DEPARTMENT OF MECHANICAL ENGINEERING

FACULTY OF ENGINEERING & ARCHITECTURE

JNV UNIVERSITY, JODHPUR

SYLLABUS

BACHELOR OF ENGINEERING

MECHANICAL

(SEMESTER SCHEME)

FOUR YEAR INTEGRATED COURSE

B. E. Second Examination, 2018 (Session 2017-18)

B. E. Third Examination, 2019 (Session 2018-19)

B. E. Final Examination, 2020 (Session 2019-20)

B.E. II Year (Mechanical), 2017-18

SEMESTER III EXAMINATION SCHEME

Branch Code	*Subject Code*	*Subject*	*Lectures*	*Tutorials*	*Practicals*	*Contact Hours*	*Credits*	*Exam Hours*	*Marks*		
									Theory	*Pract & Sess*	*Total*
A: Theory Papers											
ME	201 A	Engineering Thermodynamics (M)	2	1	-	3	3	3	100	-	100
ME	202 A	Materials Technology (M)	3	-	-	3	3	3	100	-	100
ME	203 A	Kinematics of Machine (M)	2	1	-	3	3	3	100	-	100
ME	204 A	Mechanics of Solids (M)	2	1	-	3	3	3	100	-	100
MA	205 A	Mathematics (M)	3	-	-	3	3	3	100	-	100
ME	206 A	Mechanical Measurements & Instrumentation (M)	3	-	-	3	3	3	100	-	100
Total (A)			**15**	**3**	**-**	**18**	**18**	**-**	**600**	**-**	**600**
B: Practicals and Sessionals											
ME	221 B	Thermal Engineering Lab. I (M)	-	-	3	3	1.5	-	-	100	100
ME	222 B	Machine Drawing (M)	-	-	6	6	3	-	-	100	100
ME	223 B	Mechanics of Solids Lab. (M)	-	-	2	2	1	-	-	100	100
ME	224 B	Mechanical Measurements & Instrumentation Lab. (M)	-	-	3	3	1.5	-	-	100	100
Total (B)			**-**	**-**	**14**	**14**	**7**	**-**	**-**	**400**	**400**
Grand Total (A+B)			**15**	**3**	**14**	**32**	**25**	**-**	**600**	**400**	**1000**

B.E. II Year (Mechanical), 2017-18

SEMESTER IV EXAMINATION SCHEME

Branch Code	*Subject Code*	*Subject*	*Lectures*	*Tutorials*	*Practicals*	*Contact Hours*	*Credits*	*Exam Hours*	*Marks*		
									Theory	*Pract & Sess*	*Total*
A: Theory Papers											
ME	251 A	Refrigeration & Air Conditioning (M)	2	1	-	3	3	3	100	-	100
ME	252 A	Foundry & Welding Engineering (M)	3	-	-	3	3	3	100	-	100
ME	253 A	Kinematics & Dynamics of Machines (M)	3	1	-	4	4	3	100	-	100
ME	254 A	Machine Design I (M)	2	-	-	2	2	3	100	-	100
ME	255 A	Fluid Mechanics I (M)	3	1	-	4	4	3	100	-	100
		OPEN ELECTIVE - I	3	-	-	3	3	3	100	-	100
Total (A)			**16**	**3**	**-**	**19**	**19**	**-**	**600**	**-**	**600**
B: Practicals and Sessionals											
ME	271 B	Thermal Engineering Lab. II (M)	-	-	3	3	1.5	-	-	100	100
ME	272 B	Production Engineering Lab. I (M)	-	-	3	3	1.5	-	-	100	100
ME	273 B	Machine Design I (M)	-	-	4	4	2	-	-	100	100
EE	274 B	Electrical Engineering Lab. (M)	-	-	2	2	1	-	-	100	100
Total (B)			**-**	**-**	**12**	**12**	**6**	**-**	**-**	**400**	**400**
Grand Total (A+B)			**16**	**3**	**12**	**31**	**25**	**-**	**600**	**400**	**1000**
FE	200E	Co-curricular Activities	-	-	-	-	**0**	-	-	-	**100**

B.E. III Year (Mechanical), 2018-19

SEMESTER V EXAMINATION SCHEME

Branch Code	*Subject Code*	*Subject*	*Lectures*	*Tutorials*	*Practicals*	*Contact Hours*	*Credits*	*Exam Hours*	*Marks*		
									Theory	*Pract & Sess*	*Total*
A: Theory Papers											
ME	301 A	Fluid Mechanics II (M)	3	1	-	4	4	3	100	-	100
ME	302 A	Production Machine Tools (M)	3	-	-	3	3	3	100	-	100
ME	303 A	Industrial Organization & Management (M)	3	-	-	3	3	3	100	-	100
ME	304 A	Dynamics of Machines (M)	3	1	-	4	4	3	100	-	100
ME	305 A	Machine Design II (M)	2	-	-	2	2	3	100	-	100
		OPEN ELECTIVE - II	3	-	-	3	3	3	100	-	100
Total (A)			**17**	**2**	**-**	**19**	**19**	**-**	**600**	**-**	**600**
B: Practicals and Sessionals											
ME	321 B	Thermal Engineering Lab. III (M)	-	-	3	3	1.5	-	-	100	100
ME	322 B	Production Engineering Lab. II (M)	-	-	3	3	1.5	-	-	100	100
ME	323 B	Machine Design II (M)	-	-	4	4	2	-	-	100	100
ME	324 B	Computer Aided Design Lab. (M)	-	-	2	2	1	-	-	100	100
Total (B)			**-**	**-**	**12**	**12**	**6**	**-**	**-**	**400**	**400**
Grand Total (A+B)			**17**	**2**	**12**	**31**	**25**	**-**	**600**	**400**	**1000**

B.E. III Year (Mechanical), 2018-19

SEMESTER VI EXAMINATION SCHEME

Branch Code	*Subject Code*	*Subject*	*Lectures*	*Tutorials*	*Practicals*	*Contact Hours*	*Credits*	*Exam Hours*	*Marks*		
									Theory	*Pract & Sess*	*Total*
A: Theory Papers											
ME	351 A	Steam Power Engineering (M)	3	1	-	4	4	3	100	-	100
ME	352 A	Metal Cutting & Metrology (M)	3	-	-	3	3	3	100	-	100
ME	353 A	Industrial Engineering (M)	3	-	-	3	3	3	100	-	100
ME	354 A	Mechanical Vibrations (M)	2	2	-	4	4	3	100	-	100
ME	355 A	Machine Design III (M)	2	-	-	2	2	3	100	-	100
		OPEN ELECTIVE - III	3	-	-	3	3	3	100	-	100
Total (A)			**16**	**3**	**-**	**19**	**19**	**-**	**600**	**-**	**600**
B: Practicals and Sessionals											
ME	371 B	Thermal Engineering Lab. IV (M)	-	-	3	3	1.5	-	-	100	100
ME	372 B	Production Engineering Lab. III (M)	-	-	3	3	1.5	-	-	100	100
ME	373 B	Machine Design III (M)	-	-	4	4	2	-	-	100	100
ME	374 B	Technical Dynamics Lab. (M)	-	-	2	2	1	-	-	100	100
Total (B)			**-**	**-**	**12**	**12**	**6**	**-**	**-**	**400**	**400**
Grand Total (A+B)			**16**	**3**	**12**	**31**	**25**	**-**	**600**	**400**	**1000**
FE	300 E	Co-curricular Activities	-	-	-	-	**0**	-	-	-	**100**

B.E. Final Year (Mechanical), 2019-20

SEMESTER VII EXAMINATION SCHEME

Branch Code	*Subject Code*	*Subject*	*Lectures*	*Tutorials*	*Practicals*	*Contact Hours*	*Credits*	*Exam Hours*	*Marks*		
									Theory	*Pract & Sess*	*Total*
A: Theory Papers											
ME	401 A	Heat and Mass Transfer I (M)	3	1	-	4	4	3	100	-	100
ME	402 A	Internal Combustion Engines (M)	3	1	-	4	4	3	100	-	100
ME	403 A	Hydraulic Machines (M)	3	1	-	4	4	3	100	-	100
ME	404 A	Manufacturing Technology (M)	3	-	-	3	3	3	100	-	100
ME	405 A	Operations Research (M)	3	-	-	3	3	3	100	-	100
Total (A)			**15**	**3**	**-**	**18**	**18**	**-**	**500**	**-**	**500**
B: Practicals and Sessionals											
ME	421 B	Thermal Engineering Lab. V (M)	-	-	3	3	1.5	-	-	100	100
ME	422 B	Fluid Mechanics & Machines Lab. (M)	-	-	2	2	1	-	-	100	100
ME	423 B	Production Engineering Lab. IV (M)	-	-	3	3	1.5	-	-	100	100
ME	424 B	Design Engineering (M)	-	-	3	3	1.5	-	-	100	100
ME	425 B	Project (Phase I) (M)	-	-	3	3	1.5	-	-	100	100
Total (B)			**-**	**-**	**14**	**14**	**7**	**-**	**-**	**500**	**500**
Grand Total (A+B)			**15**	**3**	**14**	**32**	**25**	**-**	**500**	**500**	**1000**

B.E. Final Year (Mechanical), 2019-20

SEMESTER VIII EXAMINATION SCHEME

Branch Code	*Subject Code*	*Subject*	*Lectures*	*Tutorials*	*Practicals*	*Contact Hours*	*Credits*	*Exam Hours*	*Marks*		
									Theory	*Pract & Sess*	*Total*
A: Theory Papers											
ME	451 A	Heat and Mass Transfer II (M)	3	1	-	4	4	3	100	-	100
ME	452 A	Gas Dynamics & Gas Turbines (M)	3	1	-	4	4	3	100	-	100
ME	453 A	Power Generation (M)	3	-	-	3	3	3	100	-	100
ME	454 A	Production & Operations Management (M)	3	1	-	4	4	3	100	-	100
ME	455 A	Elective (M)	3	-	-	3	3	3	100	-	100
		Total (A)	**15**	**3**	**-**	**18**	**18**	**-**	**500**	**-**	**500**
B: Practicals and Sessionals											
ME	471 B	Heat & Mass Transfer Lab. (M)	-	-	3	3	1.5	-	-	100	100
ME	472 B	Production Engineering Lab. V (M)	-	-	3	3	1.5	-	-	100	100
ME	473 B	FMS & Industrial Engineering Lab. (M)	-	-	2	2	1	-	-	100	100
ME	474 B	Project (Phase II) (M)*	-	-	6	6	3	-	-	200	200
		Total (B)	**-**	**-**	**14**	**14**	**7**	**-**	**-**	**500**	**500**
		Total (A+B)	**16**	**2**	**14**	**32**	**25**	**-**	**500**	**500**	**1000**
C: Others											
ME	475 C	Practical Training (M)	-	-	-	-	13	-	-	100	100
		Total (C)	**-**	**-**	**-**	**-**	**13**	**-**	**-**	**100**	**100**
		Grand Total (A+B+C)	**16**	**2**	**14**	**32**	**38**	**-**	**500**	**600**	**1100**
FE	400 E	Co-curricular Activities	-	-	-	-	**0**	-	-	-	**100**

*Project (Phase II) is continuation of Project (Phase I).

