Scheme of Instruction and Evaluation

4-YEAR B.TECH. DEGREE PROGRAMME IN MECHANICAL ENGINEERING

2ND YEAR I SEMESTER

Course Number	Course	Periods of Instruction per week			Scheme of Evaluation			Total Marks
					External Evaluation		Sessionals	
		Lectures	Tutorials	Drawing/ Practicals	Duration of Exam	Max Marks	Max Marks	
MH 211	Mathematics-II	3	1	-	3 hrs.	100	50	150
ME 212	Mechanics of Solids - I	3	1	-	3 hrs.	100	50	150
ME 213	Materials Science and Engineering	3	1	-	3 hrs.	100	50	150
ME 214	Manufacturing Processes	3	1	-	3 hrs.	100	50	150
EI 2111	Elements of Electronics Engineering	3	1	-	3 hrs.	100	50	150
ME 215	Machine Drawing	-	-	6	3 hrs.	100	50	150
ME 216	Materials Science and Testing Lab	-	-	3	3 hrs	50	25	75
ME 217	Manufacturing Processes Lab	-	-	3	3 hrs	50	25	75
		15	5	12				1050

Scheme of Instruction and Evaluation

4-YEAR B.TECH. DEGREE PROGRAMME IN MECHANICAL ENGINEERING

2ND YEAR II SEMESTER

Course Number	Course	Periods of Instruction per week			Scheme of Evaluation			Total Marks
					External Evaluation		Sessionals	
		Lectures	Tutorials	Drawing/ Practicals	Duration of Exam	Max Marks	Max Marks	
MH 221	Mathematics-III	3	1	-	3 hrs.	100	50	150
ME 222	Engineering Metallurgy	3	1	-	3 hrs.	100	50	150
ME 223	Machine Tools	3	1	-	3 hrs.	100	50	150
ME 224	Mechanics of Solids -II	3	1	-	3 hrs.	100	50	150
ME 225	Engineering Thermodynamics	3	1	-	3 hrs	100	50	150
EE 227	Elements of Electrical Engineering	3	1	-	3 hrs	100	50	150
ME 226	Engineering Metallurgy Lab	-	-	3	3 hrs	50	25	75
EE 228	Electrical & Electronics Engg. Lab	-	-	3	3 hrs	50	25	75
		18	6	6				1050

Scheme of Instruction and Evaluation

4-YEAR B.TECH. DEGREE PROGRAMME IN MECHANICAL ENGINEERING

3RD YEAR I SEMESTER

Course Number	Course	Periods of Instruction per week			Scheme of Evaluation			Total Marks
					External Evaluation		Sessionals	
		Lectures	Tutorials	Drawing/ Practicals	Duration of Exam	Max Marks	Max Marks	
MH 311	Management, Economics and Accountancy	3	1	-	3 hrs.	100	50	150
ME 312	Internal Combustion Engines	3	1	-	3 hrs.	100	50	150
ME 313	Kinematics of Machinery	3	-	2	3 hrs.	100	50	150
ME 314	Applied Thermodynamics	3	1	-	3 hrs.	100	50	150
ME 315	Design of Machine Elements-I	3	1	-	3 hrs	100	50	150
ME 316	Measurement and Metrology	3	1	-	3 hrs	100	50	150
ME 317	Internal Combustion Engines Lab	-	-	3	3 hrs	50	25	75
ME 318	Machine Tools and Metrology Lab	-	-	3	3 hrs	50	25	75
		18	5	8				1050

Scheme of Instruction and Evaluation

4-YEAR B.TECH. DEGREE PROGRAMME IN MECHANICAL ENGINEERING

3RD YEAR II SEMESTER

Course Number	Course	Periods of Instruction per week			Scheme of Evaluation			Total Marks
					External Evaluation		Sessionals	
		Lectures	Tutorials	Drawing/ Practicals	Duration of Exam	Max Marks	Max Marks	
OE 321	Open Elective	3	-	-	3 hrs.	100	50	150
ME 321	Design of Machine Elements-II	3	1	-	3 hrs.	100	50	150
CE 329	Mechanics of Fluids & Fluid Machinery	3	1	-	3 hrs.	100	50	150
ME 322	Dynamics of Machinery	3	1	-	3 hrs.	100	50	150
ME 323	Heat Transfer	3	1	-	3 hrs.	100	50	150
ME 324	Production Management	3	1	-	3 hrs	100	50	150
ME 325	Heat Transfer Lab	-	-	3	3 hrs	50	25	75
ME 326	Fluids & Dynamics of Machinery Lab	-	-	3	3 hrs	50	25	75
		18	5	6				1050

OE 321-Open Elective:

OE 321 A Entrepreneurship Development
OE 321 B Operations Research
OE 321 C Management Information Systems
OE 321 D Forex and Foreign Trade
OE 321 E Materials Engineering

Scheme of Instruction and Evaluation

4-YEAR B.TECH. DEGREE PROGRAMME IN MECHANICAL ENGINEERING

4TH YEAR I SEMESTER

Course Number	Course	Periods of Instruction per week			Scheme of Evaluation			Total Marks
					External Evaluation		Sessionals	
		Lectures	Tutorials	Drawing/ Practicals	Duration of Exam	Max Marks	Max Marks	
ME 411	Finite Element Methods	3	1	-	3 hrs.	100	50	150
ME 412	Refrigeration and Air-Conditioning	3	1	-	3 hrs.	100	50	150
ME 413	Metal Cutting Science	3	1	-	3 hrs.	100	50	150
ME 414	Mechatronics	3	1	-	3 hrs.	100	50	150
ME 415	Industrial Engineering	3	1	-	3 hrs	100	50	150
ME 416	Refrigeration, Air-conditioning and Fuels Lab	-	-	3	3 hrs	50	25	75
ME 417	Metal Cutting and Mechatronics Lab	-	-	3	3 hrs	50	25	75
ME 4PW	Project Work	-		3	-	-	50*	50
		15	5	9				950

* Based on Report and Seminar

Scheme of Instruction and Evaluation

4-YEAR B.TECH. DEGREE PROGRAMME IN MECHANICAL ENGINEERING

4TH YEAR II SEMESTER

Course Number	Course	Periods of Instruction per week			Scheme of Evaluation			Total Marks
					External Evaluation		Sessionals	
		Lectures	Tutorials	Drawing/ Practicals	Duration of Exam	Max Marks	Max Marks	
ME 420	Computer Integrated Manufacturing	3	-	-	3 hrs.	100	50	150
ME 421	Computer Aided Design &Graphics	3	-	-	3 hrs.	100	50	150
ME 422	Professional Elective	3	-	-	3 hrs.	100	50	150
ME 423	Energy Engineering & Management	3	-	-	3 hrs.	100	50	150
ME 424	CAD / CAM Lab.	-	-	3	3 hrs	50	25	75
ME 4PW	Project Work	-	-	8	-	100	150*	250
		12	-	11				925

* Based on Report, Seminar and viva-voce.

ME 422 Professional Elective

ME 422 A Flexible Manufacturing Systems
ME 422 B Total Quality Management
ME 422 C Turbo Machinery
ME 422 D Non-conventional Energy Sources
ME 422 E Fault Diagnosis of Machines
ME 422 F Robotics

MH 211 MATHEMATICS-II

Class: **II/IV B.Tech. I Semester** *Lectures:* **3,** *Tutorial:***1**
*Branch:*Common to **Mech,Civil,E&I, EEE,CSE,IT,ECE** *University Examination:***100 marks**
Duration of University Examination: **3 hours** *Sessionals:* **50 marks**

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UNIT I

1. **Complex Integration:** Line integration in complex plane, Cauchy's integral Theorem, Cauchy's integral formula. Series expansion of complex functions: Taylor's series and Laurent's series, Zeros and singularities. Residues- Residue Theorem- evaluation of real integrals using Residue Theorem (contours of the type semi circle and circle only) **8 +3**

UNIT II

2. **Laplace Transforms:** Laplace transform-Inverse Transform-Properties of Laplace Transforms- Laplace Transform of unit step function, impulse function, and periodic functions- Convolution theorem, Solution of ordinary differential equations with constant coefficients and system of ordinary differential equations with constant coefficients using Laplace Transforms. **8+3**

UNIT III

3. **Fourier Series:** Expansion of a function as Fourier series for a given range- Fourier series of even and odd functions- Half range cosine and sine series expansions. **8+3**

UNIT IV

4. **Partial Differential Equations:** Solution of wave equation, Heat flow equation, and Laplace equation by the method of separation of variables and problems of vibrating string, One dimensional unsteady heat flow, two dimensional steady state heat flow(Problems based on Fourier-Trigonometric series only) **12+3**

TEXT BOOK:

1. B.S.Grewal, *Higher Engineering Mathematics,* Khanna Publishers,New Delhi.

REFERENCE BOOKS:

1. R.V.Churchill, *Complex Variables and its Applications,* McGraw-Hill, New York.
2. M.K.Venkataraman, *Engineering Mathematics, Vol.III,* National Publishing Co., Madras.
3. E.Kreyszig, *Advanced Engineering Mathematics,* Wiley Eastern Ltd., New Delhi.

ME 212 MECHANICS OF SOLIDS-I

Class: **II/IV B.Tech. I Semester** *Lectures:***3,** *Tutorials:***1**
Branch: **Mechanical** *University Examination:***100 marks**
Duration of University Examination: **3 hours** *Sessionals:* **50 marks**

UNIT-I

1. **Simple Stress and Strain:** Types of Loads, Definition of Stress, Strain, Types of stresses, strains, Stress Tensor, Strain tensor, stress strain diagrams for ductile and brittle materials, Generalized Hooke's law, relation between elastic constants, Compound bars, Thermal stresses & strains. **5+0**
2. **Shear Force and Bending Moment:** Types of supports, types of determinate beams-simply supported, cantilever and overhang beams. Shear force and bending moment diagrams, principle of superposition. **4+3**

UNIT-II

3. **Theory of Simple Bending:** Assumption, flexure formula, bending stresses in beams, discussion of efficiency of various cross -sections. **2+2**
4. **Deflections of Beams:** Double integration method, Macaulay's method and moment area method, slope and deflection for statically determinate beams. **5+3**

UNIT-III

5. **Shear Stresses in Beams:** Flexural shear stress distribution in various shapes of cross sections of beams. **3+1**
6. **Torsion of Circular Shafts:** Theory of pure torsion in solid and hollow circular shafts, torsional shear stresses and angle of twist, transmission of power., compound shafts, torsion of tapered shafts. **3+1**
7. **Column And Struts :** Column and strut, Types of columns, end conditions, Euler's column Theory, different cases in Euler's Theory, Limitations of Euler's Theory, Rankine's formula. **3+1**

UNIT-IV

8. **Thin And Thick Cylinders :** Cylindrical shells, distinguish between Thin cylinders and cylinders , circumferential stresses, Longitudinal stresses ,Radial stresses ,Thin cylinders subjected to internal pressure , Thin spherical shells. Thick cylinders , Lame's Theory for thick cylinder , stresses in compound thick cylinders. **4+2**
9. **Strain Theory :** Strain Energy, Resistance , proof Resistance Modulus of Resistance strain energy due to gradually applied load, strain energy due to suddenly applied load , impact loading ,impact factor, strain energy due to freely falling weight , strain energy due to shear ,strain energy due to torsion ,strain energy due to bending. **4+2**

TEXT BOOK:

1. E.P.Popov, *Engineering Mechanics of Solids,* Pearson Education, New Delhi, .
2. S.P.Timoshenko, J.M.Gere, " *Mechanics Of Materials",* CBS Publishers, New Delhi.

REFERENCE BOOKS:

1. F.P.Beer and E.R.Johnston,Jr., *Mechanics of Materials,* 2/e, McGraw-Hill,1992.
2. I.H.Shames and J.M.Pitarrew, *Introduction to Solid Mechanics*,3/e, , Prentice-Hall of India, New Delhi, 2000.

3. W.F.Riley and L.W. Zachary, *Introduction to Mechanics of Materials*, John Wiley & Sons, New York, 1989.
4. S.Ramamrutham, *Strength of Materials*, Dhanpat Rai & Co. , New Delhi.

