, ion beam machining & high velocity forming.

2. **Metal casting principles & practice**- sand moulding processes, moulding processes using metal moulds, gating-rise ring & casting designs.

3. Cutting tool materials, surface treatment metals, surface finishing processes, cutting fluids, qualities of good cutting fluids, classification of cutting fluids.

4. Installation, foundation& alignment testing of machine tools, principles of foundation, factors to be considered for machine foundation, leveling& alignment of machine tool.

5. .Lubricants & Lubrication, maintenance of machine tools, acting lubrication, requirement of lubrications, selection of lubricants, maintenance of production facilities.

BE/ME-705 ELECTIVE-I (either of the two)

PRINCIPLES OF ENGINEERING TRIBOLOGY

1. Engineering Surfaces; Properties and Measurement, Surface Contact
2. Adhesion, Friction, Wear
3. Thermal Considerations in Sliding Contact
4. Surface Engineering
5. Liquid Lubricants: Properties and Measurement
6. Basic Equations for Fluid Film Lubrication, Hydrodynamic Thrust Bearings,

   Hydrodynamic Journal Bearing, Hydrodynamic Squeeze Film Bearings, Hydrostatic

   Bearings, Gas-Lubricated Bearings, Elastohydrodynamic Lubrication
7. Rolling Element Bearings
8. Boundary Lubrication

SPECIAL CASTING TECHNIUES AND WELDING ENGINEERING.

IST HALF

Introduction to special casting techniques

1. **Shell moulding:** Shell moulding, Process, Shell moulding machines, Pattern equipments, sands, resins and other materials used in shell moulding, application of shell moulding, advantages of shell moulding over other method.
2. **Centrifugal Casting :** Principle, types of centrifugal casting processes, calculation of mould rotary speed, techniques, equipment used and production processes, advantages and limitations of centrifugal casting methods.

3. **Investment Casting :** Introduction, pattern and mould material used, techniques and production of investment moulds and castings, application of investment casting processes, advantages and limitations.
4. **Die Casting :** Die casting processes, die casting machines, operations and details, die materials, metals cast by die casting methods, advantages and limitations of die casting.
5. **Recent Developments :** Low pressure die casting, squeeze casting, Rheocasting, V process, high pressure moulding

2ND HALF

1. **Weliding Processes 1 -** Gas welding, Manual, submerged arc, TIG, MIG welding plasma arc. Electroslag. Electro gas welding Pressure welding processes - cold and hot pressure welding. Resistance, Friction and explosive welding. Plastic and ceramic welding.
2. **Welding Processes 2** Radiant energy and solid phase welding processes and equipment - Beam power control. Laser beam cutting, under water welding. Diffusion welding.
3. **Allied Processes** Brazing, Soldering, Cutting, Surfacing Methods - Need, Flame Spraying. Plasma Spraying.
4. **Welding metallurgy** - weld thermal cycles and their effects - structural changes in different materials, effect of pre and post heat treatment. Weldability,
5. **Testing And Design of Weldment -** Design and quality control of welds. Edge preparation-types of joints, weld symbols. Stresses in butt and fillet welds - weld size calculations. Design for fatigue. Testing - tensile, bend hardness. Impact, notch and fatigue tests. Visual examination - liquid penetration test, magnetic particle examination. Radio graphs, ultrasonic testing. Life assessment of weldments.

BE/ME-706 Sessional work based on the syllabus of ME- 702

BE/ME-707 Laboratory work based on the syllabus of ME- 601

BE/ME-708 Sessional work based on the syllabus of ME- 705

BE/ME-709 laboratory work based on the syllabus of ME- 703

BE/ME-710 Project & Thesis - I

BE/GP – 2 PROFESSIONAL SKILL DEVELOPMENT- I

- Filling up of Curricula Vitae.
- Response to a Job advertisement.
- Joining Report in a Profession.
- Report writing on issues related to your profession such as – Improvement of work culture, Improvement of Relationship with your Collogues, submission of a sum-up of annual Report, Maintaining of Environment Friendly atmosphere in the office, Basic amenities requirement to run a good Organization / Office.

- ❖ Basic requirements of Management / Managerial Jobs.
- ❖ Notice Inviting Tenders, Issuance of Supply Orders, Memo, Complaint Letter, Invitation, Notifications etc.
- ❖ Oral Communicative Skill Practice.
- ❖ Mock Interview.

EIGHTH SEMESTER

BE/ME-801 THERMAL POWER II

1ST HALF

COMPRESSORS & GAS TURBINES

1. Adiabatic flow, Rayleigh line & pressure ratio, temperature ratio, heat added to the system. Adiabatic flow friction factor, Fannoline, normal shock & oblique shock.