List of Open Electives available for Mechanical Engineering Students

1. LIST OF OPEN ELECTIVE – I (IV SEMESTER)

Deptt. Code	Name of Subject
CE 291A	Energy Efficient Building Design
CHE 291 A	Renewable Energy Sources
CSE 291A	Object Oriented Programming Through C++
CSE 292A	Object Oriented Programming Through JAVA
Ma-291 A	Mathematical Statistics For Engineers
EE 291 A	Industrial Applications of Electrical Drives
SE 291A	Computer oriented Numerical Analysis (*)
BCT 291 A	Sustainable Architecture
Mi 291 A	Tunnelling For Engineering Projects
EC 291 A	Logic System Design

2. LIST OF OPEN ELECTIVE – II (V SEMESTER)

Deptt. Code	Name of Subject
CE 341A	Non Urban Public Hygiene & Drinking Water
CHE 341 A	Petroleum Refining Technology
CSE 341A	Data Structures and algorithms
SE 341A	Structural Dynamics
EE 342 A	Artificial Intelligence
BCT 341 A	Traditional Indian Architecture
Mi 341 A	Application for GIS and Remote Sensitive in Engineering
EC 341 A	Microprocessors and Microcontrollers

3. LIST OF OPEN ELECTIVE – III (VI SEMESTER)

Deptt. Code	Name of Subject
CE 391A	Ecosystem & Biodiversity
CHE 391 A	Nanotechnology
CSE 391A	Web Technology
CSE 392A	Data Base Management System
CSE 393A	Information and network Security
Ma 391 A	Advanced Numerical Analysis (*)
EE 391 A	Soft Computing Techniques
EE 392 A	Energy Conservation
SE 391A	Finite Element Method
PI 391A	Quality Management
BCT 391 A	Climate Responsive Architecture
Mi 391 A	Project Environment Clearance
EC 391 A	Electronic Instrumentation

(*) Note: Only one subject can be selected from a group

(i) SE 291 A / MA391

Department codes:

CE:	Dept of Civil Engg;
CHE:	Dept of Chemical Engg;
Ma:	Dept of Mathematics;
EE:	Dept of Electrical Engg;
SE:	Dept of Structural Engg;
EC:	Dept of Electronics and Communication Engg;
Mi:	Dept of Mining Engg;
BCT:	Dept of Architecture;
CSE:	Dept of Computer Sc and Engg;
ME:	Dept of Mechanical Engg;
PI :	Dept of Production and Industrial Engg.

ME-201 A: ENGINEERING THERMODYNAMICS (M)

2L, 1T **3Hours, 100 marks**

COURSE OUTCOMES:

CO1: Applying the thermodynamic laws to analyze unsteady flow processes and efficiency of ideal heat engine cycle.
CO2: Evaluate available energy, entropy and irreversibility
CO3: Evaluate properties of ideal and real gases and gas-mixtures
CO4: Apply various thermodynamic relations
CO5: Analyze the problems of fuels and combustion and stoichiometry
CO6: Analyze the performance of single & multi stage reciprocating air compressors

SYLLABUS:

Laws of Thermodynamics: Zeroth law of thermodynamics; International practical temperature scale; First law of thermodynamics applied to non-steady flow processes; Equivalence of Kelvin-Planck and Clausius statements of second law, reversible and irreversible cycle, Carnot cycle, Corrollaries of second law and Entropy, Clausius inequality, principle of increase of entropy, availability, irreversibility and efficiency.

Properties of Gases and Gas Mixtures: Ideal gas, equation of state; real gases, Vander Waals and berthelot equations of state for real gases; virial expansions; Mixture of ideal gases; Daltan's law, Amagat-Leduc law, Gibb's law; thermodynamic properties of gas mixtures.

Thermodynamic Relations: Differential relationship for systems of constant chemical composition; combined first and second law equations; Helmholtz and Gibb's functions; Maxwell’s equations; Tds equations; Equations for specific heats, internal energy, enthalpy and entropy; Clausius-Clapeyron equation, Joule-Kelvin expansion and coefficient.

Thermodynamics of combustion: Combustion process; Stoichiometric reaction equation; mass balance; complete and incomplete combustion analysis; excess air and air fuel ratio; analysis of products of combustion; Orsat apparatus.

Reciprocating Air Compressor: Introduction and classification, work done in single stage compressor, effects of clearance, volumetric efficiency; actual indicator diagram; multistage compression; effect of intercooling, Work done and condition for maximum efficiency.

ME 202 A: MATERIAL TECHNOLOGY (M)

3L **3Hours, 100 Marks**

COURSE OUTCOMES:

CO1: Understand how materials are formed and their classification based on atomic arrangement.
CO2: Describe the mechanical behavior of metallic systems and its Importance.
CO3: Evaluate system for fatigue failures.
CO4: Gain knowledge on different class of materials and their applications.
CO5: Evaluate the failure mode of the materials and to know the steps to be taken to prevent the failures.

SYLLABUS:

UNIT 1

Crystalline Nature of Solids: Crystal structure and space lattice, packing arrangement, coordination number, crystallographic planes and Miller indices; Imperfection in crystals, point defects – vacancies, Schottky, Frenkel – and line defects – dislocations, edge, screw; Burgers vector; Crystallization of metals, Cooling curves, Nucleation, Grain growth.

UNIT 2

Plastics Deformation of Metals and Alloys: Internal stresses, role of dislocation, slip, Frank-Read source, twinning; Strain hardening, Effect on mechanical properties – Stress-strain curve, Strength and Toughness, Hardness, Impact, Ductility and Brittleness, Fatigue, Creep, and Fracture. Effect of temperature – Recovery, Recrystallization, Hot and Cold deformation.

UNIT 3

Phase Diagrams and Structure of Alloys (Iron-Carbon system): Components and Phases, Solidification and Solubility; Equilibrium Phase Diagrams, Dendritic segregation (Coring), Diffusion, Precipitation hardening, Ageing; Eutectics and Eutectoids.

UNIT 4

Heat Treatment of Steels: Phase transformation, TTT diagrams (S curves); Stress relief and Annealing, Quenching and Hardening, Tempering, Normalizing, Hardenability, Case hardening, Carburizing, Nitriding, Cyaniding.

UNIT 5

Engineering Materials: Effects of alloying elements in steels; Plain Carbon steels, Alloy steels –Stainless steels, Magnetic materials; Non-ferrous metals and alloys – Brass and Bronze, Aluminium alloys, Bearing materials. Brief introduction to non-metallic materials: Polymers, Ceramics, Composites, Super conductors Nano materials, Smart materials and their applications.

Powder metallurgy: Metallic powders – Production and Characteristics; Compaction and Sintering; Materials and Products.

ME 203 A: KINEMATICS OF MACHINES

2L, 1T **3 Hours, 100 Marks**

COURSE OUTCOMES:

CO1: Describe the concepts of mechanisms, machines and related terminologies and discuss different types of methods to analyse the velocity and acceleration of various mechanism.
CO2: Discuss Geneva mechanism.
CO3: Design of a four bar chain for constant angular velocity ratio of cranks.
CO4: Explain the concepts of friction and its types. In addition, assess its effects of different mechanical components.
CO5: Analyze various motion transmission elements like belt drive, rope drive and chain drive.

SYLLABUS:

UNIT 1

Kinematic analysis of mechanism: Definitions of Links, pairs and kinematic chain, Mechanism and machine, Inversion of four bar kinematic chain and slider crank chains.

Velocity and acceleration analysis: Relative velocity method; Instantaneous center method, Coriolis component of acceleration

UNIT 2

Special purpose mechanism: Mechanisms for straight line, Motorcar steering mechanisms, Hooks joint and Geneva mechanism

UNIT 3

Kinematics synthesis of mechanism: Type of synthesis, DOF, Grashof's criterion of movability, Limit position, Dead center transmission angle synthesis of mechanism by relative pole method, Inversion method, Freudestein's methods of synthesis, Design of a four bar chain for constant angular velocity ratio of cranks.

UNIT 4

Friction: Solid, rolling greasy and viscous friction, Laws of Friction inclined plane, Friction of pivots and collars, Friction circle of turning pair and friction axis of a link, Ball and roller bearings, Single and multiple disc-clutches

UNIT 5

Belts, Ropes & Chains: Mechanics of belt drive, Length of belt, Ratio of tensions in flat and V belt , Effect of centrifugal force, Power transmission capacity, Belt materials.

Rope drive: Types of ropes, Construction, Forces on rope and breaking strength,

Chain drive: Types, Chain length, Chordal action hoisting and power transmission

ME 204 A : MECHANICS OF SOLIDS

2L, 1T **3 Hours, 100 Marks**

COURSE OUTCOMES:

CO1: Explain the concept of stress-strain and their relationships. In addition, find out stresses in the pressure vessels subjected to internal pressure.
CO2: Analyse the behaviour of structural and machine components subjected to bending.
CO3: Analyse the deflection of the beam under different loading condition.
CO4: Solve the problems of machine members subjected to pure torsion and compressive axial loading.
CO5: Understand the concept of Mohr's circle and its use to analyse the problem of combined loading conditions.

SYLLABUS:

UNIT-1

Direct Stresses in Machine Parts: Analysis of stress and strain. -Hooke's law, stress-strain diagram, Poisson's ratio, Modulus of elasticity, Relation between elastic constants
Simple stresses: Tensile, compressive, shear, crushing and bearings criteria. Hoop stress in thin Cylindrical and spherical vessels subjected to internal pressure.

UNIT-2

Machine Members in Bending: Theory of bending of straight and curved beams. Bending and shear stress distribution in beams. Shear force and bending moment diagrams. Moment of inertia of different machine element sections.

UNIT-3

Deflection and stiffness: Macaulay's method, area moment method, numerical integration method and energy method. Numerical problems of line shafts under simple loading with pulleys, ears, flywheel etc. Brief introduction to analysis of shafts with three Supports.

UNIT-4

Machine Members in Torsion: Introduction to torsion of circular solid and hollow sections. Angular deformation and strain energy.
Stress in Slender Machines Members under axial Compressive Loads: Analysis of long and short columns. Euler's theory and effect of end conditions on stresses. Empirical formulas.

UNIT-5

Machine Members subjected to Combined Loading: Combination of axial, bending, and torsional stresses. Concept of principal stresses and planes. Mohr's circle of stresses. 2D state of strain, Plane stress and Plane strain conditions. Mohr's circle for strain. Theories of failure. Simple problems of line shaft.

MA 205 A: ADVANCED ENGINEERING MATHEMATICS

3L **3 Hours, 100 Marks**

Section A

Differential equations: Simultaneous differential equations, Total differential equations, Partial differential equations of first order. Charpit's method, Partial differential equations with constant coefficients, Second order partial differential equations of type Rr + Ss + Tt = V (Monge's method), Solution of Wave, Heat and Laplace equations using separation of variables method.