ME 213 MATERIALS SCIENCE AND ENGINEERING

Class: **II/IV B.Tech. I Semester**. *Lectures:***3,***Tutorials:***1**
Branch: **Mechanical** *University Examination:* **100 marks**
Duration of University Examination: **3 hours** Sessionals: **50 Marks**

UNIT-I

1. **Introduction to Material Science -** Historical perspective, classification of materials, advanced materials, atomic structure and interatomic bonding, Influence on properties of materials, structures of crystalline solids, crystal structures, crystallography, planes and directions, polymorphism and allotropy. Determination of crystal structures by X-ray diffraction methods, non-crystalline solids. **4+1**

2. **Properties of Materials and Testing -** Tension test, Compression Test, hardness tests - Brinnells, Vickers, Rockwell, Superficial hardness test and micro hardness testing. Impact testing, creep test, fatigue test and fracture of materials and testing. **5+2**

UNIT-II

3. **Solidification Process and Imperfections in Solids -** point, line, surface and volume defects, grain-size determination, role of dislocations in strengthening materials, various mechanisms of strengthening, deformation behaviors of materials, elastic deformation, plastic deformation, and time dependent deformation processes, failure of materials, Fracture, fatigue and creep concepts and their significance. **5+2**
4. **Constitution of Alloys -** Diffusion processes and their mechanisms, factors influencing diffusion and diffusion paths, phase diagrams, construction and interpretation, Isomorphous and eutectic systems, iron-carbon equilibrium diagrams, Gibb's phase rule and its application. **4+1**

UNIT-III

5. **Polymer and Ceramic Materials -** Characteristics, applications and processing of polymers, mechanical and thermo-mechanical characteristics, polymer applications and processing, Ceramic materials and their structure, application and processing of ceramics, glasses, clay products, refractories and abrasives, composite materials, introduction to particle reinforced, fiber reinforced composites, structural composites. **5+1**
6. **Electrical and Magnetic properties** - Electrical Conduction, Semi conductivity, Introduction to semiconductor devices, dielectric behavior and types of polarization, dielectric strength, dielectric materials, Ferro electricity and piezoelectricity. Magnetic properties of materials, dia, para and ferromagnetism, anti-ferromagnetism and Ferromagnetism, Magnetic hysteresis, soft and hard magnetic materials, magnetic storage and super conductivity. **4+2**

UNIT-IV

7. **Optical and thermal properties -** Basic concepts - electromagnetic radiation, refraction, reflection, absorption, transmission, colour, opacity and translucence application of optical phenomena, luminescence, and photo-conductivity, lasers, optical fibers in communication. Thermal conductivity, thermal expansion and thermal stresses **4+1**
8. **Material Selection and Applications -** Materials selection and design considerations such as economic, environmental and service considerations for shafts, springs, bio-medical and Tribological applications, Thermal protection systems, requirements. **5+2**

TEXT BOOK:

1. William D. Callister, Jr., *Materials Science and Engineering-An Introduction*, Wiley Eastern Publishers, New Delhi.
2. V. Raghavan, *Materials Science and Engineering*, Prentice Hall of India, New Delhi.

REFERENCE BOOKS:

1. Rudin, A, *The Elements of Polymer Science & Engineering*, Academic Press, New York 1982.
2. G.E. Dieter, *Mechanical Metallurgy, SI Metric Ed.*, McGraw-Hill, New York.
3. Davis, Troxell and Huck, *Testing and Inspection of Engineering Materials*, TMH, New Delhi.

ME 214 MANUFACTURING PROCESSES

*Class:***II/IV B.Tech. I Semester** *Lectures:***3,** *Tutorials:***1**
*Branch:***Mechanical** *University Examination:* **100 marks**
Duration of University Examination: **3 hours** *Sessionals:***50 marks**

UNIT-I

1. Manufacturing Processes- Introduction, classification, selection of a manufacturing process; Patterns – Materials, Types Allowance, Pattern Design; Molding Sand – Types, Preparation and Conditioning, Properties and Testing; Cores and Core making, CO_2 Molding; Moulding Methods-Bench moulding, Floor moulding, Pit moulding and Machine moulding.
2. Elements and Design of Gating Systems- Types - Pressurized and Non-pressurized gating systems; Risering in moulds and Design, progressive and directional solidification. **9+3**

UNIT-II

3. Special Casting Methods - Shell molding, Plaster molding, Investment casting, Centrifugal casting and Die casting; Casting defects.
4. Metal Forming- Introduction, Nature of Plastic deformation, Yield Criteria, Cold working and Hot working processes; Brief description of various metal forming processes-Rolling, Forging, Extrusion and drawing of wires, rods and tubes. **9+3**

UNIT-III

5. Sheet metal operations- Shearing Action, Blanking , Piercing, Shaving, Nibbling, Notching, Deep drawing, Coining, Embossing, Seaming, Bending, Stretch forming, Metal spinning, Explosive forming and Electro hydraulic forming.
6. Welding Processes- Classification; Liquid state welding Principles- Arc welding, Selection of electrodes- Submerged arc welding, TIG and MIG welding processes; Resistance welding Processes-Spot, Seam, Projection, Percussion welding processes; Gas welding-oxyacetylene welding; Gas cutting. **9+3**

UNIT-IV

7. Solid state welding-Principles, Cold welding, Friction welding, Diffusion welding and Forge welding; Solid-liquid state welding- Principles, Brazing, Bronze welding and Soldering; Welding defects and Inspection;
8. Other welding processes-Thermit welding, Electro slag welding, Electron beam welding, Laser Beam welding and Plasma Arc welding. **9+3**

TEXT BOOKS:

1. P.N.Rao, *Manufacturing Technology*, 2/e, Tata McGraw-Hill,New Delhi, 1990.
2. Amitabha Ghosh and Ashok Kumar Mallik, *Manufacturing Science*, 4/e, Associated East West Press Pvt. Ltd., New Delhi, 1991.
3. Campbell,J S , *Principles of Manufacturing Materials and Processes*, McGraw- Hill, N York

REFERENCE BOOKS:

1. George E Dieter, *Mechanical Metallurgy*, McGraw-Hill, New York.
2. Roy, A. Lindberg, *Processes and Materials of Manufacture*, 5/e, Prentice Hall of India, New Delhi, 1992.
3. O P Khanna, *Welding Technology*, Dhanapat RaiPublications (P) Ltd., New Delhi
4. R S Parmar, *Welding Technology*, Khanna Publishers, New Delhi

EI 2111 ELEMENTS OF ELECTRONICS ENGINEERING

(Qualitative Treatment only)

Class: **II/IV B.Tech. I Semester** *Lectures:***3,** *Tutorials:***1**
Branch: **Mech, Civil** *University Examination:* **100 marks**
Duration of University Examination: **3 hours** *Sessionals:* **50 marks**

UNIT-I

1. **P-type and N-type Semiconductors:** P-N junction, V-I characteristics of diode, temperature dependence of V-I characteristics, Break down of junctions-zener and avalanche-Diode as a rectifier, Half wave rectifier, Full wave center tapped rectifier, Full wave Bridge rectifier, derivations of parameters-Filters: L, C, LC, Pi-section filters, derivations of ripple factors-basic Zener regulator circuit. **10+4**

UNIT-II

2. **Transistors:** PNP and NPN transistor, symbols and diode equivalent of transistor, transistor current components, CE, CB, CC characteristics, comparison of three configurations-Transistor Biasing: Operating Point, DC load line, Basic stability, Thermal run away, Bias stabilization circuits: Fixed Bias, collector to base bin, self bias and their stability factors.
3. **Amplifiers:** RC coupled Amplifier; Frequency response curve of RC coupled Amplifier, Basic concept of feed back, advantages of negative feed back. Basic principle of oscillator circuit, RC oscillators; RC phase shift oscillator, wean bridge oscillator, LC oscillators: Hartley, Colpitts oscillators, Derivations for frequency of oscillations. **10+5**

UNIT-III

4. **Introduction to Operational Amplifiers:** Characteristics (Ideal & non ideal) Amplifiers: inverting, Non-inverting, Difference- Applications: adder, subtractor, Integrator, Differentiator, and square wave generator, Digital circuits: Gates, NAND and NOR as Universal gates, R-S Flip Flop, J-K Flip Flop, Concept of Raced Around condition, Master slave JK Flip Flop, D-Flip Flop & T-Flip Flops. Counters: Ripple and Decade Counter, Shift registers, Digital interfacing: Sample & hold circuit- ADC (successive Approximation, Dual slope)- DAC (weighted Resistor, R-2R ladder). **8+3**

UNIT-IV

5. **Basic Concepts of Microcomputer:** RAM, ROM, EPROM-Block diagram of 8085, microprocessor, Basic assembly language programs – Interrupts-Data Transmission Modes (DMA); Electronic Instrumentation: Cathode Ray Tube, Cathode Ray Oscilloscope- Block diagram of measurement system, Electrical Transducer, strain gauge transducer, LVDT, variable gap capacitive transducer, Thermistor & thermocouple. **6+0**

TEXT BOOKS

1. N.N.Bhargava, D.C. Kulshreshtha, S.C.Gupta, *Basic electronics & Linear Circuits*, TTTI Publications,Tata McGraw-Hill, New Delhi.
2. Jacob Milliman & Christos C.Halkias, *Integrated Electronics*, McGraw-Hill, 1991.

REFERENCE BOOKS:

1. R.A.Gayakwad, *OP-AMPS & LinearIntegrated Circuits*, 3/e, Prentice Hall of India,1985.
2. A.P. Malvino & Leach, *Digital Principles and Applications*, Tata McGraw-Hill, New Delhi,1995.
3. Ramesh S.Goankar, *Microprocessors Architecture, Programming & Applications*, Pen Ram Publishers.
4. A.K. Sawhney, *Electrical and Electronic Measurements and Instrumentation*, 11/e, Dhanpat Rai & Sons, Delhi, 1995.

ME 215 MACHINE DRAWING

Class: **II/IV B.Tech. I Semester** *Practicals:**6***
Branch: **Mechanical** *University Examination:***100 marks**
Duration of University Examination: **3 hours** *Sessionals:* **50 marks**

1. **Introduction:**
   Drawing practice as per IS: 696, Classification of drawings, conventional representation of gears, bearings, springs, welded joints. Materials etc., dimensioning, Screw threads, single and multi-start threads, different types of bolts and nuts-drawing. Different types of keys, Different types of riveted joints. Muff-coupling, split-muff coupling, rigid and flexible flange couplings, Universal coupling, Cotter and knuckle joints. Journal and pivot bearing.

18

2. **Assembly drawings:**
   Introduction to assembly drawings, Steps to prepare assembly drawings. Introduction to Sectional Views

   - Stuffing box ,
   - Eccentric,
   - Screw jack,
   - Swivel bearing
   - Lathe tail-stock
   - Three-way stop valve

24

3. **Part Drawings :**
   Introduction to Limits, Fits and Tolerances. Surface roughness and Process sheets. Introduction to Part drawings, Steps to prepare part drawings.
   .

   - Fast and loose pulley
   - Drill jig
   - Double action press.
   - Revolving center
   - Steam stop valve
   - Fuel injection pump

30

Note: At least THREE assembly drawings and THREE part drawings must be practiced on computer using AutoCAD.

TEXT BOOKS:

1. Siddheshwar, Kannaiah and Sastry, *Machine Drawing,* Tata McGraw-Hill, New Delhi.
2. G.Pohit , G. Ghosh , " *Machine Drawing with Auto CAD",* Pearson Education, New Delhi
3. Narayana, Venkat Reddy, Kannaiah, *Machine Drawing,* New Age International, New Delhi.

ME 216 MATERIALS SCIENCE AND TESTING LAB

Class: **II/IV B.Tech. I Semester** *Practicals:***3**
Branch: **Mechanical** *University Examination:* **50 marks**
Duration of University Examination: **2 hours** *Sessionals:***25 marks**

LIST OF EXPERIMENTS

1. Preparation and study of Crystal Models.
2. Observation of Micro-structures of single phase and multiphase and composite materials
3. Tension test on various materials - Determination of Tensile properties, Observation of fracture surface.
4. Impact Testing – Determination of impact properties.
5. Brinnel and Vickers Hardness Testing.
6. Determination of Strain Hardening Index and Strength Coefficient.(Mayer's analysis)
7. Rockwell Hardness Test. Variation of Hardness in response to heat treatment.
8. Determination of Young's modulus of non-ferrous materials.
9. Measurement of hysterics curve
10. Effect of strain on rate of corrosion.
11. Determination of Young's modulus by deflection method
12. Compression test on springs – Determination of Stiffness and modulus of rigidity.

TEXT BOOK:

1. E.C. Subba Rao, *Experiments in Material Science,* Tata McGraw-Hill, New Deli.
2. Davis, Troxell and Huck, *Testing and Inspection of Engineering Materials*, Tata McGraw-Hill, New Delhi.

ME 217 MANUFACTURING PROCESSES LAB

Class: **II/IV B.Tech. I Semester** *Practicals:***3**
Branch: **Mechanical** *University Examination:* **50 marks**
Duration of University Examination: **3 hours** *Sessionals:* **25 marks**

LIST OF EXPERIMENTS

FOUNDRY SHOP

1. Pattern making.
2. Sand preparation and mould preparation for a pulley pattern and testing for mould hardness.
3. Determination of permeability and shatter index of a given moulding sand.
4. Determination of grain fineness number of a given moulding sand.
5. Determination of green compression/shear strength and dry compression/shear strength of a given moulding sand.
6. Determination of moisture and clay content of a given moulding sand.

WELDING SHOP

7. Preparation of a corner joint using a DC arc welding machine.
8. Perform pipe-joining operation by gas welding.
9. Performing gas-cutting operation.
10. Study of V-I characteristics of D.C. welding power source.