2. **Principle of Rotating Machines**: General Equation for Rotating mechanism, classification of machines, general thermo-dynamic energy analysis, Rotary compressors, differences between rotary & reciprocating compressors. Root blowers, vane blowers, centrifugal compressors, slip, pre-wheel surging & chocking, stalling.

3. **Axial flow compressors:** Aerofoil theory, principle of operating, introduction to Aerofoil theory, overall isentropic efficiency, polytropic efficiency in terms of pressure ratio, temperature ratio,& specific heat ratio. Flow co-efficient, pressure co-efficient, work co-efficient.

4. **Jet propulsion**: Ramjet engine, Pulse-jet engine, Turbo-jet engine, Turboprop engine, Thrust equation, Ram efficiency, Thermal efficiency of turbo-jet engine, Propulsion efficiency, Overall efficiency of a propulsive system. Introduction to rocket propulsion. Performance, difference of the Air breathing engine & Rocket engine, Rocket propellant.

5. Concepts of MHD power plant, solar energy power plant. Fundamentals of power plant economic- load factor, utilization factor.

6. Investment cost, fixed & annual operating cost, unit cost, tariff, selection & location of plants.

2ND HALF

GAS TURBINE:

1. Air Standard Brayton cycle, Actual Brayton cycle, Air rate, Work Ratio Means of improving the efficiency & the specific output.

2. Open cycle gas turbine with Reheat & Regeneration. Open cycle gas turbine with intercooling, reheat & regeneration, Effect of intercooling to reheat & regeneration on efficiency, Effect of operating variable on thermal efficiency on Air Rate & on Work Ratio.

3. Closed cycle gas turbine, Advantages of closed cycle gas turbine over the open cycle gas turbine. Advantages & disadvantages of gas turbine over steam turbine power plants.

4. Axial flow turbines, velocity diagram, blade loss, static head efficiency, total head efficiency, degree of reaction. Selection of blade materials.

BE/ME-802 ROBOTICS & NUMERICAL CONTROL OF MACHINE TOOLS

1ST HALF

I. Robotics

1. Industrial robots and their applications for transformational and handling activities. Configurations and motions. Actuators, sensors and end effectors. Features like work envelop, precision of movements, weight carrying capacity, Robot programming languages.

2. Vision systems, Introduction to intelligent robots.

2ND HALF

II. Numeric control

1. Introduction to numerical control, components, axes of NC machine tools, open and closed loop control, actuation and feed back systems. Point to point, linear and contouring systems. Tooling for NC systems. Steps in NC manufacturing. Machining and turning centers and their features. ATC and APC.

2. NC programming: Input media and coding formats, manual part programming for lathe, drilling and milling machines, cutter diameter and length compensation. Computer assisted part programming languages APT, EXPAT, ADAPT, COMPACT.CAD/CAM approach of programming.

3. Computer numerical control, direct and distributed numerical control, adaptive control.

BE/ME-803 INDUSTRIAL ENGINEERING & MANAGEMENT

1ST HALF

1. **Evaluation of work study :** Work of F.W. Taylor; Frank and Lillian Gilbreth and others; productivity definitions; means of increasing productivity; work study definitions; Productivity and work study; human factor in the application of work study.

2. **Motion Study:** Definition; aims; procedure for method study; selection of jobs; recording techniques; micromotion study; therbligs; Cyclograph and Chrono-cyclograph; Principles of motion economy; Design of work place layout; Analysis in the form of a chart; operation chart; flow process chart; flow diagrams; String diagram; Man machine chart; two hand chart; Simo chart.

3. **Work Measurement(Time Study) :** Definition; uses; procedure; time study equipment; Performance rating; allowances; number of cycles to be studied; determination of standard time; Predetermined motion time systems.

2ND HALF

1. **Job Evaluation :** Job evaluation; objectives of job evaluation; methods; non quantitative and quantitative methods.

2. **Wages and incentives :** Characteristics of a good wage or incentive system, methods of wage payment, concept of wage incentive scheme; financial and non financial; Halsely premium plan; Merick's multiple piece rate system.

3. **Concept of new technique:** Shedulling through network C.P.M and P.E.R.T; use of linear programming methods to solve product + mix problems.

4. **Value Engineering:** Concept of value, product life cycle, value engineering approaches, job plan, value tests.