Section B

Numerical Analysis: Interpolation with equal intervals: Newton-Gregory interpolation formulae. Lagrange's interpolation formula for unequal intervals. Central difference interpolation formulae: Gauss' forward and backward formulae, Stirling's and Bessel's interpolation formulae. Numerical integration: Trapezoidal rule. Simpson's 1/3 and 3/8 rule. Numerical solution of algebraic and transcendental equations: Bisection, regula falsi and Newton-Raphson methods. Numerical solution of linear simultaneous equations: Gauss elimination. Gauss-Jordon, Jacobi and Gauss-Siedal methods. Numerical solution of ordinary differential equations: Euler's, Runge-Kutta fourth order and Milne's methods.

Section C

Laplace Transform, Inverse Laplace Transform, Application of Laplace Transform to solve differential equations with constant coefficients. Infinite Fourier Transform.

ME-206 A: MECHANICAL MEASUREMENTS AND INSTRUMENTATION (M)

3L **3Hours, 100 marks**

COURSE OUTCOMES:

CO1: Understanding a generalized measurement system and various static and dynamic characteristics of instruments.
CO2: Understand various errors of instruments and uncertainty in measurements.
CO3: Understand the transducer (electrical/mechanical) based temperature and pressure measurement.
CO4: Measurement of flow using various flow meters
CO5: Force, torque and strain measurement using various gauges.
CO6: Displacement, angular velocity and Vibration measurement using various techniques/methods.

SYLLABUS:

Basic concepts and instruments characteristics: Generalized measurement system and its functional elements; Static characteristics; Range, span, accuracy, error, precision, calibration, hysteresis, sensitivity, threshold, resolution, linearity; Dynamic characteristics; input and output impedance; impedance matching.
Measurement errors, their classification and causes; Statistical analysis of test data; Mathematical theory of errors and uncertainty estimate.

Transducers: Definition and classification, variable resistance, variable inductance, variable capacitance and self-voltage-generating type transducers, desired characteristics of transducers.

Pressure measurement: Measurement devices for low and high pressures; Bourdon-tube and diaphragm gauges; Bridgman gauge; thermal conductivity and ionization gauges.

Temperature measurement: Bimetallic thermometer; temperature measurement by thermoelectric effects, thermocouples, laws of thermocouples, thermocouple types and their ranges, reference junction compensation, thermopile; resistance temperature detector; thermistors; temperature measurement by optical and radiation pyrometers.

Flow measurement: Flow-obstruction meters, flow measurement by drag effects; pressure probes; Hot-wire anemometer, magnetic flow meter; flow visualization methods; schlieren technique.

Force, Torque and Strain measurement: Resistance strain gauge, gauge factor, unbonded and bonded strain gauges; wheat stone bridge; temperature compensation in strain gauges;

Hydraulic and pneumatic load cells, strain gauge load cell; Use of strain gauges on rotating shafts.

Displacement, Velocity and Vibration measurement: LVDT and its applications; Angular velocity measurement by photocell, magnetic pick-up and stroboscopic methods; Seismic instruments, vibration pick-ups, reed vibrometer.

Display Units: indicating and recording devices; x-t, y-t and x-y recorders; single point and multi-point recorders; indicating and digital type instruments; Cathode-ray oscilloscope.

ME 222 B: MACHINE DRAWING (M)

2P **100 Marks**

COURSE OUTCOMES:

CO1: Understand various I.S. Codes, Limits and fits, tolerances and draw fully assembled drawing.
CO2: To draw full assembled drawing of bearing, valves, pipe fitting, engines.

SYLLABUS:

Familiarization with various I.S. and other codes currently in use. Limits and fits, tolerances and tolerance dimensions, machine symbols. Fully dimensioned assembly drawing of the following:

(i) Bearing .Ball, roller and needle bearings

(ii) Valves: Stop, gate, globe, check, butterfly and needle type valves, safety valves

(iii) Standard pipe fittings, pipe joints and layout of piping.

(iv) Reciprocating and rotary machine parts

(v) Machine Tool components, Jigs and fixtures, detailed drawings Blue print marking Introduction to AUTO-CAD Software and its use in generating and editing 2-D orthographic and Isometric drawings

ME-251 A: REFRIGERATION AND AIRCONDITIONING (M)

2L, 1T **3Hours, 100 marks**

COURSE OUTCOMES:

CO1: Understand various air-refrigeration cycles for aircraft refrigeration.
CO2: Analyze vapor compression system at various operating conditions.
CO3: Understand the CFC, HCFC, HFC and HC types of refrigerants and their properties.
CO4: Demonstrate the concept of vapor absorption refrigeration system and Electrolux refrigerator.
CO5: Understand the psychrometry of moist air and its measurement
CO6: Explain psychrometry of summer and winter air-conditioning processes with its use in comfort air-conditioning.

SYLLABUS:

Refrigeration principle: Second law interpretation of heat engine, heat pump and refrigerator; reversed Carnot cycle, coefficient of performance, limitations of reversed Carnot cycle, unit of refrigeration.

Air Refrigeration System: Bell-Coleman cycle; air cycle systems for aircraft refrigeration; simple system, boot strap system, regenerative system and reduced ambient system.

Vapour Compression System: Theoretical vapour compression systems, cycle analysis using p-h diagram; Effect of operating conditions, suction vapour superheat and liquid sub cooling, Deviation of actual cycle from ideal cycle.

Refrigerants: Desirable properties, designation and comparative study of refrigerants; substitutes for CFC refrigerants.

Vapour absorption system: Simple vapour absorption system, common refrigerant-absorbent combinations; Electrolux refrigerator.

Refrigeration Equipment's: Types of compressors, condensers, evaporators and expansion devices and their working; cooling towers; control and protection devices.

Psychrometric: Thermodynamics properties of moist air, perfect gas relationship for approximate calculation; psychrometric properties, DBT, DPT, humidity ratio, degree of saturation, relative humidity, enthalpy, WBT, Adiabatic saturation process, psychrometric chart.

Psychrometry of air conditioning processes: Cooling and dehumidification, sensible cooling with dry coils, direct expansion wet coils, apparatus dew point, by pass factor; heating and humidification, heating coils; Air Washers; chemical dehumidification; water and steam injection; Summer and Winter air conditioning.

Introduction to comfort air conditioning, effective temperature and comfort charts.

ME 252 A: FOUNDRY AND WELDING ENGINEERING (M)

3L **3 Hours, 100 Marks**

COURSE OUTCOMES:

CO1: Study of casting process and its parameters.
CO2: Understand, classify and distinguish various casting processes.
CO3: Develop concepts for casting techniques used in specific applications.
CO4: Understand, classify and distinguish different welding processes.
CO5: To learn testing of welded joints and application of welding.

SYLLABUS:

UNIT 1

Foundry: Mould making; Pattern – types, allowances; Moulding sand – ingredients, additives, properties, methods of testing; Core materials. Casting Design: Metal solidification, cooling, shrinkage, directional solidification; Chaplet and Chill, Gate, Runner and Riser; Product design considerations.

UNIT 2

Expendable Mould Casting methods: Sand casting – Green, Dry, Loam sand moulding, Carbon dioxide moulding, Pit and Floor moulding; Shell moulding; Investment casting; Plaster and Ceramic mould casting. Permanent Mould Casting Methods: Die casting; Centrifugal casting; Continuous casting.

UNIT 3

Foundry Practices: Equipment, machines and mechanization; Melting furnaces – constructional features and operation of Cupola, Electric furnace; Fettling, cleaning and inspection; Casting defects and remedies; Sand reclamation.

UNIT 4

Welding: Metal coalescence; Types of joints, welds and welding positions; Physics and metallurgy of welding; Weldability. Brazing and Soldering: Methods and materials. Fusion Welding: (i) Arc Welding: Principle; Electrodes, welding machines, tools and power source – current, voltage and polarity; Constant current and Constant potential machines; Shielded metal arc welding; Gas metal arc (MIG); Flux-cored arc; Electrogas; Submerged arc. Non-consumable electrode arc welding processes – Gas tungsten arc (TIG); Plasma arc; Carbon arc and Stud welding. (ii) Resistance Welding: Spot, Seam, Projection, Flash butt, Upset, Percussion, High-frequency resistance welding; Thermal spraying. (iii) Oxyacetylene Gas

Welding: Heat generation and flame; Torch and other equipment; Gas cutting; Oxyhydrogen welding. (iv) Electron beam; Laser beam; Electroslag; Thermit welding.

UNIT 5

Introduction to Solid-State Welding: Forge; Roll; Hot pressure; Diffusion; Explosive; Friction; Ultrasonic welding. Weld Quality: Residual stresses and distortion; Heat affected zone; Welding defects and remedies; Inspection and Non-destructive testing – Dye penetrates; Magnetic particles; Ultrasonic; Radiographic

ME 253 A : KINETICS & DYNAMICS OF MACHINES

3L, 1T **3 Hours, 100Marks**

COURSE OUTCOMES:

CO1: Classify different types of braking system, and identify the application for them.
CO2: Categorize the dynamometers.
CO3: Construct different types of cam profile for a given data and analyse their velocity and acceleration.
CO4: Explain the function of governor and its types and analyse the Proell governor.
CO5: Static force analysis of slider crank mechanism, using principle of virtual work and explain the concept of gyroscopic motion and its effect on automotive vehicles.

SYLLABUS:

UNIT 1

Brake: Band brakes, Block brake, Braking action: Effect of braking on vehicle

UNIT 2

Dynamometers: Types and their suitability for power measurement

UNIT 3

Cams: Types of cams and followers, drawing of cam profile for given type of motion and to draw displacement, velocity and acceleration diagrams for a given cam profile

UNIT 4

Governor: Types of governor: Watt, Porters, Proell and spring types, Effect of friction, Controlling force curves, Sensitiveness, Stability, Hunting, Isochronism, Effort of a governor

UNIT 5

Static Force Analysis of Machines: Force body diagram, Static equilibrium, Principle of virtual work, Static forces analysis in a machines; Slides Crank mechanism, Four bar linkage, Shaper Mechanism, Gyroscopic motion and elementary concepts of ship stabilization , Stability of automotive vehicle

ME 254 A: MACHINE DESIGN -I (M)

2L, 4P **3 Hours, 100 Marks**

COURSE OUTCOMES:

CO1: Demonstrate the design processes and morphological analysis in various aspect of design.
CO2: Compare various theories of failure. In addition, explain the concept of stress concentration and fatigue failure.
CO3: Design the machine elements under direct and eccentric loading conditions like cotter joint and rivet joints.
CO4: Design the machine elements subjected to bending like beams etc.
CO5: Design the machine elements subjected to torsion like shaft and coupling.

SYLLABUS:

UNIT1

Introduction: Design definitions and significance, kind of design work, design process. Need analysis, specification of a problem. Designing through Morphological analysis, Designers Responsibility introduction to various aspects of design.