FORMING:

11. Erichsen cup test
12. Study of wire/ rod drawing process (effect of process parameters)

TEXT BOOK:

1. P.N.Rao, *Manufacturing Technology*,2/e, Tata McGraw-Hill, New Delhi,1987.

REFERENCE BOOK:

1. A.Ghosh and A. K. Mallik, *Manufacturing Sciences*,5/e, Affiliated East-Press, New Delhi,1991.

MH 221 MATHEMATICS-III

Class: **II/IV B.Tech. II Semester** *Lectures:***3,** *Tutorial:***1** *Branch:* **Mech, Civil, E&I, EEE, CSE, IT, ECE** *University Examination:* **100 marks**
Duration of University Examination: **3 hours** *Sessionals:* **50 marks**

UNIT I

1. **Matrices:** Rank of matrix-Solution of system of linear equations-linear dependence and independence of vectors-Characteristic roots and characteristic vectors of a matrix-Cayley Hamilton 's Theorem (without proof)-Reduction of a matrix to diagonal form and normal form-Reduction of a quadratic form to canonical form.

8+3

UNIT II

2. **Probability And Statistics:** Curve fitting-Method of least squares- Straight line and parabolic curves-correlation coefficient – rank correlation- regression- linear regression equations. Random variables-Discrete land continuous distributions-Density and distribution functions- Illustration through Binomial, Poisson and normal distributions.

12+4

UNIT III

3. **Numerical Analysis:** Interpolation-Forward and Backward differences interpolation-Newton's and Lagrange's formulae.

4. **Numerical Dfferentiation And Integration:** First and Second derivatives using forward and backward interpolation- Numerical integration-Trapezoidal and Simpson's rule.

8+3

UNIT IV

5. **Solution To System Of Linear Equations:** Jacobi, Gauss Siedel iteration method-Solution of algebraic and transcendental equations – Bisection method, Regula-Falsi method and Newton Raphson's method.

6. **Numerical Solution Of Ordinary Differential Equations:** Taylor'smethod, Picard's method, Euler's method and Runge-Kutta methods of second and fourth orders. **8+3**

TEXT BOOK:

1. B.S.Grewal, *Higher Engineering Mathematics,* Khanna Publishers, New Delhi.

REFERENCES BOOKS:

1. S.S.Sastry, *Introduction to Numerical Analysis,* Prentice Hall of India, New Delhi.
2. E.Kreyszig *Advanced Engineering Mathematics*, Wiley Eastern Ltd., New Delhi.
3. Gupta and Kapoor, *Fundamentals of Mathematical Statistics*, S.Chand and Co., New Delhi.

ME 222 ENGINEERING METALLURGY

Class: **II/IV B.Tech. II Semester** *Lectures:***3,** *Tutorials:***1**
Branch: **Mechanical** *University Examination:* **100 marks**
Duration of University Examination: **3 hours** *Sessionals:* **50 marks**

UNIT-I

1. Introduction to metallurgy, extraction of iron, the principles of production of direct reduced iron and pig iron, principles of steel making, industrial methods of iron and steel production, Crucible process, Bessemer, open hearth, L.D. Kaldo processes. **4+1**
2. Constitution of alloys, construction and interpretation of binary equilibrium diagrams, eutectic, eutectoid, Fe-C equilibrium diagram. Isothermal transformation curves, continuous cooling curves, effect of alloying elements on microstructure. Fe-C diagram and T-T-T curves. **5+2**

UNIT-II

3. Heat treatment of steel, principles of annealing, normalizing, hardening, tempering, surface hardening and age hardening, austempering, martempering, ausforming, marforming, thermo-mechanical treatments. **5+1**
4. Structure and properties of low, medium and high plain carbon steels, stainless steels, wear resistant steels, high speed tool steels, free cutting steels, die steels, forging quality steels, and special alloys, for high temperature and magnetic applications, Haste alloys, Nimonics, Inconel Mu-metal, permalloys, Alnicos and Kanthal. **4+2**

UNIT-III

5. Cast irons, types and production of cast irons, white cast iron, malleable cast iron, grey cast iron, nodular cast iron, their properties and uses, alloy cast-iron, Ni-hard, Ni-resist, chilled cast iron and Nitrocil. **4+1**
6. Non-ferrous metals and alloys, properties and uses of Cu and Cu-alloys, Al and Al-alloys, Ni & Ni-alloys Mg & Mg-alloys and super alloys. **5+2**

UNIT-IV

7. Powder metallurgy processes, preparation, characteristics and processing of metal powders into friction, anti-friction and filter components, applications of powder metallurgy. **4+1**
8. Metallurgical instrumentation, Non destructive testing methods – Fluorescent penetrant test, magnetic particle inspection, X - ray and gamma ray radiography, Eddy current techniques. Brief introduction to temperature measurement, thermocouples, pyrometers - optical, radiation pyrometers, resistance thermometer etc. **5+2**

TEXT BOOK:

1. Sydney.H.Avener, *Introduction to Physical Metallurgy*, McGraw-Hill, New York.
2. John, D. Sharp, *Elements of Steel Making Practice*, Pergamon Press, New York.

REFRENCE BOOKS:

1. A.G.Guy, *Elements of Physical Metallurgy*, Addison and Wesley, New York.
2. Clarke and Varney, *Introduction to Physical Metallurgy*, TMH, New Delhi

ME 223 MACHINE TOOLS

Class: **II/IV B.Tech. II semester** *Lectures:* **3**, *Tutorials:* **1**

Branch: **Mechanical** *University Examination:* **100 marks**
Duration of University Examination: **3 hours** *Sessionals:* **50 marks**

UNIT-I

1. **Introduction of Machine Tools:** Classification, types of machine tools,concepts of generatrix and directrix motion. Elements of Kinematics of Machine Tools.

2. **Lathe:** Description, types, operations, accessories, attachments and machine time calculations. Introduction to Capstan and Turret Lathe and Automatic Machine.

3. **Drilling**: Description,types of drilling machines,drilling operations,machine time calculations. **9+3**

UNIT-II

4. **Milling**: Description, types of milling machines, Mounting of milling cutters, types of milling operations, machining time calculation, types of indexing methods.

5. **Shaping, Planning and Slotting**: Description, types of machines and operations, tool setting and quick return mechanisms. Machining time calculations. **9+3**.

UNIT-III

6. **Gear cutting**: Types of gear cutting, generation and copying processes, description of hobbing and gear shaping machines

7. **Grinding**: Various types of grinding machines, specification and selection of grinding wheels, machining time calculations.
8. **Super finishing operations**:Introduction**,**Honing,lapping & buffing operations. **9+3**

UNIT-IV

9. **Jigs and Fixtures**: Introduction, Types of jigs, Quality-standards in jig elements, Universal jigs.
10. **Locating Elements**: Principles of location; degrees of freedom-constraints-redundant location-different types of locators-locating examples. Fouling pins and fool proofing.

11. **Clamping Elements**: Introduction, Principles, types of clamps- strap, lever, toggle, cam screw. Mechanical clamps-equalizing clamps- hydraulic and pneumatic clamping. **9+3**

TEXT BOOKS:

1. SKH Choudhary, AKH Choudhary, Elements *of Workshop Technology*, Vol.II, Asia Publishing House, Bombay.
2. Kempster, M.H.A., *Principles of Jig and Tool Design*, English University Press, London.

REFERENCE BOOKS:

1. P.N.Rao, *Manufacturing Technology-Metal cutting and Machine Tools*, Tata McGraw-Hill, New Delhi, 2000.
2. Henrich Gerling, *All About Machine Tools*, New Age International, New Delhi, 1965
3. G.C.Sen, A.Bhattacharya , *Principles of Machine Tools,* New Central Book Agency, Calcutta, 1988.

ME 224 MECHANICS OF SOLIDS – II

Class: **II/IV B.Tech. II Semester** *Lectures:* **3**, *Tutorials:* **1**

Branch: **Mechanical** *University Examination:* **100 marks**
Duration of University Examination: **3 hours** *Sessionals:* **50 marks**

UNIT-I

1. **Introduction:** Introduction to Continuum Mechanics. Review of vector calculus. **2+0**
2. **Analysis of Stress:** Definition and notation of stress, normal and shear stress components, specification of stress at a point, stress Tensor, Differential equations of equilibrium, Principal stresses and the Mohr Diagram, Stresses in Polar coordinates. **3+2**
3. **Analysis of Strain:** Definition and notation of strain, Strain components, Specification of strain at a point, Strain Invariants, Mohr's Circle for strains. Strains in Polar coordinates. Compatibility equations. **4+2**

UNIT-II

4. **Stress-Strain Relations and the General Equations of Elasticity:** Idealization of Engineering Materials, Generalized Hooke's law in terms of Engineering elastic constants, Saint-Venant's principle. Thermal Stresses, Thermo elastic stress-strain relations, strain-displacement relations. General equations in cylindrical coordinates. Plane-Stress and Plane-Strain conditions. **4+1**
5. **Combined Loads:** Analysis of biaxial state of stress at a point, principal stresses, Mohr's circle representation of stresses. Applications to combined axial, torsion, eccentric and flexural loads, equivalent bending and twisting moments. **4+3 UNIT-III**
6. **Theories of Elastic Failure: The** importance of failure theories in design, maximum normal strain, theory maximum shear stress theory, Max. axial strain theory, Energy distortion theory, applications. **3+2**
7. **Fatigue Loads:** Types of **Fatigue** loads, phenomenon of Fatigue failure, endurance limit, Stresses concentration and its importance in design, stress concentration factor, notch sensitivity, Soderberg equation, Goodman line, Gerber's parabola, fatigue design under Combined loading. **4+2** **UNIT-IV**
8. **Bending of Curved Bars:** Stresses in bars of small initial curvature, strength in bars of large initial curvature, Extension of curved bars, practical design application. **3+1**
9. **Springs:** Closed coiled helical springs, deflection and stresses in helical springs, concentric springs, springs under variable loads. **3+1**
10. **Energy Principles and Variational Methods:** Principle of Potential energy, Principle of complementary energy. The Principles of potential and complementary energy considered as variational principles. Rayleigh-Ritz method, Galerkin method. Reciprocal Theorem and Castigliano's Theorems. **4+1**

TEXT BOOK:

1. A.C.Ugural and S.K.Fenster, Advanced Strength and Applied Elasticity, 3/e, PTR Printice Hall, Eaglewood Cliffs, New Jersey, 1995
2. E.P.Popov, *Engineering Mechanics of Solids,* Pearson Education, New Delhi
3. L.S. Srinath, *Advanced Mechanics of Solids, 2e,* Tata McGraw-Hill, New Delhi, .

REFERENCE BOOKS:

1. C.T. Wang, *Applied Elasticity,* McGraw-Hill, New York, 1953.

ME 225 ENGINEERING THERMODYNAMICS

Class: **II/IV B.Tech. II Semester** *Lectures:***3,** *Tutorials:***1**
Branch: **Mechanical** *University Examination:* **100 marks**
Duration of University Examination: **3 hours** *Sessionals:* **50 marks**

UNIT-I

1. FUNDAMENTAL CONCEPTS: Units and dimensions- Introduction to SI units. System and continuum. Thermodynamic state, property, process and cycle. Intensive and extensive properties. Energy: Work and heat, Microscopic and macroscopic points of view of thermodynamics. Perfect and real gases, joule-thomson coefficient, inversion curve, Vander walls equation of state. Thermodynamic equilibrium, Zeroth law and its applications, Principles of thermometry, fixed points.
   3+1
2. FIRST LAW OF THERMODYNAMICS:First law, applications to closed systems- internal energy – applications to open systems-Enthalpy, Steady flow energy equation and its applications. Specific heats. Processes of closed system- constant volume, constant pressure, Isothermal, adiabatic and polytropic. **6+2**

UNIT-II

3. SECOND LAW OF THERMODYNAMICS:Limitations to first law, statements of Second law and their equivalence, Reversible and Irreversible processes. Carnot's cycle, Carnot's theorem, Thermodynamic efficiency and Temperature scales. Heat engine, Heat pump and Refrigerator. **9+3**

UNIT-III

4. ENTROPY: Concept of entropy, Classius inequality, Entropy changes in various processes, Third law of thermodynamics. **3+1**
5. AVAILABILITY AND IRREVERSIBILITY::Available energy, Available energy referred to a cycle, Helmholtz and Gibb's functions, Availability in steady flow, entropy equation for a flow process, irreversibility, effectiveness. **6+2**

UNIT-IV

6. THERMODYNAMIC RELATIONS:Max-well relations, coefficient of volume expansion, isothermal compressibility factor, T-ds Equations, difference in heat capacities, ratio of heat capacities, change in internal energy, entropy and enthalpy equations.
4+1

7. GAS POWER CYCLES: Brayton, Otto, Diesel and dual cycles- calculation of air standard efficiency and mean effective pressure, Representation of stirling, ericsson and atkinson cycles on P-V and T-S diagrams. **5+2**

TEXT BOOK:

1. Nag.P.K., *Engineering Thermodynamics,* Tata McGraw-Hill, New Delhi.
2. Mathur M.L and Mehta F.S, *Thermal Engineering*, Jain Brothers, New Delhi.