BE/ME-804 PRODUCTION ENGINEERING-II

1ST HALF

1. Manufacturing science & its application to mass production. Machining allowances, machining accuracy, surface finish.

2. Different mass production techniques-both chip forming & non chip forming- their advantages & disadvantages.

3. Recent advances in manufacturing technology-Non-conventional machining processes, Mechanisation & automation of manufacturing & assembly lines.

4. Machining & tooling for mass production-Jigs & Fixtures design. Locating, clamping, guiding, indexing devices. Hydropneumatic devices. Tooling economics.

5. Automated Machine Tools, Numerically controlled machines, CNC machines, their construction, components & operation, part programming for CNC machines. Advantages & disadvantages of CNC machines.

6. Manufacture of typical machine parts, e.g. screw threads, gears, housing. machine beds, engine components.

2ND HALF

1. Product Development & Design, Production Design-productibility consideration of product & components, value engineering process planning, group technology.

2. Manufacturing Costs, Break-Even Analysis, Economic Batch Quality, Economics of Metal Removal, Economics of material utilization.

3. Production Planning & Control, sequencing & scheduling, processing of "n" jobs through two machines, processing of "n" jobs through three machines, processing of two jobs through "n" machines, Assignment Models.

4. 10.Assembly line balancing Theory, Ranked positional weight technique of Assembly line Balancing. Computerized method of sequencing operations for Assembly lines(COMSOAL).

BE/ME-805 ELECTIVE II (Either of the Two)

HYDRAULIC CONTROL

Introduction to fluid power : Advantages of fluid power system, properties of hydraulic fluids, selection of hydraulic fluids, hydraulic symbols.

Pumps and Rotors : Characteristics and selection of hydraulic pumps and motors, fixed and variable displacement operation, calculation of flow, torque and power, hydrostatic transmission system.

Elements of hydraulic systems : Hydraulic pumps, cylinders, and motors - Construction, sizing, and selection.Control valves; pressure, flow, and direction - Servo-valves.

Accessories of hydraulic systems : Design of hydraulic power packs, pipes of main and return lines, pipe fittings, calculation involving the use of accumulators, intensifiers, selection and application of seal and pickings. Hydro mechanical servo systems, proportional valves, applications for hydraulic servo systems, maintenance of hydraulic systems.

Sequential circuit design : Sequencing module, fringe condition module, cascade method, step counter method.

Typical industrial applications of oil hydraulics ; Hydraulic circuits for deceleration, regenerative circuits, differential circuits, feed circuit design, selection of elements, sizing of pipes, design of power packs.

Design of hydraulic circuits : Total design of a hydraulic circuit for linear drive applications in a SPM-specification of the circuit, circuit design, selection of elements, sizing of pipes, design of power packs.

Design of electrical sequencing circuits: Ladder diagrams, introduction to the use of PLCs for sequence control in hydraulic circuits.

References:

1. Esposito. A., *Fluid Power with Applications, 5th* ed., Pearson Education, 2003.
2. *Industrial Hydraulics,* Vickers - Sperry Manual, 2002.

RENEWABLE ENERGY

Solar energy - Solar radiation - Heat transfer equations.
Solar thermal energy conversion - Efficiencies - Solar photo Voltaic energy.
Bio energy - Conversion - bio degradation - Biogas generation - Fuel properties - Biomass gasifier.
Wind energy - Data and energy estimation, Conversion - Wind mill - Performance, applications Geothermal.
Tidal energy - Magneto hydrodynamic - Thermionic - Fuel cell.

References:

1. Sukhatme, S.P., *Solar Energy: Principle of Thermal Collection and Storage, 2nd* ed.,Tata McGraw Hill, 2000.
2. Rao, S. and Parulekar, R.B., *Energy Technology - Nonconventional, Renewable and Conventional,* Khanna Publishers, 1995.
3. Rai, G.D., *Nonconventional Energy Sources,* Khanna Publishers, 1999.
4. Le Gourieres, D., *Wind Power Plant - Theory and Design,* Pergaman Press, 1982.

BE/ME-806 Sessional work based on the syllabus of **ME 802**
BE/ME-807 Sessional work based on the syllabus of **ME 805**
BE/ME-808 laboratory work based on the syllabus of **ME 801**
BE/ME-809 Project & Thesis - II
BE/ME-810 Grand Viva Voce

BE/GP-3 PROFESSIONAL SKILL DEVELOPMENT- II

- Group Discussion
- SEMINERS (Power Point Presentation)
- Extempore Speech Practice
- Details of Future Profession of the Student Concerned – to be prepared / presented in the practice shop.
- General aptitude Test.