UNIT2

Design for Strength: Type of loads, failure criteria, Theories of failure, Allowable stress, factor of safety, stress concentration, fatigue failure.

UNIT3

Design of Machine Elements subjected to Direct Stress: Cotter Pin, Riveted and keyed joints. Design of screw fastening. Types of locking devices, types of load and modes of failure. Design of welded joints.

UNIT4

Design of Members in Bending: Beams, levers, laminated springs.

UNIT5

Design of Members in Torsion: Shafts, couplings and helical springs Design of Eccentrically Loaded Components and Joints Design of Curved Beams and Crane hook.

ME-255 A: FLUID MECHANICS I (M)

3L, 1T **3Hours, 100 marks**

COURSE OUTCOMES:

CO1: Acquiring knowledge of properties and basic definitions of fluids.
CO2: Understanding laws employed in fluid statics and its uses.
CO3: To apply conservation laws to fluid flow problems in engineering applications.
CO4: Understanding the equation of motion and energy equation.
CO5: Understanding the use of various flow measurement devices.
CO6: To make use of appropriate non-dimensional number in different flow situations.

SYLLABUS:

Basic Definitions and Fluid Properties: Definition of fluid, concept of continuum, incompressible and compressible fluids, mass density, specific volume, specific weight, specific gravity, viscosity, Newtonian and Non-Newtonian fluids, ideal fluid, kinematic viscosity, effect of temperature and pressure on viscosity.

Fluid Statics: State of rest, Pascal's law, hydrostatic law; measurement of pressure in fluid at rest, manometers and their types; Hydrostatic force on submerged plane surface, centre of pressure; Equilibrium of submerged and floating bodies, centre of buoyancy and metacentre, determination of metacentric height.

Fluid Kinematics and Conservation of Mass: Description and types of fluid flow, Lagrangian and Eulerian approach; Streamline, path line, streak line and stream tube; Fluid velocity and acceleration; Law of conservation of mass, equation of continuity for three dimensions; Deformation of a fluid element, irrotational and rotational flow, concept of vorticity and circulation, stream function and velocity potential, Laplace equation.

Fluid Dynamics: Forces acting on a fluid in motion, equations of motion, Navier Stoke's equation for viscous flows, Euler's equation of motion, integration of Euler's equation– Bernoulli's equation; Application of Bernoulli's equation, venture meter, orifice meter, flow nozzle; Measurement of static, stagnation and dynamic pressure and velocity, Pitot-static tube; The momentum theorem, applications of the momentum theorem, force on a pipe bend.

Flow through orifices and mouthpieces; orifice discharging free jet, vena contracta, coefficient of contraction, velocity, discharge and resistance; Flow over notches and weirs.

Dimensional Analysis: Dimensional homogeneity, Buckingham theorem; Model similitude; Force ratios, Reynolds, Froude, Mach, Weber and Euler numbers and their applications; Undistorted and distorted models, scale effect in models.

ME-301 A: FLUID MECHANICS II (M)

3L, 1T **3Hours, 100 marks**

COURSE OUTCOMES:

CO1: Classify laminar and turbulent flows in pipes and understand related laws.
CO2: Estimate major loss and various minor losses for the flow through pipes.
CO3: Understanding the development of boundary layer, its thickness and applicable equations.
CO4: Explain the phenomenon of boundary layer separation and its control.
CO5: Compare and contrast lift and drag forces on streamlined v/s bluff body.
CO6: Understand the aerofoil geometry and pressure distribution on it.

SYLLABUS:

Flow Through Pipes: Reynolds's experiment, laminar and turbulent flows; Friction loss in pipe flow, Darcy's-Weisbach equation; Minor losses, loss of head due to sudden enlargement, contraction, entrance, exit and bend; Hydraulic gradient and total energy line; Flow through long pipes; Pipes in series and parallel; Transmission of power through pipes.

Laminar Flow: Laminar flow in circular pipes, Hagen-Poiscuille flow; laminar flow between parallel plates, Couette flow.

Turbulent Flow in Pipes: Turbulent shear stresses, Prandtl Mixing length hypothesis applied to pipe flow, velocity distribution in smooth and rough pipes, Variation of friction factor with Reynold's number, Universal pipe friction laws, Colebrook white formula.

Boundary Layer flow: Description of the boundary layer, Development of boundary layer on a flat plate in uniform free stream with no pressure gradients, Boundary layer thicknesses; Prandtl boundary layer equations, Solution for laminar boundary layer; Integral momentum equation for the boundary layer, approximate momentum analysis for laminar and turbulent boundary layer, viscous sublayer; combined laminar and turbulent boundary layers; Separation of boundary layer, methods to control separation.

Flow Around Immersed Bodies: Forces on immersed bodies, lift and drag, skin friction drag, pressure drag, combined skin friction and pressure drag (profile drag), wave drag, induced drag; Streamlined and bluff bodies, flow around a circular cylinder, separation, Karman vortex street, Strouhal number; Flow around a sphere, stokes' law; Flow around an aerofoil, nomenclature of an aerofoil, Symmetrical and asymmetric aerofoils, pressure distribution around aerofoils.

ME 302 A: PRODUCTION MACHINE TOOLS (M)

3L **3 Hours, 100 Marks**

COURSE OUTCOMES:

CO1: Study of various types of machine tools
CO2: Understand various operations and their application in different machine tools.
CO3: Study of metal forming machine tools.
CO4: Understand various types of automats.
CO5: Basic understanding about NC/CNC/DNC machine structures and their components.

SYLLABUS:

UNIT 1

Constructional Details of, Operations on and Ancillary Tools for: (i) Centre, Capstan and Turret Lathes. (ii) Shaper, Planner and Slotter – Quick return mechanism. (iii) Drilling and Boring machines – Radial, gang, multi-spindle, deep hole drilling, jig boring.

UNIT 2

(iv) Horizontal, Vertical and Universal Milling machines; Indexing – types and heads, (v) Broaching machines. (vi) Grinding machines – Surface, Cylindrical and Centre less; Tool and cutter grinding;

UNIT 3

Grinding wheels – dressing and truing, (vii) Lapping, Honing and super finishing.

Special purpose tools: Jigs and Fixtures – Principles of location and clamping; Drilling jigs and Milling fixtures.

UNIT 4

Automats and Semi-automats – Single and multi-spindle, operation planning, tool layout and cam design; Hydraulic tracer controlled machine tools. Forging and Press tools: Punch-Die for bulk deformation and sheet metal working – Compound, Combination and Progressive dies.

UNIT 5

Numerically controlled machine tools (except NC programming): Automation strategies;

Classification of NC machine tools – Open and Closed loop, PTP and Contouring, NC/CNC/DNC; Position and Velocity feedback devices; Adaptive control; Machine control unit; NC Tooling; Machining centers; Economics..

ME 303 A: INDUSTRIAL ORGANIZATION AND MANAGEMENT (M)

3L **3 Hours, 100 Marks**

COURSE OUTCOMES:

CO1: Understand, classify and distinguish different type of organizations.
CO2: Develop concepts about different type of theories used in scientific management.
CO3: To understand the concept of various financial statements and cost analysis in business organization.
CO4: Introduction to various human resource aspects in business organization.
CO5: Improveleadership qualities, accountability, authority and responsibility.

SYLLABUS:

UNIT 1

Business Organization: Objectives of business; Formation and working of Sole proprietorship, Partnership, Private and Public limited company, Public sector undertaking, and Cooperative society.

UNIT 2

Management: Principles, Functions and Elements of Management; Historical development and Theories of management – contributions of Taylor (Scientific management), Fayol, Gilbreths, Mayo, Drucker, etc. Planning – Long-term and Short-term decisions; Organization structure and chart – Line and Staff relations and conflicts, Span of control, Authority and Responsibility, Delegation and Decentralization.

UNIT 3

Organizational behavior – Formal and Informal organization; Motivation – Maslow's and Herzberg's theories; Direction; Communication; Leadership; Co-ordination; Control.
Marketing Management: Functions; Product and Pricing strategies; Advertising and Sales promotion; Distribution channels; Marketing research, e-Business – Exports and Globalization

UNIT 4

Financial Management: Functions; Financial Statements – Profit and Loss account, Balance Sheet, Ratio analysis; Break even analysis and profit planning; Working capital, Capital budgeting – Investment appraisal criteria – Money-time relationship and Discounting.

UNIT 5

Personnel Management: Functions; Manpower planning; Recruitment and Selection; Job specification and Job qualification; Training and Placement.

ME304 A: DYNAMICS OF MACHINES (M)

3L, 1T **3 Hours, 100 Marks**

COURSE OUTCOMES:

CO1: Utilize analytical, mathematical and graphical aspects of kinematics and kinetics of machines.
CO2: Analyze the position, velocity and acceleration of links of different slider crank mechanisms.
CO3: Understand the concept of flywheel and construct turning moment diagram.
CO4: Study and analyze the gear profiles and gear trains, evaluate gear tooth geometry and select appropriate gears for the required applications.
CO5: Analyze the balancing problems in rotating and reciprocating machinery.

SYLLABUS:

UNIT 1

Inertia Torque: Inertia forces of a floating link and a link rotating about a fixed centre, Four-bar Mechanism, Combined static and inertia force analysis.

UNIT 2

Dynamics of slider crank mechanism; Displacement, velocity and acceleration of slider, Velocity and acceleration of connecting rod, Crank effort, dynamically equivalent Systems.

UNIT 3

Flywheel and turning moment diagram: Coefficient of fluctuation of speed and energy, Weight of flywheel, Flywheel applications.

UNIT 4

Gear: Definition and law of gearing, Velocity of sliding between two teeth in mesh, Involute and cycloidal profiles for gear teeth, Interference and its checking, helical, Spiral, bevel and worm gear

Gear Train: Simple, compound and epicyclic trains including Humpage's gear, Gear train Applications

UNIT 5

Balancing: Balancing of rotating masses in one and different planes, Balancing of reciprocating masses, Balancing of inline and V- engines, Balancing machines

ME 305 A: MACHINE DESIGN II (M)

2L, 4P **3 Hours, 100 Marks**

COURSE OUTCOMES:

CO1: Design the machine components subjected to compound stresses like line shaft.
CO2: Design of Power Transmission System: Rope and Chain drives
CO3: Formulate the design procedure for various gear design.
CO4: Solve the problem of designing the various screw motion mechanism.
CO5: Design the clutches and brakes.

SYLLABUS:

UNIT1

Design of components subjected to compound stresses: Line shaft

UNIT2

Design of Power Transmission System: Rope and Chain drives, flat and V-belt drives

UNIT3

Gear transmission systems using spur, helical, bevel and worm gears.

UNIT4

Design of Screw motion mechanism: Screw jack, Togle jack, Lead screw, screw press etc.

UNIT5

Design of clutches and brakes.