REFERENCE BOOKS:

1. Gupta C.P. & Prakash.R. *Engineering Thermodynamics*, Nem Chand & Brothers, Roorkee.
2. Van Wylen, G.J., *Fundamentals of Classical Thermodynamics,*John Wiley, New York.
3. D S Kumar, *Thermal science and Engineering*, S K Kataria and sons, New Delhi.

EE 227 ELEMENTS OF ELECTRICAL ENGINEERING

Class: **II/IV B.Tech. II Semester** *Lectures:***3,** *Tutorials:***1**
Branch: **Mechanical** *University Examination:* **100 marks**
Duration of University Examination: **3 hours** *Sessionals:* **50 marks**

UNIT – I

Ohm's Law, Network Elements, Kirchoff's Laws, Source Transformation, Mesh and Nodal Analysis, Power in Electric Circuits, Series, Parallel and Series Parallel and Combination of Resistances, network

reduction by Star – Delta Transformation, Superposition, Thevenin's, Norton's, and Maximum Power transfer theorems. (9+3)

UNIT – II

1 – Phase A.C. Circuits: Phasor representation of sinusoidal quantities, Average, R.M.S. values and Form factor, A.C. through Resistor, Inductor and Capacitor, Analysis of R-L-C series and parallel circuits, Power factor, power triangle, Series Resonance.

3-ϕ A.C. Circuits: Production of 3-ϕ Voltages, Voltage & Current relationships of Line and Phase values for Star and Delta Connections, 3-ϕ Power Measurement by two-wattmeter method for balanced loads. (9+3)

UNIT – III

Magnetic circuits: Self and Mutual Inductance, Dot Convention, Coefficient of Coupling. B- H loop curve.

D.C.Machines: Constructional features, Methods of Excitation, Characteristics of Series, Shunt and Compound Generators and Applications, Torque development in D.C. motor, Characteristics of Series, Shunt and Compound motors and Applications.

Single Phase Transformers: Construction and operation principle, Development of No Load & On Load Phasor diagrams, Equivalent circuit, O.C. and S.C. tests, Losses and Efficiency, Voltage regulation. (9+3)

UNIT – IV

3-ϕ Induction Motor: Constructional features, Principle of Operation, Production of Rotating Magnetic Field, Torque – slip Characteristics, Applications.

1-ϕ Induction Motors: Production of Rotating Field in various type of 1-phase motors split phase, capacitor start, capacitor run, shaded pole motors and applications.

Synchronous Generators and Motors: Principal of Operation and its Applications. (9+3)

TEXT BOOKS:

1. Vinvent Del Toro, *Principles Of Electrical Engineering*, PHI, New Delhi.
2. Edward Hughes, *Electrical Technology*, Pearson Publisher, New Delhi

REFERENCE BOOKS:

1. M.S. Naidu & S.Kamakshaiah, *Introduction To Electrical Engineering.*
2. B.L. Thereja, *Electrical Technology*, S.Chand & Company Ltd., New Delhi
3. Sudhakar and Shyam Mohan, *Network Analysis and Synthesis*, TMH, New Delhi.
4. Nagrath and Kothari, *Basic Electrical Engineering*, TMH, New Delhi.

ME 226 ENGINEERING METALLURGY LAB

Class: **II/IV B.Tech. II Semester** *Practicals:* **3**
Branch: **Mechanical** *University Examination:* **50 marks**
Duration of University Examination: **2 hours** *Sessionals:* **25 marks**

LIST OF EXPERIMENTS

1. Principles of metallurgical microscope, importance of sample preparation, operational details, terminology.
2. Preparation of ferrous sample for metallographic observations.

3. Preparation of non-ferrous samples for metallographic observations.
4. Observation of microstructures of pure metals and single-phase alloys. Armco Iron, Pure copper, Brass, austenitic stainless steels, pure aluminum.
5. Observation of microstructures of plain carbon steels, low alloy steels.
6. Observation of microstructures of various types of cast irons
7. Observation of microstructures of heat-treated samples, surface hardened and work hardened materials, HSS, Die steels, carburized steels etc.
8. Measurement of grain size, flake size and grading.
9. Measurement of Rockwell hardness and the effect of grain size and prior history of the material on the hardness.
10. Observation of Welded Structures and Heat Affected Zone (HAZ).

TEXT BOOK:

1. V.D.Kodgire, *Material Science and Metallurgy*, Everest Publications, Pune.
2. Kehl, *Metallographic Laboratory Practice*- McGraw-Hill, New York.

REFERENCE BOOK:

1. Brick, Gordon and Philips, *Structure and Properties of Materials*, Tata Mc Graw hill Book Co., New Delhi.

EE 228 ELECTRICAL & ELECTRONICS ENGINEERING LAB

Class: **II/IV B.Tech. II Semester** *Practicals:* **3**
Branch: **Mechanical** *University Examination:* **50 marks**
Duration of University Examination: **2 hours** *Sessionals:* **25 marks**

LIST OF EXPERIMENTS

1. Verification of Kirchaff's Law.
2. Verification of Superposition Theorem.
3. Verification of Thevenin's Theorem.
4. Verification of Maximum Power Transfer Theorem.
5. Voltage and Current relationships of Line and Phase values in Star, Delta connections and 3-Phase power measurement by 2- Wattmeter method.

6. Determination of parameters of choke coil.
7. Demonstration Experiments
    a) DC Motor.
    b) DC Generator (O.C.C).
    c) 1-Phase Induction Motor.
    d) Alternators.
8. Semiconductor Diode Characteristics.
9. Zener Diode Characteristics.
10. Full Wave Rectifier with different filters.
11. Transistor characteristics in CB configuration.
12. Transistor characteristics in CE configuration.

MH 311 MANAGEMENT, ECONOMICS AND ACCOUNTANCY

Class: **III/IV B.Tech. I Semester** ***Lectures:* 3, *Tutorials:* 1**
Branch: **Mechanical** *University Examination:* **100 marks**
Duration of University Examination: **3 hours** *Sessionals:* **50 marks**

MANAGEMENT
UNIT-I

1. **Management:** Meaning and definition, scope of management – principles of management. *Scientific management:* definition, characteristics – criticism. **4**

2. **Functions of Management:** Planning – definition-process – characteristics. *Organizing:* definition of organization, characteristics, types, principles of organization. *Departmentation:* Meaning and fundamentals of departmentation. *Centralization and decentralization:* definitions, features, merits and demerits. *Communication:* Process of communication, channels, Media and barriers. **10**

UNIT-II

3. **Staffing:** Meaning and functions of personnel management. *Coordination* definition*:* definition – steps to achieve effective coordination. *Controlling:* definition and process.**4**

ECONOMICS
UNIT-III

4. **Economics:** Meaning and definition, scope: micro and macro, assumptions, methods, utilities – laws of economics: differences with laws of physical sciences. **2**
5. **Factors of Production:** Meaning, definition and characteristics of land, labor, capital and entrepreneurship – *Division of labour:* types, advantages and disadvantages. Formation of capital. Forms of business organizations: Sole trade concern, partnership firm, co-operative society, Joint Stock Company: types of partners, types of Joint Stock Company, Merits and demerits. **6**

ACCOUNTANCY
UNIT-IV

6. **Double entry Book- Keeping:** Definition, journalisation of transactions. Ledger posting and balancing. Preparation of trial balance. **10**
7. **Preparation of Final Accounts:** Trading Account, Profit and Loss Account and Balance sheet (with simple adjustments). **7**

TEXT BOOKS:

1. K K Dewett, *Modern Economic Theory*
2. Y K Bhushan, *Business Organization and Management*
3. T S Grewal, *Introduction to Accountancy.*

REFERENCE BOOKS:

1. Koontz and O'Donnell, *Management*
2. L M Prasad, *Principles and Practice of Management.*

ME 312 INTERNAL COMBUSTION ENGINES

Class: **III/IV B.Tech. I Semester** ***Lectures:* 3, *Tutorials:* 1**
Branch: **Mechanical** *University Examination:* **100 marks**
Duration of University Examination: **3 hours** *Sessionals:* **50 marks**

UNIT I

1. INTRODUCTION: Classification, working principle of four stroke and two stroke, SI and CI engines, comparison of SI and CI engines, four stroke and two stroke engines. valve-timing and port timing diagrams. **5**
2. FUEL-AIR CYCLES AND THEIR ANALYSIS: Fuel-Air cycles and their significance. Composition of cylinder gases and variable specific heats, dissociation, comparison of Air-Standard and Fuel-Air cycles and effect of operating variables – compression ratio and fuel-air ratio. **4**

UNIT II

3. FUELS AND COMBUSTION: Solid, liquid and gaseous fuels-their characteristics, structure of hydrocarbon fuels, flash and fire points, calorific value of fuels, chemically correct or stochiometric air-fuel ratio, air-fuel ratio from analysis of products of combustion, conversion of volumetric analysis to mass analysis, mass of dry flue gases per kg of fuel burnt, mass of excess air supplied, important qualities of SI and CI engine fuels. Rating of fuels. **6**
4. FUEL SUPPLY SYSTEMS: Spark Ignition Engines-carburetion, mixture requirements. Calculation of air fuel ratio, types of carburetors. Compression Ignition Engines-Functional requirements of an injection system, injection pump, injector nozzle. **3**

UNIT III

5. IGNITION: Energy requirements for ignition, Requirements of an ignition system, Types of ignition systems-battery ignition system, magneto ignition system, transistorized coil ignition system and capacitance discharge ignition system. **4**

6. COMBUSTION PROCESS IN I.C. ENGINES: S.I. Engines-Normal combustion and flame front propagation, factors affecting flame speed, rate of pressure rise, abnormal combustion, combustion chambers for S.I. Engines. C.I. Engines- Stages of combustion, ignition delay, factors affecting delay period, combustion knock and combustion chambers for C.I. Engines. **5**

UNIT IV

7. TESTING OF I.C. ENGINES: Indicator diagram, mean effective pressure, indicated power, brake power, frictional power, fuel consumption, air consumption, air-fuel ratio, excess air ratio, equivalence ratio, specific fuel consumption. Mechanical, volumetric, thermal efficiencies and heat balance. **5**
8. SPECIAL TOPICS: Scavenging, supercharging, exhaust emissions, pollutants from gasoline engines and control, diesel engine emissions and control. Wankel rotary piston engine. **4**

TEXT BOOKS:

1. Ganesan V., *Internal Combustion Engines,* Tata McGraw-Hill, New Delhi, 1994.
2. Mathur M. L.,Sharma R. P., *A Course in I. C. Engines,*Dhanpat Rai&Sons, N Delhi.

REFERENCE BOOKS:

1. Gill P. W. & Smith J. H., *Fundamentals of I. C. Engines,* Oxford & IBH, New Delhi.
2. Domkundwar A. V. & Domkundwar V. M., *A Course in Internal Combustion Engines,* Dhanpat Rai & Sons, New Delhi.

ME 313 KINEMATICS OF MACHINERY

Class: **III/IV B.Tech. I Semester** *Lectures:* **3**, Tutorials: **2**

Branch: **Mechanical** ***University Examination:*** **100 marks**
Duration of University Examination: **3 hours** ***Sessionals:*** **50 marks**

UNIT-I

1. **Basic Concepts:** Element, Link, kinematic pair, kinematic chain, mechanism, inversion, structure, machine, constrained motion, Grubbler's criterion, quadric chain, Grashoff's criterion, Inversions of four bar, single slider and double slider crank chains. Introduction to special mechanisms such as Geneva wheel, pawl and rachet mechanism, straight line mechanisms, steering gear mechanism. **6+0**
2. **Velocity Analysis**: Relative Velocity Method, Instantaneous center Method, the Aronhold-Kennedy Theorem of Three centers, Velocity Diagrams **5+4**

UNIT-II

3. **Acceleration Analysis:** Radial and Transverse Components of Acceleration, The Coriolis Component of Acceleration, Acceleration Diagrams, and Klein's construction **3+4**
4. **Synthesis of Planar Mechanisms:** Synthesis of four-link mechanism and single slider-crank mechanism, relative pole method, inversion method, Frudenstein method, Chebyshev spacing for three precision points. 4**+4**

UNIT-III

5. **Cams:** Classification of cams and followers. Analysis of motions the follower for cams with specified contours-Roller follower on tangent cam, roller follower on convex sided cam, flat-faced follower on convex sided cam. Displacement, velocity and acceleration diagrams for specified follower motion- uniform velocity, SHM, uniform acceleration and retardation, cycloidal motion. Generation of cam profiles with different types of followers- knife-edge, roller, and flat foot. Reciprocating and oscillating types-radial and offset types. **6+8**

UNIT-IV

6. **Toothed Gearing:** Law of gearing, velocity of sliding, involute profile, path of contact, arc of contact, interference, methods to avoid interference, minimum number of teeth on pinion to avoid interference, involute and cycloidal tooth profiles, comparison.