ME-351 A: STEAM POWER ENGINEERING (M)

3L, 1T **3Hours, 100 marks**

COURSE OUTCOMES:

CO1: Understand the working of high pressure boilers used in steam power plants.
CO2: Understand design parameters of steam nozzle and critical conditions.
CO3: Classify the types and compounding of steam turbines.
CO4: Performance calculations of steam turbine and modified cycles.
CO5: Understand the working of different type of steam condensers and governors.
CO6: Understand the working of air pump, spray pond and cooling tower.

SYLLABUS:

Steam Generators: High-pressure boiler, forced circulation, super critical pressure boiler,

Testing of boilers, heat balance sheet-problems involving combustion. Boiler draught: Natural draught, Height of chimney, artificial draughts and Fans.

Steam Nozzles: Steam flow through nozzles, type of nozzles, critical pressure, throat and exit areas for optimum discharge, friction effect, Super saturation phenomenon, Effect of variation of back pressure.

Steam Turbines: Types and classification. Impulse and reaction turbine, methods of reducing rotor speed, Flow of steam through turbine blading, blade sections and height; Velocity diagrams, stage and other efficiencies, condition for maximum efficiency of a single stage turbine, reheat factor, regenerative feed heating, bleeding, reheating and water extraction cycles, turbine characteristics and performance, principles of governing speed and emergency governors, Low pressure, exhaust, mixed pressure and back pressure turbines. Binary vapour cycles; Labyrinth packing.

Condensers: Types Description, calculations involving efficiency and cooling water requirements. Capacity of air pumps with and without air-cooling section. Cooling of circulating water; spray ponds and cooling towers.

ME 352 A: METAL CUTTING AND METROLOGY (M)

3L **3 Hours, 100 Marks**

COURSE OUTCOMES:

CO1: Understand the different mechanism of chip formation in machining.
CO2: Illustrate the various machining processes such as turning, drilling, boring, shaping, slotting, milling and grinding.
CO3: Identify and suggest correct manufacturing process for particular application.
CO4: Apply the principle of different metrology instruments.

SYLLABUS:

UNIT 1

Metal Cutting: Machining operations – types, elements and cutting conditions; Theory of chip formation and chip flow – shear angle; Orthogonal and Oblique cutting; Geometry and designation of single point cutting tool, milling cutters, twist drill, broaches; Form tools.
Merchant's Force Analysis: Forces, Stresses and Power consumption in orthogonal cutting; Velocities, Strain (rate), Specific cutting energy; Measurement of cutting forces – Strain gauges and dynamometers.

UNIT 2

Friction and Thermal Aspects: Stick and Slip phenomenon; Heat generation; Measurement of cutting temperatures. Tool Wear: Location – Crater, Flank; Mechanism – Abrasion, Adhesion, Diffusion, Oxidation; Tool life – Taylor's equation; Effects of cutting parameters on forces, power and surface finish; Machinability; Economics of machining. Cutting Tools: Requirements; Materials and characteristics. Cutting Fluids: Functions; Materials and applications.

UNIT 3

Metrology: Dimensional, Geometrical and Relative Co-ordination accuracy and precision of machined surfaces – Types of errors; Interchangeability; Standardization; BIS system of Limits, Fits and Tolerances; Tolerance analysis in manufacturing and assembly; Design of Limit gauges – Taylor's principle; Slip gauges and Angle measurement; Comparators – Mechanical, Electrical, Optical and Pneumatic.

UNIT 4

Measurement of flatness, parallelism and surface finish – Autocollimators, Optical Interferometry; Measurement of screw threads – Major, Minor and Effective diameters, Best wire size, Pitch, Angle; Measurement of gears – Pitch, Chord width, Run-out checking, Composite error checking; Machine tool metrology – Alignment tests.

UNIT 5

Statistical Quality Control: Implementation of quality at Policy, Design, Manufacturing and Installation stages; Assignable and unassignable causes of variability in quality; Control charts for Variables – , R, and Attributes – p, c; Acceptance sampling – OC curve, Single and multiple sampling plans; Total quality management; ISO 9000.

ME 353 A: INDUSTRIAL ENGINEERING (M)

3L **3 Hours, 100 Marks**

COURSE OUTCOMES:

CO1: To predict the demand of components by means of forecasting techniques.
CO2: To analyse various methods of costs and depreciation.
CO3: To develop the understanding and analyzing the reliability of the system.
CO4: To develop the concept of work study.
CO5: To develop the understanding of industrial wages and incentive schemes including industrial acts and legislation.
CO6: To control pollution and create better methods of industrial waste management

SYLLABUS:

UNIT- 1

Demand and Supply Analysis: Theory of supply and demand – Market structure, Equilibrium, Demand elasticities; Demand forecasting techniques – Qualitative, Regression, Correlation and Least Squares, Time series, Exponential smoothing; Make-or-buy decision.

UNIT- 2

Elements of Costing: Classification of costs – direct, indirect, labour, material, overheads, prime cost, factory cost; Allocation of overhead costs; Depreciation – Methods of computing; Standard costing; Budgets and budgetary control.

UNIT- 3

Value engineering: Value analysis; Product development – Product life cycle, Standardization, Simplification, Diversification. Reliability and Plant Maintenance: Maintenance policies – Preventive, Break-down, Corrective maintenance; Failure rate analysis – Hazard curve, System reliability; Economics of replacement – models.

UNIT- 4

Work study: Productivity; Method study; Recording techniques – various charts, diagrams, graphs; Micro and Memo motion study; Principles of motion economy; Work measurement – Time study, Work sampling, Synthetic data and Pre-determined motion time standards; Learning curve; Ergonomics.

UNIT- 5

Wages Payment: Job evaluation and Merit rating. Methods of wage payment – Time wages, Piece wages and Incentive schemes. Industrial Relations: Management-union relations; Trade union movement; Industrial disputes and methods of settling them – Conciliation, Arbitration, Collective bargaining, Workers' participation; Legal legislation and Acts; Labour welfare and safety; Pollution and Waste management.

ME 354 A: MECHANICAL VIBRATIONS (M)

2L, 2T **3 Hours, 100 Marks**

COURSE OUTCOMES:

CO1: Analyse free, damped vibration with single degree of freedom and Develop mathematical model of dynamic systems with single degree of freedom.
CO2: Analyse the forced vibration system.
CO3: Calculate natural frequency of torsional vibrational system and calculate the whirling speed of shaft.
CO4: Develop and analyse the mathematical model of dynamic systems (multiple degrees of freedom) with analogous electrical circuits.
CO5: Analyse mechanical system utilising concept of control system and Laplace transformation.

SYLLABUS:

UNIT-1

Direct Stresses in Machine Parts: Analysis of stress and strain. -Hooke's law, stress-strain diagram, Poisson's ratio, Modulus of elasticity, Relation between elastic constants
Simple stresses: Tensile, compressive, shear, crushing and bearings criteria. Hoop stress in thin Cylindrical and spherical vessels subjected to internal pressure.

UNIT-2

Machine Members in Bending: Theory of bending of straight and curved beams. Bending and shear stress distribution in beams. Shear force and bending moment diagrams. Moment of inertia of different machine element sections.

UNIT-3

Deflection and stiffness: Macaulay's method, area moment method, numerical integration method and energy method. Numerical problems of line shafts under simple loading with pulleys, ears, flywheel etc. Brief introduction to analysis of shafts with three Supports.

UNIT-4

Machine Members in Torsion: Introduction to torsion of circular solid and hollow sections. Angular deformation and strain energy.
Stress in Slender Machines Members under axial Compressive Loads: Analysis of long and short columns. Euler's theory and effect of end conditions on stresses. Empirical formulas.

UNIT-5

Machine Members subjected to Combined Loading: Combination of axial, bending, and torsional stresses. Concept of principal stresses and planes. Mohr's circle of stresses. 2D state of strain, Plane stress and Plane strain conditions. Mohr's circle for strain. Theories of failure. Simple problems of line shaft.

ME 355 A: MACHINE DESIGN III (M)

2L,4P **3 Hours, 100Marks**

COURSE OUTCOMES:

CO1: Classify various types of bearings and design a bearing according to the application.
CO2: Illustrate the procedure of deigning the I.C engine components.
CO3: Design the pressure vessels considering the influence of fatigue and creep.
CO4: Design of flywheels and rotating discs.
CO5: Make use of computer aided design for machine elements.

SYLLABUS:

UNIT1

Design of Bearings: Journal, radial and thrust. Selection of ball and roller bearings

UNIT2

Design of components subjected to high temperature and pressure: I.C. Engine piston, cylinder and cylinder head, crank shaft and connecting rod.

UNIT3

Pressure vessels: Fatigue and creep considerations and Pipe-joints.

UNIT4

Design of flywheels and rotating discs.

UNIT5

Introduction to computer aided design of machine elements; line shafts. springs, gear, belts, pulleys and flywheels

ME-401 A: HEAT AND MASS TRANSFER I (M)

3L, 1T **3Hours, 100 marks**

COURSE OUTCOMES:

CO1: Understanding various modes of heat transfer and laws governing heat transfer rates.
CO2: Determine steady state one-dimensional heat conduction through plane and composite solids of different geometries.
CO3: Analyze heat transfer from extended surfaces of uniform cross sections.
CO4: Explain Lumped heat capacity analysis for transient heat conduction.
CO5: Understanding thermal radiation and laws of radiation heat transfer.
CO6: Analyze radiation heat exchange between different surfaces.

SYLLABUS:

Introduction: Various modes of heat transfer, Fourier's, Newton's and Stefan Boltzman's Law, combined modes of heat transfer, overall heat transfer coefficient, resistance concept and electrical analogy.

Conduction: Thermal conduction in solids, liquids and gases, General differential equation of heat conduction in cartesian, cylindrical and spherical coordinates, thermal diffusivity, initial and boundary conditions.

One dimensional steady state heat conduction through plane wall, cylinder and sphere; Heat flow through composite plane walls, cylinders and spheres; Critical thickness of insulation.

Heat transfer from fins of uniform cross section, rectangular fin, Pin fin; efficiency and effectiveness of fins; errors in measurement of temperature in thermometric wells.

Transient heat conduction in solids with infinite thermal conductivity, lumped heat capacity systems, Biot number, Fourier number.

Radiation: Thermal radiation; monochromatic and total emissive power; absorptivity, reflectivity and transmissivity, black, gray and real surfaces; Plank’s distribution law; Wein’s displacement law; Stefan-boltzman’s law; Kirchhoff’s law.

Radiative heat transfer between black surfaces and gray surfaces; Heat transfer in the presence of re-radiating surfaces; Electric network method for radiation heat exchange to simple problems; Radiation shields; Shape factors

ME-402 A: INTERNAL COMBUSTION ENGINES (M)

3L, 1T **3Hours, 100 marks**

COURSE OUTCOMES:

CO1: Understand combustion process, detonation, carburetion and fuel injection in S.I. engines.
CO2: Understand combustion process and knocking phenomenon in C.I. engines.
CO3: Testing the performance of I.C.Engines by various performance parameters and make heat balance sheet.
CO4: Understand the phenomenon of Supercharging, its methods and types in I.C. Engines.
CO5: Understand scavenging process and its methods for two strokes I.C. Engines.
CO6: Illustrate various norms related to air pollution from vehicular emission and methods of its control.