5+0

7. **Gear Trains:** Simple, compound, reverted, epicyclic gear trains, Analysis of epicyclic gear train, torques in epicyclic gear trains, sun and planet gear, compound epicyclic gear trains, Bevel-epicyclic gear train, Wilson four speed gear box and differential gear box of an automobile. **9+2**

TEXT BOOK:

1. S.S Rattan, *Theory of Machines,* Tata McGraw-Hill, New Delhi.
2. R.S.Kurmi & J.K.Guptha, Theory of Machines, S.Chand & Co.,New Delhi, 2005

REFRERENCE BOOKS:

1. R.L.Norton, *Design of Machinery-An Introduction to the Synthesis and Analysis of Mechanisms and Machines,* McGraw-Hill, New York, 1992.
2. J.S.Rao and R.V. Dukkipati, *Theory of Mechanisms and Machine Theory,* New Age International, New Delhi.
3. Ambekar, *Theory of Mechanisms and Machines,* Jain Brothers, New Delhi
4. Thomas Bevan, *The Theory of Machines,* CBS Publishers, New Delhi.

ME 314 APPLIED THERMODYNAMICS

Class: **III/IV B.Tech. I Semester** *Lectures:* **3,** *Tutorials:* **1**
Branch: **Mechanical** *University Examination:* **100 mark s**
Duration of University Examination: **3 hours** *Sessionals:* **50 marks**

UNIT-I

1. PROPERTIES OF STEAM: Steam properties, use of property diagrams, Mollier diagram, properties for various processes- isobaric, isochoric, isothermal, adiabatic and polytropic. Measurement of steam quality. **5+2**
2. VAPOUR CYCLES: Rankine cycle, modified rankine cycle, description of re-heating, re-generation, binary vapour cycles. **4+1**

UNIT-II

3. STEAM GENERATORS: Classification, low-pressure boilers – construction and working of Lancashire, Babcock and Wilcox & Stirling boilers.High-pressure boilers- Lamont and Benson boilers. Criteria for boiler selection, comparison of fire tube and water tube boilers, supercharged and supercritical boilers. Mountings and accessories. Boiler efficiency and equivalent evaporation. **6+1**
4. DRAUGHT: Classification, comparison of natural and artificial draught, chimney calculations. **3+2**

UNIT-III

5. STEAM NOZZLES: Steam flow through nozzles – velocity of steam discharge, continuity equation, calculation of area, velocity and mass flow rate for equilibrium conditions, critical mass flow rate. Super saturated flow – Wilson's line, degree of under cooling and degree of super-saturation. **5+2**
6. STEAM CONDENSERS: Function of condenser, surface and jet condensers, advantages of surface condensers, effect of air in condenser, vacuum efficiency, condenser efficiency, circulating water requirement. **4+1**

UNIT-IV

7. STEAM TURBINES: Impulse and reaction turbines, velocity diagrams, power output, axial thrust, diagram efficiency, stage efficiency and overall efficiency. Compounding of impulse turbines, multistage turbine, degree of reaction, reheat factor, condition curve. Governing of turbines. **9+3**

TEXT BOOKS:

1. Roy Choudary, T., *Basic Engineering Thermodynamics,* Tata McGraw-Hill, New Delhi.
2. Vasandani V.P. and Kumar D.S., *Heat Engineering* Metropolitan Book Co., New Delhi.

REFERENCE BOOKS:

1. Mathur, M.L., and Mehta F.S., *Thermal Engineering*, Jain Brothers, New Delhi..
2. Kearton, W.T., *Steam Turbine Theory and Practice,* ELBS, London.

ME 315 DESIGN OF MACHINE ELEMENTS-I

Class: **III/IV B.Tech. I Semester** *Lectures:* **3**, *Tutorials:* **1**
Branch: **Mechanical** *University Examination:* **100 marks**
Duration of University Examination: **3 hours** *Sessionals:* **50 marks**

UNIT-I

1. **Introduction**: Engineering Design, Basic Design procedure, Basic requirements of machine elements, Important Materials for Machine Components. Review of basic equations of mechanics of solids, Factor of safety , Design Criterion. **5+0**

2. **Eccentric loading**: Design of Machine Frames and Brackets under eccentric and flexural loads, Circular bars under axial, torsion and bending loads, equivalent bending and twisting moments. **4+3**

UNIT-II

3. **Shafts**: Introduction , Shaft Materials, Design criterion for shafts, Design of solid and hollow shafts under static loads-combined torsion, axial and bending. Design of solid shafts under fluctuating loads. **3+2**
4. **Keys:** Types of Keys, Standard proportions for Keys, Deign of Keys, Splines and Splined shaft. **2+0**
5. **Couplings:** Functions of Couplings, Types of couplings, Design of Rigid Couplings- Muff and Flange couplings, Design of bush pin Flexible Couplings. **3+2**

UNIT-III

6. **Cotter Joints:** Design of cotter joints – socket & spigot type, sleeve type, Gib type and Knuckle joint. **4+2**
7. **Riveted joints**: Terminology, different types of riveted joints, failure modes, Design procedure, structural joints-lozenge joint, eccentrically loaded riveted joints. **4+2**

UNIT-IV

8. **Bolted joints:**-initial stresses, gasket joints, eccentrically loaded bolted joints, design of power screws & nuts. **4+2**
9. **Welded joints**: Conventional representation of welded joints, Butt and fillet welds under static and varying loads, welded joints under eccentric loading. **4+2**

TEXT BOOK:

1. N.C.Pandya and C.S.Shah, *Elements of Machine Design*, Charotar Publishing House, Anand, 2000.
2. R.S.Kurmi and J.K.Guptha, A Text book of Machine Design, S.Chand & Co. New Delhi,2005

REFERENCE BOOKS:

1. J.E.Shigley and C.R.Mischke, *Mechanical Engineering Design*, 5/e, McGraw- Hill, New York, 1989.
2. R.C.Juvinall and K.M. Marshek, 3/e,Fundamentals of Machine component Design, John Wiley & Sons,Newyork,2000
3. Andrew D. Dimarogonas, *Computer Aided Machine Design*, Prentice Hall International (UK) Ltd., 1988.
4. V.B.Bhandari, *Design of Machine Elements*, Tata McGraw-Hill, New Delhi.

ME 316 MEASUREMENTS AND METROLOGY

Class: **III/IV B.Tech. I Semester** *Lectures:***3** , *Tutorials:***1**
Branch: **Mechanical** *University Examination:* **100 marks**
Duration of University Examination: **3 hours** *Sessionals:* **50 marks**

UNIT-I

1. **Introduction to Measurement:** Classification, application, generalized measurement system, functional elements, concept of block diagram. Classification of instruments:

Automatic/manual, Self/power operated, analog/digital, Mechanical, electrical and electronic instruments. **3+1**

2. **Instruments Characteristics**: Static characteristics: range and span, error specifications, calibration, hysteresis, dead zone and drift. Sensitivity, threshold and resolution. Accuracy, precision, repeatability and stability. Dynamics characteristics: speed of response and measuring lag, fidelity and dynamic error, overshoot, frequency response. Classification of errors. **4+2**
3. **Sensors and Transducers**: Classification, mechanical detector transducers and sensitivity. Piezoelectric and photoelectric transducers. **2**

UNIT-II

4. **Concept of Accuracy**- Part accuracy, general concept of accuracy of machine tools, Influence of geometric accuracy of machine tools on work piece accuracy. Acceptance tests for machine tool alignment tests. Surface roughness: Definition and terms. Influence of machining parameters on surface roughness. **9+3**

UNIT-III

5. **Line and end standards**: Generation and calibration of end standards. Limits fits and tolerances, Taylor's principles for limit gauges and design. Use of ring, plug, snap and slip gauges. Comparators -mechanical, electrical, optical & pneumatic comparators **9+3**

UNIT-IV

6. **Angular Measurement**: Sine bar, Angle gauges, spirit level, clinometer and optical collimator.
7. **Surface roughness measurement**: Tomlinson surface meter, Taylor-Hobson Talysurf.
8. **Measurement and gauging of screw threads**: Screw thread measuring elements-measurement of effective diameter by 2-wire and 3-wire method.
9. Measurement of gear profiles. **9+3**

TEXT BOOKS :

1. D.S. Kumar, *Mechanical Measurements and Controls*, 3/e, Metropolitan, Delhi.
2. R.L.Murty, *Precision Engineering in Manufacturing*, New Age International, New Delhi.
3. I.C. Gupta, *Engineering Metrology*, Dhanpat Rai and Sons, New Delhi, 1988.

REFERENCE BOOKS:

1. T.G.Beckwith and Buck, N.L. *Mechanical Measurements*, 2/e, Addison Wesley, 1969.
2. Taher M.R., *Metrology and Measuring Instruments*, Ram Naraian Lal Beni Prasad, Allahabad.
3. JFW Gayler and Shotbolt, *Metrology for Engineers*, ELBS, London.
4. Mahajan, *A Text Book on Metrology*, Dhanpat Rai and Sons, New Delhi.

ME 317 INTERNAL COMBUSTION ENGINES LAB

Class: **III/IV B.Tech. I Semester** *Practicals:* **3**
Branch: **Mechanical** *University Examination:* **50 marks**
Duration of University Examination: **3 hours** *Sessionals:* **25 marks**

LIST OF EXPERIMENTS

1. Study of models of Internal Combustion Engines.

2. Load Test & Heat Balance on single cylinder, Four Stroke, Diesel engine with Rope brake.

3. Valve-Time diagram for a single cylinder, Four stroke, Diesel engine.

4. Load test & Heat Balance on Twin cylinder, Four stroke, Diesel engine with hydraulic brake.

5. Morse Test on Four Cylinder, Four stroke, petrol engine.(Ambassador)

6. Performance evaluation of Two-stroke petrol engine.

7. Disassembly and identification of various parts of a single cylinder four stroke diesel engine.

8. Assembly and operation of single cylinder, four stroke diesel engine.

9. Acquisition of pressure, crank angle data from a single cylinder diesel engine and analysis for combustion parameters.

TEXT BOOKS:

1. Ganesan V., *Internal combustion engines*, Tata McGraw-Hill, New Delhi, 1994.
2. Mathur M. L. & Sharma R. P., *A Course in I. C. Engines*, Dhanpat Rai & Sons, Delhi.

REFERENCE BOOKS:

1. Gill P. W. & Smith J. H., *Fundamentals of I. C. Engines*, Oxford & IBH, New Delhi.
2. Domkundwar A. V. & Domkundwar V. M., *A Course in Internal Combustion Engines*, Dhanpat Rai & Sons, Delhi.

ME 318 MACHINE TOOLS AND METROLOGY LAB

Class: **III/IV B.Tech. I Semester** *Practicals*: **3**
Branch: **Mechanical.** *University Examination:* **50 marks**
Duration of University Examination: **3 hours** *Sessionals:* **25 marks**

LIST OF EXPERIMENTS

PART –A (MACHINE TOOLS)

1. Performimg step turning operation.
2. Performing taper turning operation.
3. Performing thread cutting operation.
4. Performing eccentric turning operation.
5. Performing counter boring, counter sinking and tapping operation on a drilling machine.

6. Milling of a slot on a Cast Iron block.
7. Machining of a V-groove using shaper.

PART- B (METROLOGY)

1. Measurement of linear dimensions using Vernier calipers & Vernier height gauge.
2. Measurement of angular dimensions by Bevel protractor and Sine bar.
3. Measurement of screw thread characteristics by Screw thread micrometer and 3-wire set.
4. Statistical Quality Control. (8 and R chart)
5. Measurement of bore diameter, taper and ovality by bore gauge.
6. Study and use of gauges (Slip gauges, ring and plug gauges) and comparators (Pneumatic, mechanical and electrical).
7. Alignment tests for machine tools (i.e., 1. Lathe 2. Drilling)
8. Surface roughness measurements – Talysurf.
9. Measurement of gear / Thread Profiles – Profile projector.
10. Measurement of straightness and flatness.

Note: Two different Panel of Examiners may be appointed for the conduct of the Lab

TEXT BOOKS :

1. S.J.Choudhary, AKH, Choudhary, *Elements of Workshop Technology, Vol. I & II*, Asia Publishing House, Bombay.
2. I.C.Gupta, *Engineering Metrology*, Dhanpat Rai & Sons, New Delhi.
3. JFW Gayler and Shotbolt, *Metrology for Engineers*, ELBS. London.

REFERENCE BOOKS:

1. R.K.Jain, *Engineering Metrology*, Khanna Publishers, New Delhi.
2. R.L.Murty, *Precision Engineering*, New Age International, New Delhi.
3. Mahajan, *A Text Book on Metrology*, Dhanpat Rai & Sons, New Delhi.

ME 411 FINITE ELEMENT METHODS

Class: **IV/IV B.Tech. I Semester** *Lectures:* **3,** *Tutorials:* **1**
Branch: **Mechanical** *University Examination:* **100 marks**
Duration of University Examination: **3 hours** *Sessionals:* **50 marks**

UNIT-I

1. The Finite Element Method: Introduction, steps of the finite element method, historical background, advantages and limitations of the finite element method, basic concepts-nodes, equilibrium, continuity, degrees of freedom, boundary conditions, derivation of element stiffness equation by direct method: spring and spring assemblage, properties of stiffness matrix, stiffness matrix for an arbitrarily oriented bar, tensile and torsion loads on tapered bar, stepped bar,handling of distributed tensile loads-lumped loads,stress calculations in bar,thermal loads. **6+2**

2. Truss element: Plain stress and plane strain conditions-biaxial stress and strain transformations, displacement transformation, stiffness matrix for truss element by equations of transformation, thermal load on truss element, stress calculation in a truss member, matrix sparsity, banded matrix, semi-band width, node numbering for reduction of band width and sparsity, equation solvers. **3+1**

UNIT-II

3. Beam element: Derivation of stiffness matrix for a beam element-direct method, plane frame element, space frame element, mechanical loads-reduced and consistent loads, fixed and cantilever beams with u.d.l. and point loads, roller, spring supports. **9+3**

UNIT-III

4. Basic elements: Interpolation and Shape functions; Linear, quadratic and cubic interpolations, C^o, C^1 continuity-derivation of stiffness matrix using principle of virtual work-bar, beam element, constant strain triangle, linear strain triangle, bilinear rectangle, quadratic rectangle, Q_9 element, rectangular solid element, 20-node rectangular solid element, comparison of various elements, choice of interpolation functions, consistent nodal loads, stress calculation. **5+1**

5. Isoparametric elements: Bar element, triangles, bilinear quadrilateral (Q4), numerical integration, quadratic quadrilateral, static condensation, choices in numerical integration, load considerations, stress calculations, effect of element geometry, patch test. **4+2**

UNIT-IV

6. Weighted Residual and Variational Methods: Galerkin method, bar and beam elements, Rayleigh-Ritz method, strong and weak form solutions, functional, Euler-Lagrange equation.One Dimensional Heat flow problems. **9+3**

TEXT BOOKS

1. Harold C. Martin, *Introduction to Matrix Methods of Structural Analysis*, McGraw Hill, New York, 1966.
2. Robert D. Cook, David S. Malkus, Michel E. Plesha, Robert J. Witt, *Concepts and Applications of Finite Element Analysis*, 4/e, John Wiley & Sons, Singapore, 2003.

REFERENCE BOOKS

1. P. Seshu, *Text Book of Finite Element Analysis*, Prentice Hall of India, New Delhi, 2003.
2. T.R. Chandrupatla, *Finite Element Analysis for Engineering and Technology*, Universities Press, Hyderabad, 2003.

3. T.R. Chandrupatla, *Introduction to Finite Elements in Engineering,3/e,* Pearson Education, New Delhi, 2002

ME 412 REFRIGERATION AND AIR CONDITIONING

Class: **IV/IV B.Tech. I Semester** *Lectures:* **3,** *Tutorials:* **1**
Branch : **Mechanical** *University Examination:* **100 marks**
Duration of University Examination: **3 hours** Sessionals: **50 marks**

UNIT I

1. **Methods of Refrigeration**: Definition of Refrigeration-units of refrigeration-. Evaporative Refrigeration-Steam jet Refrigeration. Introduction to simple Air Refrigeration system-Bell Coleman cycle. **3+1**

2. **Vapor Compression Refrigeration Systems**: Vapor compression Refrigeration cycle on p-h, T-s -s diagrams. Analysis of vapor compression Refrigeration system-Wet versus dry compression, super heating, sub cooling, effect of suction pressure and discharge pressure on COP. **4+2**

3. **Refrigerants**: classification, Refrigerant nomenclature, properties of refrigerants- thermal, physical and safe working properties. **2+0**

UNIT II

4. **Vapor Absorption Refrigeration System**: Determination of COP of vapor absorption Refrigeration system,, aqua-ammonia absorption system, Electrolux Refrigeration system, Lithium Bromide –water .Absorption Refrigeration system-Comparison of Vapor compression and Vapor absorption Refrigeration System. **5+2**

5. **Non conventional refrigeration systems:** Vortex-tube – description, advantages, disadvantages, applications. Thermo-electric refrigeration system – working principle, comparison between thermo electric and vapour compression refrigeration system. **4+1**

UNIT III

6. **Psychrometry:** Definition of Air-conditioning-Psychrometry-Psychometric properties, Psychrometric chart, Psychometric processes. **3+1**
7. **Cooling Load Calculations**: Design of simple air-conditioning systems-summer, winter and year round air conditioning systems; cooling load calculations. **6+2**

UNIT IV

8. **Pressure losses and duct sizing:** Continuity equation, Bernoulli's equation, pressure losses, variation of pressure losses along a duct, system resistance, duct sizing. **5+3**
9. **Applications of Refrigeration & Air Conditioning:** Household Refrigerators, window Air-conditioners, Air-conditioning of Theatres, Hospitals, Air conditioning in Textile & Dairy milk industries. 4**+0**

TEXT BOOKS:

1. Arora S.C. and S.Domkundwar, *Refrigeration and Air Conditioning*, Dhapatrai & Sons, New Delhi.
2. Arora C.P., *Refrigeration and Air Conditioning*, Tata McGraw-Hill, New Delhi.
3. Ballaney P.L., *Refrigeration and Air Conditioning*, Khanna Publishers, New Delhi

REFERENCE BOOKS:

1. Stoker and Jones, *Refrigeration and Air Conditioning*, McGraw-Hill, New York.
2. Manohar Prasad, *Refrigeration and Air Conditioning*, New Age Internatonal, New Delhi.

3. *ASHRAE Hand Book*, McGraw-Hill, New York.

ME 413 METAL CUTTING SCIENCE

Class: **IV/IV B.Tech. I Semester** *Lectures:* **3,** *Tutorials:* **1**
Branch: **Mechanical** *University Examination:* **100 marks**
Duration of University Examination: **3 hours** *Sessionals:* **50 marks**

UNIT-I

1. **Tool Geometry**: Single point cutting tool-types of reference systems–ASA, ORS/NRS and Maximum Rake System. Inter-relationship. Geometry of twist drill and plain milling cutter.
2. **Chip Formation**: Mechanism of chip formation, shear plane model, relationship for chip geometry, slip line model-types of chips, effect of cutting parameters on chip reduction coefficient. **9+3**

UNIT-II

3. **Mechanics of Chip Formation**: Forces in chip formation-Cutting force analysis- Ernst and Merchant analysis-theory of Lee and Shaffer. Effect of various cutting parameters on cutting forces, Theory of strain and strain rate in metal cutting. Energy consideration.
4. **Measurement of Cutting Forces and Temperatures**: Principles of strain gauges-Dynamometer-principle and construction of two, three component lathe dynamometer. Source of heat in metal cutting-temperature zones. Estimation of average cutting temperature. Experimental methods of cutting temperature measurement. **9+3**

UNIT-III

5. **Tool Wear:** Different causes-various forms of tool wear-measurement of tool wear. Tool life. Machinability-criterion for machinability-influence of variables affecting machinability.
6. **Tool Materials**: Various tool materials, their properties and general guidelines for selection.
7. **Cutting Fluids**: Functions, properties, types and selection.
8. **Economics of Metal Cutting**: Various types of costs and their estimation. Determination of cutting speed for maximum production rate and minimum cost criteria. **9+3**

UNIT-IV

9. **Modern Machining Processes**: Principles and application of Abrasive Jet Machining, Ultra Sonic Machining, Electro Chemical Machining, Electric Discharge Machining, Electron Beam Machining, Laser Beam Machining and Plasma Arc Machining. **9+3**
10. **Design of Cutting Tools**: Design of single point cutting tool, Twist drill, Design of form tools-Flat and Circular.

TEXT BOOKS:

1. A.Bhattacharya, *Metal Cutting Theory and Practic*e, Central Book Publishers, Calcutta.
2. Ghosh and Mallik, *Manufacturing Science,* Affiliated East-West Press, New Delhi.
3. Pandey and Shan, *Modern Machining Processes,* Tata McGraw-Hill, New Delhi.

REFERENCE BOOKS:

1. *Hand Book on Production Technology*, HMT,Bangalore.
2. Boothroyd.G, *Fundamentals of Metal Machining*, Edward Arnold, London.
3. P.C.Sharma, *Production Engineering*, Dhanpat Rai & Sons, New Delhi.
4. Milton C Shaw, Metal Cutting Principles, CBS Publishers&Distributors,Delhi

ME 414 MECHATRONICS

Class: **IV/IV B.Tech. I Semester** *Lectures:* **3,** *Tutorials* : 1
Branch: **Mechanical** *University Examination:* **100 marks**
Duration of University Examination: **3 hours** *Sessionals:* **50 Marks**

UNIT-I

1. **Introduction to Mechatronics**: Measuring systems**,** control systems, Microprocessor based controllers. Mechatronics approach.
2. **Sensors and Transducers**: Performance, terminology. displacement, position, proximity, velocity and motion. **9+3**

UNIT-II

3. **Actuation Systems**: Pneumatic and hydraulic systems, directional control valves, pressure control valves, process control valves and rotary actuators.
4. **Electrical Actuation Systems**: Electrical system, mechanical switches, solid-state switches solenoids, D.C.motors, AC motors and stepper motors. **9+3**

UNIT-III

5. **Basic Models**: Mathematical models, mechanical system building blocks, electrical system building blocks, fluid system building blocks and thermal system building blocks.
6. **System Models**: Engineering system, rotational-translational system, electro- mechanical systems and hydraulic-mechanical system. **9+3**

UNIT-IV

7. **System Transfer functions**: Transfer function, first order system, second order system, system in series and systems with feedback loops.
8. **Closed Loop Controllers**: Continuous and discrete processes. Control modes. Two step mode and proportional mode. Derivative control,integral control, PID controller,digital controllers,velocity controllers and adaptive control.**9+3**

TEXT BOOKS:

1. Bolton W., *Mechatronics*, 2/e, Addison Wesley, New York, 1999.
2. Nitaigour Premchand Mahalik, *Mechatronics: Principles Concepts and Applications, 1/e, TMH, New Delhi, 2003*

REFERENCE BOOK:

1. HMT, *Mechatronics*, Tata McGraw-Hill, New Delhi, 2000.
2. Devdas Shetty, Richard and Kilk, *Mechatronics System and Design*, 1/e, PWS Publishing Co., Boston, 2001.

ME 415 INDUSTRIAL ENGINEERING

Class: **IV/IV B.Tech. I Semester** *Lectures:* **3** *Tutorials:* **1**
Branch: **Mechanical** *University Examination:* **100 marks**
Duration of University Examination: **3 hours** *Sessionals:* **50 marks**

UNIT-I

1. **Productivity**: Introduction to productivity, factors affecting productivity, productivity improvement, Break even analysis, functions and different fields of Industrial Engineering. 2+0
2. **Facility Location and Plant Layout Design**: Introduction to Plant location and layout, procedure of location , factors influencing location, objectives of plant layout, types of layouts, factors affecting layout, layout design-material flow pattern, string diagram and travel charts 4+2

3. **Material handling System**: Introduction, objectives, principles, analysis of material handling, types and selection of MH system, handling system design. **3+1**

UNIT-II

4. **Work Study:** Introduction to work study, Historical development, work study techniques, Method study- Introduction, methods improvement, questioning techniques, method study tools, process charts, Motion Study, Therbligs, principles of motion economy, Micro motion Study, introduction to ergonomics. 5+2
5. **Work Measurement:** Introduction, time study equipment, time study procedure, data collection, PMTS, MTM, work sampling, standard time calculations, performance rating, systems of rating. 4+1

UNIT-III

4+1UNIT-III

6. **Job Evaluation, Merit Rating and Wage Incentive Plans**: Introduction, Objectives of Job evaluation, methods of job evaluation, Wage structures, Methods of rating, Wage Incentive plans, Value engineering. 3+1
7. **Statistical Quality Control(SQC)**: Introduction, Control Charts (X,R,P and C), Acceptance Sampling, OC-Curve, Introduction to Reliability, Availability and Redundancy 5+1
8. **Organization Structure:** Introduction, departmentalism, authority, span of control chain of command, types of organization. 2+0 **UNIT-IV**
9. **Decision Analysis:** Game theory- pure and mixed strategies, LP Models- graphical and simplex method, Simple waiting line models, assignment models. 6+2
10. **System simulation:** Introduction to simulation, MIS and DBMS 2+0
11. **Factory Legislative Acts:** Factories Act, Payment of Wages Act, Workmen's Compensation Act. 2+0

TEXT BOOKS:

1. Hajra Choudhary *Production Management-Integrated with Industrial Engineering Appproach*, Media Promoters and Publishers, Bombay, 1993.
2. Taha, H., *Operations Research*, Tata McGraw-Hill, New Delhi.
3. Basu, et.al., *Works Organisation and Management*, Oxford & IBH, New Delhi.