SYLLABUS:

S.I. Engines: Deviation from the ideal cycle, combustion losses, flame development and propagation, effects of operating variable on detonation; Detonation rating of engine fuels, HUCR Dope, preignition combustion chambers, Mechanics of carburetion, MPFI systems, mixture requirement and combustion.

C.I. Engines: Stages of combustion, Diesel knock, effect of operating variables, knock rating of C.I. engine fuels, Cetane number; Effect of additives, combustion chambers. Requirements of fuel injection system and its mechanism, Fuel filters.

Lubrication and Cooling: Forced, splash, by-pass and direct, Blow by and crankcase dilution. Air and water cooling, Thermostatic control.

Performance and Testing: High speed indicators, various efficiencies, Morse Test and Willan's line; torque and mean effective pressure, performance and heat balance sheet, Measurement of volumetric efficiency, Effect of atmospheric condition on performance of I.C. Engines; Supercharging; high altitude problem of I.C. Engines, methods and types of supercharging; suitability of S.I. and C.I. Engines;

Two-stroke Engines: Advantages, Uniflow and loop scavenging. Reversed flow scavenging comparison of scavenging methods, Air capacity, scavenging Pumps.

Air Pollution: Vehicular emission, its norms, Causes and control of air pollution from diesel and petrol engines, catalytic converter.
Introduction to dual fuel and multi-fuel engines; free-piston engine and rotary combustion engine.

ME-403 A: HYDRAULIC MACHINES (M)

3L, 1T **3Hours, 100 marks**

COURSE OUTCOMES:

CO1: Understand momentum equation, unit and specific quantities for hydraulic machines.
CO2: Classifying hydraulic turbines and analyze their performance characteristics.
CO3: To acquire knowledge of the hydroelectric power plants and their practical use.
CO4: Understand working of reciprocating pump and its performance parameters.
CO5: To classify the centrifugal pumps and understand its characteristics curves.
CO6: Analysis of various machines used for hydraulic power transmission.

SYLLABUS:

Introduction: Application of the momentum and moment of momentum equations for flow through hydraulic machines, Euler's fundamental equation, Classification of hydraulic machines; Unit and specific quantities, specific speed of a turbine and a pump.

Hydraulic Turbines: Classification of water turbines; Pelton Impulse turbine, constructional details, velocity triangles, power and efficiency; Reactions turbines; Francis and Kaplan turbines, Constructional details, velocity triangles, power and efficiency, degree of reaction; draft tube and its types; Cavitation and its prevention, Thoma's cavitation factor; performance characteristics of Water turbines.

Hydro Electric Power Plants: Introduction, essential components of water power plants, classifications and their field of use

Reciprocating Pumps: Reciprocating pump, working principle, single acting and double acting, slip, coefficient of discharge, indicator diagrams, effect of friction and acceleration; theory of air vessel,

Roto-dynamic Pumps: Centrifugal pumps, classification, Vector diagrams, Specific speed, head, power and efficiency calculations, model testing, characteristic curves of centrifugal pump, priming of pumps, Selection of pumps, cavitation and abrasive wear of pumps.

Miscellaneous Hydraulic Machines: Gear pumps, vane pumps, air lift pump, jet pump and Hydraulic ram.

Hydraulic Power Transmission: Hydrostatic and hydro-kinetic systems, Hydraulic Press, hydraulic crane; theory of hydraulic couplings and torque converters.

ME 404 A: MANUFACTURING TRCHNOLOGY (M)

3L **3 Hours, 100 Marks**

COURSE OUTCOMES:

CO1: To study of plastic deformation criteria and power requirement.
CO2: To understand the various methods of plastic deformation.
CO3: To study modern machining methods and effect of their controlling parameter on MRR.
CO4: To analyse typical manufacturing processes for basic components like shafts, gears and threads.
CO5: To understand the structure of various computer controlled technology used in manufacturing technology.
CO6: To develop the ability to do NC and CNC programming.

SYLLABUS:

UNIT – 1

Metal Working: Metal behaviour in metal forming – Principal stresses and strains, Plastic deformation and Yielding criteria; Hot and Cold working; Friction and Lubrication in metal forming.

UNIT – 2

Bulk Deformation Processes: Forging – Open and Closed die, Impression, Drop, Upset and Press forging; Rolling – Flat and Shape rolling; Extrusion – Forward, Backward and Impact extrusion; Wire, Rod and Tube drawing. Sheet Metal Working: Cutting – Shearing, Blanking, Punching; Drawing; Bending; Spinning; High energy rate forming.

UNIT - 3

Modern Machining Methods: Classification; Abrasive and Water jet; Ultrasonic; Electrochemical; Chemical milling; Electric discharge; Plasma arc machining.

UNIT - 4

Production of Machine Components: Processes of producing Shafts; Threads – Chasing, Rolling, Dies and Taps, Milling, Grinding; Gears – Casting, Stamping, Rolling, Milling, Shaping, Hobbing, Shaving and Grinding.

UNIT – 5

Rapid Prototyping: Techniques; Applications. Robotics and Mechatronics. Flexible Manufacturing Systems: NC part programming – Manual and Computer assisted (APT); Concept of flexibility; Computer integrated manufacturing systems.

ME 405 A: OPERATIONS RESEARCH (M)

3L **3 Hours, 100 Marks**

COURSE OUTCOMES:

CO1: Identify and Apply operations research techniques in industrial optimization problem.
CO2: Ability to formulate a real-world problem as a mathematical linear programming model.
CO3: Conduct sensitivity analysis and apply primal-dual relationship to analyze problem.
CO4: Application of linear programming to solve transportation problems.
CO5: Application of game theory to evaluate best strategy in decision making.
CO6: Learning and Analyzing various OR models like Inventory, Queuing, Assignment etc. and apply them for optimization.

SYLLABUS:

UNIT 1

Operation research: Characteristics; Scope; Methodologies; Modeling.

UNIT 2

Linear Programming: Problem formulation; Graphical and Simplex methods – Restricted or unrestricted variables, Equality or inequality constraints, Degeneracy, Alternative optima, Unbounded space and solution, Infeasibility; Duality – Primal-dual relationship; Sensitivity analysis – Changes in resource and contribution coefficients

UNIT 3

Transportation and Assignment: LP formulation; Transportation algorithm; Hungarian algorithm
Game theory: Pure and mixed strategies; Graphical solution; Dominance; LP formulation

UNIT 4

Inventory Control: Types of inventories; Relevant costs; Static inventory decisions under risk – Payoff, Opportunity cost, Expected value of perfect information; Uncertainty – decision criteria; Dynamic inventory models under certainty – EOQ with finite or infinite rate of replenishment, with or without shortages, price breaks; Probabilistic inventory models safety stocks, re-order levels; Selective control of inventories

UNIT 5

Queuing Theory: Elements; Measures of performance; (M/M/1):(FCFS/∞/∞) model. Simulation: Monte Carlo technique; Applications to inventory and queuing situations. Elementry Concept of CPM and PERT

ME424 B: DESIGN ENGINEERING (M)

3 P **100 Marks**

COURSE OUTCOMES:

CO1: Understand the theory of optimization methods and algorithms developed for solving various types of optimization problems.
CO2: Able to do comprehensive design of Machine tool/ I.C. engine/ Heat transfer equipment.

SYLLABUS:

Optimization Aspect in Design: Design variables, constraints, objective function and variable bounds. Analytical and numerical methods of optimization, search algorithms for unconstrained and constrained problems. Computer Aided optimum design for minimum cost, strength, rigidity, reliability etc.
Application of Finite Element Method

Design Projects:
A comprehensive design of one of the following:
(i) Machine Tool
(ii) I.C. Engine
(iii) Heat Transfer Equipments.

ME-451 A: HEAT AND MASS TRANSFER II (M)

3L, 1T **3Hours, 100 marks**

COURSE OUTCOMES:

CO1: Utilize dimensional analysis to illustrate functional dependence of dimensionless numbers on free and forced convection heat transfer.
CO2: Understand conservation equations for convective heat transfer in simple geometries.
CO3: Make use of empirical relations to determine free and forced convection heat transfer.
CO4: Classify and understand condensation and boiling heat transfer phenomenon.
CO5: Classify heat exchangers and analyze their performance using LMTD/€-NTU method.
CO6: Understand diffusion and convective Mass transfer and its non-dimensional correlations.

SYLLABUS:

Fundamentals of convective heat transfer: Free and forced convection, local and averaged heat transfer coefficient, continuity, momentum and energy equations; development of hydrodynamic and thermal boundary on a flat plate and in a circular tube;

Convection (Forced): forced convection on a flat plate and in a circular tube; Simple Reynolds analogy, Dimensional analysis of forced convection, Empirical relationships for forced convection.

Convection (Natural): Dimensional analysis of natural convection, Empirical relationships for natural convection.

Convection with phase-change: Description of condensing flow, film and dropwise condensation; Fundamentals of boiling heat transfer, pool boiling and forced convection boiling; Empirical relationship for convection with phase change.

Heat Exchangers: Types of heat exchangers, overall heat transfer coefficient, Fouling factor, Logarithmic mean temperature difference (LMTD) and Effectiveness-NTU methods of heat exchanger analysis for parallel and counter-flow heat exchangers.

Introduction to Mass Transfer: Mass and mole concentrations, molecular diffusion, eddy diffusion, Molecular diffusion from an evaporating fluid surface; Mass transfer in laminar and turbulent convections, Reynolds's analogy, non-dimensional correlations for convective mass transfer.

ME-452 A: GAS DYNAMICS AND GAS TURBINES (M)

3L, 1T **3Hours, 100 marks**

COURSE OUTCOMES:

CO1: Understanding the phenomenon of compressible fluid flow and its governing equations.
CO2: Analyze various modifications of the gas turbine cycle for work ratio and efficiency.
CO3: Analyze various losses in the gas turbine component and effect on turbine performance.
CO4: Performance analysis calculations of turbojet, turbofan and turboprop engines.
CO5: Understand the basics of rocket propulsion and various propellants used.
CO6: Understanding centrifugal and axial flow compressors and carry out their performance calculations.

SYLLABUS:

Gas Dynamics: Integral equation of conservation of mass, momentum and energy as applied to control volumes; speed of sound, Mach-number values, stagnation properties, one dimensional flow equation, isentropic flow of perfect gas, area velocity relationship, critical conditions, isentropic flow through converging and converging diverging nozzles, effect of friction on nozzle performance, Normal shock, formation of shock waves, governing equations, Fanno line and Rayleigh line.

Gas Turbines: Joule cycles, Atkinson cycle, Ericsson cycle, Deviation from ideal cycle, Gas Turbine cycles with multistage compressions, Reheating, regeneration and intercooling; pressure losses in heat exchangers and combustion chamber, Combustion chamber requirements, component and overall efficiencies, and velocity ratio, turbine performance, losses.