REFERENCE BOOKS:

1. Barnes Ralph M, *Motion and Time Study* 7/e, John Wiley, New York.
2. Maynard, *Hand Book of Industrial Engineering*, McGraw-Hill, New York.
3. B.Kumar, Industrial Engineering, Khanna Publishers, New Delhi.
4. ILO, *Introduction to Work Study*, Oxford & IBH, New Delhi.

ME 416 REFRIGERATION, AIR CONDITIONING AND FUELS LAB

Class: **IV/IV B.Tech. I Semester** *Practicals:* **3**
Branch : **Mechanical** *University Examination:* **50 marks**
Duration of University Examination: **3 hours** *Sessionals:* **25 marks**

LIST OF EXPERIMENTS

1. C.O.P. of vapor compression refrigeration system.
2. Calculation of psychometric property variations in different processes.

3. Bypass factor of cooling coil
4. Vortex Tube Refrigeration System
5. Performance of Vapor Absorption Refrigeration System.
6. Performance testing of window air-conditioner
7. Psychrometric process of evaporative cooling.
8. Viscosity measurement of given oil by Redwood viscometer.
9. Estimation of carbon residue in a given sample using Ramsbotom apparatus.
10. Determination of flash & fire points of a given fuel using Cleveland's apparatus.
11. Finding calorific value of a given liquid fuel using bomb calorimeter.
12. Finding calorific value of a given gaseous fuel using Junker's calorimeter.

TEXT BOOKS:

1. Arora C.P., *Refrigeration and Air Conditioning*, Tata McGraw-Hill, New Delhi.
2. Arora S.C. and S. Domkundwar, *Refrigeration and Air Conditioning*, Dhapat Rai & Sons, New Delhi.

REFERENCE BOOKS:

1. Stoker and Jones, *Refrigeration and Air Conditioning*, McGraw Hill, New York.
2. Manohar Prasad, *Refrigeration and Air Conditioning*, New Age International, New Delhi.
3. *ASHRAE Hand Book*, McGraw-Hill, New York.
4. Ballaney P.L., *Refrigeration and Air Conditioning*, Khanna Publishers, New Delhi.

ME 417 METAL CUTTING AND MECHATRONICS LAB

Class: **IV/IV B.Tech. I Semester** *Practicals:* **3**
Branch: **Mechanical** *University Examination:* **50 marks**
Duration of University Examination: **3 hours** *Sessionals:* **25 marks**

LIST OF EXPERIMENTS

PART – A (METAL CUTTING)

1. Grinding of a single point cutting tool.
2. Determination of shear angle in turning process.
3. Determination of shear angle in shaping process.
4. Study of chip formation in machining Ferrous and Non-Ferrous materials.
5. Determination of average chip-tool interface temperature by natural work-tool thermocouple method.
6. Determination of cutting forces in turning operation using a lathe-tool dynamometer
7. Tool wear measurement.

PART – B (MECHATRONICS)

1. Controlling A.C.Non servomotor clockwise and anti clockwise with time delay.
2. Controlling A.C.Non servo motor using digital inputs (sensors and micro switches).

3. Control of D.C servomotor in open loop and closed loop with time delay and number of times
4. Homing and Teach pendant.
5. PID turning to obtain the accuracy and smoothness in motion of servo motors.
6. Loop operation of LSB between two positions using time delay and number of times.
7. Controlling loop operations using inputs.
8. Integration of AC Non servo motor, pneumatic cylinder and Axis1.
9. Integration of Axis1, AC Non- servomotor and pneumatic cylinder with digital inputs.
10. Hydraulic, Pneumatic and Robo X Simulation.

TEXT BOOKS:

1. V.C.Venkatesh and H.Chandra Sekaran, *Experimental Techniques in Metal Cutting*, Prentice Hall of India, New Delhi.
2. *ATS Manual of L.S. Mechatronics*, Secunderabad, 2000.

REFERENCE BOOKS:

1. Bhattacharya, *Metal Cutting Theory and Practice,* Central Book Publishers, Calcutta.
2. S.J.Choudhary, AKH, Choudhary, *Elements of Workshop Technology*, *Vol. I & II*, Asia Publishing House, Bombay.
3. W.Bolton, *Mechatronics*, *2/e*, Addison Wesley Longman Inc., USA, 1999.

ME 420 COMPUTER INTEGRATED MANUFACTURING

Class: **IV/IV B.Tech. II Semester** *Lectures:* **3**
Branch : **Mechanical** *University Examination:* **100 marks**
Duration of University Examination: **3 hours** *Sessionals:* **50 marks**

UNIT-I

1. **Automation in Production Operations:** Introduction, Functions in manufacturing, Types of automations, Production concepts and mathematical modeling, automation strategies. Organization and information processing in manufacturing system. **9**

UNIT-II

2. **Numerical Control of Production Systems**: Basic elements; principle and types of NC CNC, DNC systems. NC Part programming-Manual, computer aided part programming. Adaptive control –Introduction, types and applications. **9**

UNIT-III

3. **Introduction to Industrial Robots:** Types, configuration, sensor technology and applications
4. **Group Technology**: Introduction, Part families, Classification and coding-OPITZ code. Benefits of GT.
5. **CAPP**: Introduction, types of process planning- retrieval and generative, applications. **9**

UNIT-IV

6. **Computerized Manufacturing Planning Systems:** introduction, Shop floor control. Automated inspection systems-Co-ordinate Measuring Machine and machine vision. Computer networks for manufacturing-LAN, STAR, RING and BUS topologies. **9**

TEXT BOOKS:

1. Mikell P.Groover, *Automation, Production, System and Computer Integrated Manufacturing*, Prentice Hall of India, New Delhi, 1989.
2. PN Rao, NK Tiwari and TK Kundra, *Computer Aided Manufacturing,* Tata McGraw-Hill, New Delhi.

REFERENCE BOOKS:

1. Yorem K. *Computer Numerical Control of Manufacturing Systems,* McGraw-Hill, New York.
2. Surendra Kumar and A.K.Jha, *Technology of Computer Aided Design/ Manufacturing,* Dhanpat Rai & Sons, New Delhi.
3. Radhakrishnan, et.al, *CAD/CAM/CIM*, 2/e, New Age International, New Delhi, 2000.

ME 421 COMPUTER AIDED DESIGN & GRAPHICS

Class: **IV/IV B.Tech. II Semester** *Lectures:* **3**
Branch : **Mechanical** *University Examination:* **100 marks**
Duration of University Examination: **3 hours** *Sessionals:* **50 marks**

UNIT-I

1. **Overview of Computer Aided Drafting:** Applications, fundamentals of computer architecture, Input-Output devices, Interactive display devices.
2. **Graphics Primitives:** Monitor pixels and frame buffers, generation of points, lines, and circles, algorithms. **9**

UNIT-II

3. **Transformations:** 2D and 3D transformations scaling, translation, shearing, Rotation, Reflection, homogeneous transformation, Matrix operations, concatenation, isometric, orthographic and perspective projections. **9**

UNIT-III

4. **Generation of Curves:** Cubic splines, Bezier Curves, B-spline curve, NURBS. **9**

UNIT-IV

5. **Geometric Modeling:** Design of surfaces, Bezier surfaces, B-spline surfaces, Solid modeling-wire frame model, winged edge data structures, Euler's operation, Boundary representation techniques and constructive solid geometry.
6. **Engineering Data Management Systems:** Graphic standards, Data exchange standards, Model storage and data structures, Data structure organization, Tree data structures, Network data structures, relationship data structures. **9**

TEXT BOOK

1. David F.Rogers and J.Alan Adams, *Mathematical Elements for Computer Graphics*, McGraw-Hill, New York.
2. I.Zeid, *CAD/CAM*, Tata McGraw-Hill, New Delhi, 2001.

REFERENCE BOOKS

1. Donald Hearn and M.Pauline Baker, *Computer Graphics, 2/e*, Prentice-Hall of India, New Delhi, 2000.
2. James D. Foley, Andries Van Dam, et. al., *Computer Graphics: Principles and Practice, 2/e in C*, Pearson Education, New Delhi, 2001.

ME 422A FLEXIBLE MANUFACTURING SYSTEM
(ME 422 Professional Elective)

Class: **IV/IV B.Tech. II Semester** *Lectures:* **3**
Branch : **Mechanical** *University Examination:* **100 marks**
Duration of University Examination: **3 hours** *Sessionals:* **50 marks**

UNIT-I

1. **Introduction**: Elements, classification and applications of FMS.
2. **Automated Flow Lines**: Detroit type automation-automated flow lines, general forms of work flow, methods of work transport, transfer mechanisms, control functions, analysis of automated flow lines, automated assembly systems and line balancing.

9

UNIT-II

3. **Material Handling System**: Types of material handling equipment-conveyors, cranes, monorails. Principles and analysis of material handling systems- conveyors.
4. **Automated Material Handling System:** Automated Guided Vehicle Systems-types, vehicle guidance and routing. Quantitative analysis of AGV systems. **9**

UNIT-III

5. **Industrial Robots**: Types, physical configuration, basic motions. Types of drive systems-Electric, pneumatic and hydraulic. Sensors and end effectors. Work cell design and robot applications. Robot programming methods.
6. **Automated Storage and Retrieval Systems (AS/RS)**: Principles, classification, basic components and analysis of AS/RS. **9**

UNIT-IV

7. **Automated Inspection and Assembly Systems**: Co-ordinate Measuring Machine (CMM), Machine Vision. Automated Assembly-types and applications.
8. **FMS:** Layouts, configuration, planning and analysis. Dead locks-detection, avoidance and prevention. Applications and benefits of FMS. **9**

TEXT BOOKS:

1. Mikell P.Groover, *Automation, Production System and Computer Integrated Manufacturing*, Prentice Hall of India, New Delhi.
2. Vishwanathan N. and Narasimhan, *Performance Modeling of Automated Manufacturing Systems*, Prentice Hall of India, New Delhi, 2000.

REFERENCE BOOK:

1. PN.Rao, NK.Tiwari and TK Kundra, *Computer Aided Manufacturing*, Tata McGraw-Hill, New Delhi.

ME 422B TOTAL QUALITY MANAGEMENT

(ME 422 Professional Elective)

Class: **IV/IV B.Tech. II Semester** *Lectures:* **3**
Branch : **Mechanical** *University Examination:* **100 marks**
Duration of University Examination: **3 hours** *Sessionals:* **50 marks**

UNIT-I

1. **Introduction**: The need for Total Quality Management. Changing structure of industrialized economies. Traditional approach to quality management-Inspection, rejection and quality assurance. Quality-A new perspective.
2. **Concepts of Total Quality Management**: TQM defined. Origins and growth of the concepts of TQM. TQM and traditional management thinking-TQM as an organization development process-Ingredients of success-Benefits from successful TQM installations. **9**

UNIT-II

3. **Quality Systems**: Relationship of TQM to the quality management standard ISO 9000-Model for quality assurance in Design, Development, Production, Installation and servicing (ISO 9001-1994), ISO 14000 Series Certification, QS 9000 Certification and Quality Auditing, Software Engineering Industry Certification- CMM Levels
4. **Approaches to Implementation of TQM**: Managerial Decree approach- Managerial sales compaign approach-Spread of knowledge approach-Quality circles approach-Packaged approaches to implementation of TQM (Edward Demings, Juran, Philip Crosby approaches)-Planned change approach-The Seven 'P' Process-Role of Awards in implementing TQM. **9**

UNIT-III

5. **Tools and Techniques for TQM**: Idea Generation-Consensus-Process definition-Collecting Data-Analyzing cause and effect-Analyzing and displaying data- (Charts, Force field analysis, Histogram, Matrix diagram, Pareto chart, Prioritization Matrix, scatter diagram, SPC-Control charts and Process Capability and 6 Sigma Approach.
6. **Planning Tools**: Activity network diagrams-Gantt chart, Process Decision Program Chart, Storey boards, Tree diagram.
   9

UNIT-IV

7. **Organizational Aspects of TQM**: Planning, Developing LIMP (Local Implementation Master Plan), CID continuum (Communication Involvement and Development), Quality Policy Deployment. Creating the environment for participation-Attitude Surveys, Design and Testing. Organizational Sub-systems- Team approach, team dynamics and maintenance, team roles and contributions. Business process Re-engineering.

8. **Team Structures in TQM**: Consultative groups, Permanent, functional or departmental teams, cross-functional problem solving teams-Fast track process- objectives and selection of teams. **9**

TEXT BOOKS:

1. John Pike and Richard Barnes, *TQM in action*, Chapman & Hall, New York.
2. L Suganthi and Anand A Samuel, *Total Quality Management,PHI,,New Delhi*

REFERENCE BOOK:

1. Roger C. Swanson, *The Quality Improvement Handbook-Team Guide to Tools and Techniques*,Vanity Books International, Deep & Deep Publishing Co., New Delhi.
2. SD Bagade, *Total Quality Management*, Himalaya Publishing, Mumbai, 2000.

ME 422C TURBOMACHINARY

(ME422 Professional Elective)

Class: **IV/IV B.Tech. I Semester** *Lectures:* **3**
Branch: **Mechanical** *University Examination:* **100 marks**
Duration of University Examination: **3 hours** *Sessionals:* **50 marks**

UNIT I

1. **Compressors:** Classification, advantages of compressed air, reciprocating compressors-working principle,iso-thermal efficiency, effect of clearance,volumetric efficiency, multistage compression, effect of volumetric efficiency, condition for maximum efficiency, heat rejected in compressor and inter cooler. **9**

UNIT II

2. **Rotary compressors:** Classification, comparison of reciprocating and rotary compressors, working principle of positive and non positive displacement compressors. **5**

3. **Combustion chambers:** Introduction, Classification, requirements of good combustion chambers, working principle of can and annular type combustion chambers. 4

UNIT III

4. **Gas turbines:** Introduction, classification, open and closed cycles, comparison of cycles, intercooling, re-heating and regeneration cycles, co-generation systems, comparison of gas turbines and steam turbines, applications of gas turbines. **9**

UNIT IV

5. **Jet propulsion:** Introduction, Ram jet, pulse jet, turbo jet and turbo prop engines, thrust equation, specific thrust of turbo jet engine, diffuser efficiency, thermal efficiency of turbo jet engine, propulsive efficiency. **6**
6. **Rocket propulsion:** Introduction, classification, chemical rockets, rocket propellants, electric propulsion engines, iron rocket, magneto plasma rocket engines, Solid and liquid propellant rockets. **3**

TEXT BOOKS:

1. P.R. Khajuria, S.P.Dubey, Gas Turbines &Propulsive systems, Dhanapat Rai & sons
2. M.L.Mathur & F.S. Mehta, Thermal engg., Jain publications.

REFERENCE BOOKS:

1. Gill P.W. & Smith, Fundamentals of IC engines.

D.S. Kumar& Vasandhani, Heat engg, Metropolitian publications

ME 422D NON-CONVENTIOINAL ENERGY SOURCES

(ME 422 Professional Elective)

Class: **IV/IV B.Tech. II Semester** *Lectures:* **3**
Branch: **Mechanical** *University Examination:* **100 marks**
Duration of University Examination: **3 hours** *Sessionals:* **50 marks**

UNIT-I

1. INTRODUCITON: Distinction between Conventional and Non-conventional sources of energy- Brief description of the different sources. **2**
2. SOLAR ENERGY: Solar energy option-Solar radiation-Solar flat Plate Collectors-Air heaters-Collectors with booster mirrors-Concentric collectors-Thermal storage systems. Solar Photovoltaic (SPV) Systems: Introduction. Prospects of SPV systems. Principle of a PV cell. Large scale SPV systems. Economic considerations of SPV Systems. PV Cell Technology. Merits and limitations of SPV Systems.Applications of SPV Systems-street lighting, domestic lighting, Battery charging, SPV pumping systems. Concept of Satellite solar power systems (SSPS). **7**

UNIT-II

3. WIND ENERGY: Brief History of wind power-Principles of wind power-Operation of a wind turbine-Site Characteristics. **4**
4. GEOTHERMAL ENERGY: Origin and Types of geothermal energy-Operational difficulties-Vapor dominated systems-Liquid dominated systems-Petro-thermal systems-Hybrid geothermal systems. **5**

UNIT-III

5. ENERGY FROM OCEANS: Ocean temperature differences-the open and closed cycle analysis- Modification of the Open cycle Analysis-closed or the Anderson cycle Analysis-Ocean Waves-Wave motions and tides-Energy from the Waves. **9**

UNIT-IV

6. BIO ENERGY: Introduction-Biomass conversion-Technologies-Wet processes-Dry processes-Photosynthesis-Biogas generation-Biogas from plant wastes-methods of maintaining Biogas production-Utilization of biogas. Biomass gassification- Applications of gassifiers. **5**
7. MANAGETO HYDRO DYNAMIC (MHD) POWER GENERATION: MHD systems-Open and closed systems-MHD design problems and Developments-Advantages of MHD Systems. **4**

TEXT BOOKS:

1. Bansel N.K., M.Kaleeman, and M.Miller, *Renewable Energy Sources and Conversion Technology*, Tata McGraw-Hill, New Delhi.
2. Rai G.D., *Non-conventional Energy Sources*, Khanna Publishers, New Delhi.

REFERENCE BOOKS:

1. EL-Wakil M.M., *Power Plant Technology*, McGraw-Hill, New York.
2. Duffie and Beckman, *Solar Energy Thermal Processes*, John Wiley & Sons, New York.

ME 422E FAULT DIAGNOSIS OF MACHINES
(ME422 Professional Elective)

Class: **IV/IV B.Tech. II Semester** *Lectures:* **3**
Branch : **Mechanical** *University Examination:* **100 marks**
Duration of University Examination: **3 hours** *Sessionals:* **50 marks**

UNIT-I

1. **Introduction**: System failure, component failure, failure decisions, failure classifications, types of failure, failure investigations, causes of failure, Methods of maintenance- condition based maintenance, preventive maintenance, proactive maintenance, time based maintenance, predictive maintenance.
2. **Condition Monitoring**: Need and importance of condition monitoring, the decision to monitor, common monitoring techniques, online/off-line monitoring, commonly measured operating characteristics, condition monitoring/predictive maintenance as used in industry. **9**

UNIT-II

3. **Transducers and Instrumentation for Recording and Analysis**: Vibration transducers, Displacement transducers, velocity pickups, accelerometers, Temperature transducers, Vibration meters, FFT analyzers, Time domain instruments, Tracking analyzers, Magnetic tape recorders, amplifiers. **9**

UNIT-III

4. **Analyzing Machine Condition**: General characteristics-Process measurements, vibration. Typical vibration sources, symptoms of other common machinery problems. Development and use of acceptance limits-guide lines and limits based on physical constraints, Vibration severity criteria, changing machinery condition-time trends, statistical limits, detailed diagnostic monitoring. **9**

UNIT-IV

5. **Data Processing & Vibration Analysis**: Fourier analysis, frequency analysis techniques, vibration signature, vibration monitoring equipment, system monitors and vibration limit detectors.
6. **Performance Trend Monitoring**: Primary and secondary performance parameters, performance monitoring systems. **9**

TEXT BOOKS

1. Collacott, R.A., *Mechanical Fault Diagnosis and Condition Monitoring,* Chapman and Hall, London, 1977.
2. John S.Mitchell: *Introduction to Machinery Analysis and Monitoring,* 2/e, Pennwell Books, Oklahama.

REFRENCE BOOKS

1. Trever M. Hunt, *Condition Monitoring of mechanical & Hydraulic Plant* – A concise introduction and guide, Chapman & Hall, Madras

2. Philip Wild, *Industrial Sensors and applications for Condition Monitoring*, Mechanical Engineering Publications Ltd., London Joseph Mathew, *Common Vibration Monitoring Techniques – handbook of Condition Monitoring*, Chapman & Hall, 1998

ME 422F ROBOTICS
(ME 422 Professional Elective)

*Class:***IV/IV B.Tech. II Semester** *Lectures:* **3**
Branch: **Mechanical** *University Examination:* **100 marks**
Duration of University Examination: **3 hours** *Sessionals:* **50 marks**

UNIT-I

1. Basic concepts in robotics, classification of robotics, Drives and control systems for robotics.

2. Robot arm kinematics: Direct kinematics, transformation matrices for rotations, combined rotations, Denavit -Hartenberg representation.

UNIT-II

3. Trajectory planning: general considerations in trajectory planning, joint interpolated trajectories, planning of Cartesian path trajectories

UNIT-III

4. Control of robot manipulators: control of robot arm, computed torque technique, feed back control, resolved motion control, **adaptive control**

UNIT-IV

5. Robot vision and sensing: Different types of sensors, proximity, touch, force and torque sensors, low level and high level vision, vision systems

6. Robot programming languages: VAL, RAIL, AML

TEXT BOOK

1. K.S. Fu, R.C. Gonzalez, C.S.G. Lee, *Robotics*, McGraw Hill, 1987.

REFERENCES

1. Y.Koren, *Robotics for Engineers*, McGraw Hill, 1985.
2. J.J. Craig, *Robotics*, Addison-Wesley, 1986.

ME 423 ENERGY MANAGEMENT AND ENGINEERING

Class: **IV/IV B.Tech. II Semester** *Lectures:* **3**
Branch: **Mechanical** *University Examination:* **100 marks**
Duration of University Examination: **3 hours** *Sessionals:* **50 marks**

UNIT-I

1. INTRODUCTION: History and present status of energy sources for modern power plants; Types of power plants; Power potentiality in India. **2**
2. NUCLEAR POWER PLANTS: Introduction, Fuels, components of reactor, properties of coolants and moderators, Types of Reactors, Boiling Water, Pressurized Water, Gas Cooled, Breeder and liquid metal Cooled ,Heavy water cooled and moderated, organic moderated and cooled Reactors, Indian nuclear power stations,
comparison between nuclear and thermal power plants, Disposal of Nuclear waste.**7**

UNIT-II

3. STEAM POWER PLANTS: Review of steam cycles for power plants; site selection, power plant layout and system components; Fuel handling; Burning-over feed and under feed stokers, Pulverized fuel and its advantages, Air circulation, Water treatment, cooling towers, Principle of Fluidized Bed Combustion (FBC) and its
advantages, Ash handling and dust collection. **9**

UNIT-III

4. HYDROLOGY: Introduction, Rain fall, run-off and its measurements, flow duration curves, mass curves and storage. **4**
5. HYDEL POWER PLANTS: Site selection, advantages of hydel plants over thermal plants. High, medium and low head hydel plants, Runoff River plants, storage reservoir and pumped storage plants, General arrangement of hydel power plants. **5**

UNIT-IV

6. POWER ECONOMICS: Introduction, load curves, demand, load, diversity and plant capacity factor. Elements of costs of power, fixed and operating costs, Depreciation methods. Selection of power generation method, input and output curves, economical load division, tariff methods for electrical energy. **9**

TEXT BOOK:

1. Arora & Domakundwar, *A Course in Power Plant Engineering*, Dhanpat Rai & Sons, New Delhi.
2. Nag P.K., *Power Plant Engineering*, Tata McGraw-Hill, New Delhi.

REFERENCE BOOKS:

1. Kajuria and Dubey, *Gas Turbine & Jet Propulsion*, Dhanpat Rai &Sons, Delhi.
2. Nagpal G.R., *Power Plant Engineering*, Khanna Publishers, New Delhi.

3. Wakil M.M.El., *Nuclear Energy Conversion*, McGraw-Hill, New York.

ME 424 CAD/CAM LAB

Class: **IV/IV B.Tech. II Semester** *Practicals:3*
Branch : **Mechanical** *University Examination:* **50 marks**
Duration of University Examination: **3 hours** *Sessionals:* **25 marks**

LIST OF EXPERIMENTS

PART –A (CAD LAB)

1. To design and implement a program for line drawing using Bresenhams Integer line algorithim.
2. Implementation of general two-dimensional rotation, reflection and scaling in modules, generation of required transformation matrices using the above modules.
3. Curve generation and manipulation program for cubic spline curve.
4. Curve generation and manipulation program for Bezier curve.
5. Orthographic Projections of Standard Mechanical components using AutoCAD.
6. Isometric Projections of Standard Mechanical components using AutoCAD.
7. Solid Part modeling of Simple mechanical components Using CATIA.
8. Assembly of solid models of simple mechanical devices using CATIA
9. Finite Element Analysis Using ANSYS
   - Simple 2D Truss problems.
   - Beam Problems
   - Plate with Circular Hole.
   - Solid imported from CATIA subjected to simple loads
   - One dimensional Thermal problems

PART – B (CAM LAB)

1. Prepare a part program for step turning component and run simulation.
2. Prepare a part program for metric threads by canned cycles and run simulation.
3. Produce a step and taper component on CNC lathe.
4. Produce a contour profile component on CNC lathe.
5. Produce a contour profile component on CNC milling machine.
6. Produce a cam profile component on CNC milling machine.
7. Build and run a simulation model of a job shop.
8. Build and run a simulation model of a material handling system.

TEXT BOOKS:

1. P.Radha Krishnan, *Introduction to CNC Machines*, New Age International, New Delhi.
2. Jerry Banks, Introduction to Discrete event simulation, Mc Graw-Hill, New York
3. James D. Foley, Andries Van Dam, et.al., *Computer Graphics-Principles and Practice,2/e,* Addison Wesley, 1997.
4. Verification Manual ANSYS

5. T.R.Chandrupatla, and A.D.Belegundu, *Introduction to Finite Elements in Engineering*, 2/e, Prentice Hall of India, New Delhi.

REFERENCE BOOKS:

1. *CNC Lathe,Milling machine Reference Manuals.*
2. P.N.Rao *Computer Aided Manufacturing,* Tata McGraw-Hill, New Delhi.

Note: Two separate Panels may be formed for conduct of Laboratory examination.