Jet Propulsion: Turboprop engine, turbojet-engine, Introduction to rocket, Types of rockets, solid propellant and liquid propellant rockets. Types of propellants, Propulsion efficiency.

Rotary Compressors: Types, impeller configuration, determination of main dimensions and vane angles for centrifugal and axial flow compressor, ideal forces on blade element, lift and drag, blade efficiency, pressurized power input.

ME 453 A: POWER GENERATION (M)

3L **3 Hours, 100 Marks**

COURSE OUTCOMES:

CO1: Understand the need and current status of power generation in India.
CO2: Study layout and various components of steam power plant and its commissioning.
CO3: Classify nuclear reactors; fuel used, its handling and safety issues.
CO4: Understand the economics of power generation and compare operating cost of various power plants.
CO5: Understand various factors involved in power generation in the power plants.
CO6: Study various renewable energy sources, their utilization and current status.

SYLLABUS:

Introduction: Sources of energy and electrical power generation; Growth in power demand, present status, principal types of power plants and their future possibilities, national power grid concept.

Steam Power Plant: Site selection, plant layout; Fuel supply, storage and handling; Selection of high pressure boilers; Pulverizing mills, mechanical stokers; Modern fuel furnaces and fluidized bed combustion; Ash handling and dust collectors; Commissioning and testing of steam power plant. Air Pollution.

Diesel Power Plant: Specific applications; Engine selection and operational performance.

Nuclear Power Plant: Elementary concept of nuclear fission and power generation; Site selection, type of nuclear reactors: BWR, CANDU, gas-cooled, liquid-metal cooled breeder reactors; Nuclear fuel production and handling; Radiation shielding, radio-active waste disposal and safety aspect.
Power Plant Economics: Plant investment: fixed, operational and maintenance costs; Selection of power plant equipment's: boilers, prime movers, size and number of power generating units, economical load sharing; Comparison of operating cost per kW of thermal, hydel and nuclear power plants; Different systems of charging the consumer; Load prediction and curves, influence of load factor, capacity factor, utilization factor and diversity factor on power plant location.

Renewable Energy Sources of Power Generation: Introduction to solar energy and its utilization, solar cells; Thermo-electric and thermo-ionic devices; Fuel cells; Magneto-hydrodynamics energy conversion; Geothermal, tidal and wind power plants; and their present status.

ME 454 A: PRODUCTION AND OPERATIONS MANAGEMENT (M)

3L, 1T **3 Hours, 100 Marks**

COURSE OUTCOMES:

CO1: Identify the types of plant layouts and material handling techniques in manufacturing.
CO2: Demonstrate the knowledge of operation plant and controlling production.
CO3: Application of various Materials Requirement Planning models, scheduling and planning of material flow (including the analysis of various lot-sizing techniques and order policies.
CO4: Learn the concepts of group technology, automation, FMS and CAD/CAM.
CO5: Make management level decisions within a manufacturing environment including operations management, supply chain management and lean manufacturing.

SYLLABUS:

UNIT 1

Production System: Inputs, Outputs, Value addition, Control feedback, External factors; Goods and Services; Decisions in POM; Types of production systems – Characteristics, Design, Operational control; Historical evolution.

UNIT 2

Plant Engineering: Location: Major factors influencing the location of an industry and choice of site; Qualitative and Quantitative methods. Plant Layout: Principles; Techniques for recording Material flow pattern, Types – Product, Process, Fixed, Cellular; Computer software. Materials Handling: Functions; Relationship with plant layout, Types of equipment – Selection; Automated material handling – Transfer lines, Robots and AGVs.

UNIT 3

Planning and Control of Mass Manufacturing: Industrial applications; Assembly line balancing. Planning and Control of Batch Processing: Optimal batch size; Aggregate production planning; Master production scheduling; Material requirement planning; Capacity requirement planning. Planning and Control of Job-Shop System: Scheduling and Sequencing heuristics; Gantt chart. Planning and Control of Project: CPM and PERT

UNIT 4

Modern Production Concept: Group technology – Part families, Product flow analysis; CAD-CAM integration; Computer aided process planning – Retrieval, Generative; Just-in-time manufacturing – Kanban system; Supply chain logistics and management; Agile and Lean manufacturing

ELECTIVE (M) ME 455 A: (a) AUTOMOBILE ENGINEERING (M)

3L **3 Hours, 100 Marks**

SYLLABUS:

Power Unit: Fuel injection and control systems: MPFI, CRDI, ignition systems, basic sensor and actuators; fuel combustion and travel information system; Engine selection and final drive ratio, over drive and fuel economy; Use of continuously variable transmissions to improve engine performance.

Chassis and Suspension: Load on frame, general considerations for strength and stiffness, engine mounting; various suspension systems: dampers, leaf and coil springs; Wind resistance, vehicle drag, aerodynamic forces and moments, factors effecting the vehicle body design and its parameters.

Transmission System: Clutches, flywheels, torque convertors; Gear-box: simple, automatic, synchromesh and overdrive; Transmission shaft, differential, rear and front axles; Rolling, air and gradient resistances; Propulsive power and overall gear ratio for specific performance.

Steering: Steering geometry, Ackermann and Davis steering mechanisms; Steering shaft, gear-box, linkages, kingpin, front and stub axles; conditions for true rolling, Quasi-static roll-over; Vehicle longitudinal & dynamic stability on curve, effect of braking on vehicle stability, power steering.

Brakes and Tyres: Servo-action, brake components; Bendix and Gerling system lock-head, hydraulic, vaccum, air and power brakes, antilock brake system; Types of tyres, tread patterns, static and dynamic balancing of wheels; Effect of caster, camber, toe-in and toe-out on tyre wear.

Advances in Automobile Engineering: Electric vehicles, hybrid vehicles and dual hybrid systems.

ME 455 A: (b) FACILITIES LOCATION AND LAYOUT PLANNING (M)

3L **3 Hours, 100 Marks**

SYLLABUS:

Site Selection: Factors affecting plant location and site selection.

Plant Layout: Types of plant layout – Process and Product Layout, Types of production activities - Job shop, Mass production, similar products and special product manufacturing and their influence on plant layout.

Layout Fundamentals: Information necessary for layout planning, Factors affecting plant layout – Materials, machinery, man movement, building, service, safety, storage and warehouses planning and layout, Process planning material of building, determination of equipment cost.

Layout Development: Collection of information, flow analysis, Process charts, multi-product charts, assembly charts, flow diagrams; Layout development aids - templates, models, etc. Computer assisted layout development: Introduction to modern layout development, Computer programs such as CRAFT, CORELAP, ALDEP, etc. Installing and evaluating the Layout: Procedure, plant engineering and acceptance.

Materials Handling: Principles of material handling, its relationship with plant layout, safety in operation, traffic and handling of equipment. Material Handling Equipment: Conveyors, cranes, hoists, mobile equipment, positioning equipment, container and support equipment, problems of packing cost size consideration, Suitability and uses of material handling equipment, Replacement models with special emphasis on material handling equipment and their obsolescence.

ME 455 A: (c) NON-CONVENTIONAL ENERGY SOURCES (M)

3L **3 Hours, 100 Marks**

SYLLABUS:

Conventional and Alternative Energy Sources: Effect on environment of fossil fuels, nuclear energy and hydroelectric power, Alternative energy sources-solar, wind, geothermal, tidal and wave, biomass etc,

Solar Energy: The sun and the earth, spectral distribution of extra-terrestrial radiation. Solar constant, depiction of solar radiations in the atmosphere. Solar radiation at the earth surface. Sun earth angle, Derived solar angles, solar time measurement and estimation of solar radiations. Instruments for measurement. Radiation properties of gauge material, Transmission of radiation through transparent media

Collection of Solar Energy: Flat plate collector construction Types, working, material selection, design considerations and testing procedure. Focusing collectors types, concentration tracking mechanism

Application: Solar water and air heaters, distillation, drying of materials power generation cookers, solar refrigeration

Wind Energy: nature of its resource and its potential, wind mill types their merits and demerits, design of wind rotors and control systems.

Geothermal Energy: The geological setting. Different geothermal systems. Utilization of geothermal energy, its economic and environmental comparison.

Biomass: The nature of its resource and its potential, Different bio-conversion techniques, production of bio-solid, liquid and gaseous fuels. Brief description of different of different utilization techniques for the following:

(a) Ocean Thermal Energy
(b) Tidal and Wave Energy

Syllabus of Open Electives I, II and III

CE 291 A: Open Elective-I: ENERGY EFFICIENT BUILDING DESIGN

3L **3 Hours, 100 Marks**

SYLLABUS:

Environment and man, external environment and built environment, Built-environment – integrated approach.

Climate: elements of climate, classification of climate, Micro-climate, site climate.

Comfort: desirable conditions, thermal comfort factors, comfort indices, effective and corrected effective temp. Tropical summer index.

Thermal Design: heat loss from a building under steady state condition, heat gains due to solar radiation, steady state and cyclic conditions, Means of thermal control – mechanical, structural control, air infiltration into buildings by natural means, shape of buildings,-thermal cube, fabric heat loss, ventilation loss and volume.

Light & Lighting: illumination requirement, day-lighting, artificial lighting, energy conservation.

Noise Control: Sources of noise, means of control, control requirements, behaviour of sound in rooms, vibration & vibration control.

Building Services: Mechanical & electrical services in building, lifts, escalators.

CHE 291 A: Open Elective-I: RENEWABLE ENERGY SOURCES

3L **3 Hours, 100 Marks**

SYLLABUS:

Sources of energy: Energy sources and their availability, renewable energy sources.

Energy from Biomass: Introduction, Biomass as a source of energy, Biomass conversion technologies, Biogas generation, classification of biogas plants, Biomass gasification.

Solar Energy: Sun and solar energy, solar radiation and its measurement, solar energy collectors, solar energy storage, Photovoltaic systems, Application of solar energy.

Wind Energy: Wind as an Energy source, Basic principles of wind energy conversion, Types of Wind machines, Components of wind energy conversion system, Performance of wind machines, application of wind energy.

Geothermal Energy: Introduction, Origin and distribution of geothermal energy, types of geothermal resources, Hybrid geothermal power plant, Application of geothermal energy.

Hydrogen energy: Introduction, Hydrogen production, Hydrogen storage, Hydrogen transportation.

Energy from the Oceans: Introduction, Ocean Thermal Electric Conversion (OTEC), Energy from Tides, Ocean Waves.

CSE 291A: Open Elective-I: OBJECT ORIENTED PROGRAMMING THROUGH C++

3L **3 Hours, 100 Marks**

SYLLABUS:

A review of C. Concepts of object oriented programming using C++. Data types: elementary and derived data types, literals.

Operators and expressions: operators, association and precedence rules of operators, expressions using unary, binary and ternary operators.

Statements: declarations as statements, selection statements, iteration statements, goto statement, break statement, continue statement, return statement, try-catch block.

Functions: void functions, functions with return value, call by value and call by reference parameter passing, default parameters, recursive functions, inline functions.

Classes: classes, objects, friend functions, classes within a class, local classes, global classes, constructors, destructors.

Derived classes: single and multiple derivation of classes, multilevel and hybrid derivation of classes, constructors, destructors.

Polymorphism: function and operator overloading, virtual functions.

Streams: input and output of built-in data types, manipulators.

File streams: opening a file, accessing a file, closing a file.

Exceptions: catching exceptions, rethrowing the exception, standard exceptions.

Templates: defining a template, template instantiation, function templates, class templates.

Elementary case study of a object oriented database in C++.

CSE 292A: Open Elective-I: OBJECT ORIENTED PROGRAMMING THROUGH JAVA

3L **3 Hours, 100 Marks**

SYLLABUS:

Overview of object oriented concepts in JAVA.

Introduction – Java & internet, java applets and its applications, Java features like – security, portability, byte code, java virtual Machine, object oriented, robust, multi-threading, architectural neutral, distributed & dynamic.

Data types and control structures, operators, arrays, Java methods and classes.
Inheritance of procedures and data, Packages and interface, exception handling, multi-threaded programming – thread priorities, synchronization, messaging, creating and controlling of threads. IO and applets.

String handling and various string functions.

Java utilities like java.lang, java.util and their uses, java.io, basics of networking using Java.

Java applets and their use, event handling, AWT and working with windows.

Introductory study of Java Beans, Servelets and JDBC.

Ma-291 A: Open Elective-I: MATHEMATICAL STATISTICS FOR ENGINEERS

3L **3 Hours, 100 Marks**

SYLLABUS:

Theory of probability: Theoretical probability distribution (Binomial, Poisson and Normal).

Correlation and Regression Analysis: Karl-Pearson's coefficient, Spearman's coefficient, Regression analysis of two variables system.

Sampling Theory: Test of significance, Large sample tests for mean and proportions. χ^2 (chi-square) , t and F Test of significance for Small sample.

Theory of attributes: association and independence of attributes, coefficient of association.

Index Number: Various types of index numbers, construction of index number of prices, fixed base and chain base methods

EE291 A: Open Elective-I: INDUSTRIAL APPLICATIONS OF ELECTRICAL DRIVES

3L **3 Hours, 100**

SYLLABUS:

Operating-Characteristics: Individual, group and collective drives, steady state individual and joint characteristics of electric motors and driven industrial units under different conditions of operation.

Transient Characteristics: Causes of transient conditions starting, braking, reversing, speed transition and sudden system changes. Forces and torques on the drives referred to a common reference shaft. General equation of motion, Accelerating and decelerating times. Starting and braking time and means of reducing.

Drives Control: Parameters characterizing speed control methods of electric drives, speed control of Industrial d.c. and a.c. motors under constant and varying torque and h.p. conditions.

Families of speed torque characteristics: Idea of manual and automatic control gears, Master-controller.

Motor Ratings: Continuous-short time and intermittent ratings, overload capacity. Effect of altitude, Motor heating and cooling curves. Equivalent current, power and torque. Selection motor for various duty cycles. Permissible frequency of starting, features of load diagram construction. Load equalisation and use of fly wheels. Types of motor enclosures.

Illumination: Units of light, Point, linear and surfact sources. Laws of illumination. Candle power distribution, MSCP and reduction factor, Indoor lighting system and their classification. Contrast, glare, shadow and color. Mounting height and spacing. General and local lighting Total lumen and point by point methods of calculations. Outdoor lighting distributor and protector fittings. Isolux diagram. Flood, gas, discharge and arc-lamp-working, characteristics and applications.

Electric Heating and Welding: Principles of electric heating. Direct and indirect resistance heating, lead baths and self baths. Resistance oven convection and rediation ovens. Arc resistance and induction furnance, elements of operation, performance and power supply arrangements. Temperature regulation of ovens and furnances. Induction, high frequency and dielectric heating and their uses. Elementary study of different kinds of electric welding operation, Power supply for welding. Elements of Electrics Traction: Electric traction versus others System of electric traction for tramways, trolley buses, motor coach trains and locomotive hauled trains. Idea about suitability of electric motor for traction. Conductor rail and pantograph. Meaning for multiple-unit operation.

Economics: Methods for economic selection of Industrial drives, loss factor and cost of losses, Effect of load factor. Power factor and factory diversity factor. Methods of power factor improvement and its economic limit. Economic calculations for illumination schemes Economic value of good lighting.

SE 291 A: Open Elective-I: COMPUTER ORIENTED NUMERICAL ANALYSIS

3L **3 Hours, 100 Marks**

SYLLABUS:

Error Analysis:- Approximations and errors, Round off errors.

Roots of Equations:- Bisection method, Newton – Raphson method.

Curve Fitting:- Linear Regression, Least Square Ft, Co-relation.

Interpolation:- Linear & Quadratic, Newton's & Lagrange's polynomials.

Numerical Differentiation:- Forward / Backward / Centered F.D. method.

Numerical Integration:- Trapezodial rule, Simpson's rule.

Solution of simultaneous Linear algebraic equations.

BCT 291 A: Open Elective-I: SUSTAINABLE ARCHITECTURE

3L **3 Hours, 100 Marks**

SYLLABUS:

MODULE -I

Concepts of sustainability : Energy and Global environment, Energy use and Climate change – Its impact, Types of Energy systems, Concept of Sustainability - Principles of conservation -synergy with nature, Bioregionalism - community basis shelter technology within bioregional patterns and scales, Ethical- environmental degradation.

MODULE -II

Sustainable planning & Design: Sustainable Development -Sustainable approach to site planning and design - site inventories- relationships between site factors - development impacts from one area of the site on the other areas - phasing of development - limits of change - Design facility within social and environmental thresholds

MODULE -III

Sustainable Building Materials and Construction : Properties, Uses and Examples of - Primary, secondary and Tertiary Sustainable Materials, Principles to improve the energy efficiency - siting and vernacular design, shade, ventilation, earth shelter, thermal inertia and air lock entrances. Techniques of sustainable construction - technologies, methods of effectiveness, and design synthesis – alternative materials and construction methods: solar water heating panels; photovoltaic electricity generation; use of local materials and on site growth of food, fuel and building materials.

MODULE -IV

Recycling and Reuse : Pre building, Building, Post building stages - Architectural Reuse, Waste prevention, Construction and Demolition recycling- Conservation of natural and building resources- Energy and material savings – types of wastes - Elimination of waste and minimize pollution- various Decomposing methods – Innovative reuse of various wastes Case Studies and Rating systems : Sustainable Development Case Studies: illustrated examples of the planning, development, and construction. Green architecture and various international rating systems for sustainability- EAM (UK), CASBEE (Japan), LEED (US), Green Star (Australia), etc. – Indian systems – TERI GRIHA rating, LEED India rating, IGBC

References:

1. B.C.Bose, “Integrated approach to sustainable Development”, Rajat Publications, Delhi
2. Laurie Baker’s, “Chamoli Earthquake hand book”, Costford, Centre of science and technology for rural development.
3. Fuller Moore, “Environmental control systems Heating, Cooling, Lighting”. McGraw Hill, Newyork.
4. Caring A.Langston, Grace K.C.Ding, “Sustainable practices in built environment”, second edition, Butterworth-Heinmann Linacre House Jordanhill Oxford.
5. R.N.Trivedi, “Environmental Sciences”, Anmol Publications Pvt Ltd, New Delhi

MI 291A: Open Elective-I: TUNNELING FOR ENGINEERING PROJECTS

3L **3 hours, 100 Marks**

SYLLABUS:

Tunneling: Introduction about tunnels, functions, advantages and disadvantages of tunnels compared to open cuts, Criteria for selection of size and shape of tunnels, consideration in tunneling, geological investigation, tunnel alignment, tunnel shafts, pilot tunnels. Advantages of twin tunnels and pilot tunnels, portals and adits.

Conventional Method of Tunneling: Drilling, Blasting, Loading and Transport of Muck, Supports, Ventilation, Drainage, and Equipments. Drivage work in varying ground conditions using conventional methods

Fast Tunneling: Dill jumbos, trackless mucking and transportation units. Tunnel boring machine

Tunneling in Soft Ground: General characteristics of soft ground, shield methods, needle beam method and NATM method of tunneling in practice.

Tunneling (rock bolting and guniting), Safety measures, Ventilation in tunneling, Lighting, Drainage.

EC 291 A: Open Elective-I: LOGIC SYSTEM DESIGN

3L **3 Hours, 100 Marks**

SYLLABUS:

Number Systems & Codes: Binary, Octal and Hexadecimal number systems. Different numerical and alpha-numeric codes.

Basic Logic Circuits and Combinational logic: Positive and negative logic of OR, AND, NOT, NOR, NAND, Exclusive OR and Exclusive NOR gates. Boolean algebra, Boolean functions and expressions. Simplification and minimization techniques, K-map and tabular methods. Design of minimal combinational systems and realization.

Arithmetic circuits: Design and realization of Digital comparator, half and full adders, parallel and serial binary adders, half and full subtractors.

Miscellaneous sub systems: Encoders, decoders and code converters. Parity generator and parity checking circuits. Multiplexers and demultiplexers.

Sequential logic: Storage devices and sequential sub systems. Introduction to synchronous and asynchronous sequential systems. Mealay and moore circuits.

Synchronous sequential systems: Introductory examples, memory elements and their excitation functions. Synthesis of synchronous sequential circuits. Analysis and design of synchronous sequential circuits.

Asynchronous sequential circuits: Fundamental mode circuits. Analysis procedure. Circuits with latches. Design of pulse mode asynchronous sequential circuits. Problems in asynchronous circuits - races and hazards.

CE 341 A: Open Elective-II: NON URBAN PUBLIC HYGIENE & DRINKING WATER

3L **3 Hours, 100 Marks**

SYLLABUS:

Communicable disease: Disease and immunity, communicable disease sources, mode of transfer. Control of communicable disease.

Fly and mosquito control: Life cycle of flies and mosquitoes. Various methods of fly and mosquitoes control.

Milk and food sanitation: Essential of dairy farm and cattle shed sanitation. Tests for milk and dairy products. Food epidemic, food poisoning. Botulism. Rural sanitation, village latrines, aqua privies, storm water and sullage problems, animal waste, methods of composting. Biogas collection and disposal of refuse, solid waste management through vermicomposting.

Septic tank (only salient features), percolation pits, sub surface disposal.

Rural water supply: Importance of village community in India, conditions of Indian villages with special regards to economic, social and health aspects. Quality of water needed for village community, sources of water for village water supplied, domestic roof water harvesting. Types of wells of sanitary aspects in well construction. Disinfections of wells. Different types of pumps used for village wells. Operation and maintenance of pumps, water borne diseases. Quality of water, human and cattle population and their water requirement. Rate of water supply. Standards of potable water. Rain water storage.

Treatment of water: Disinfection, desalination, Defluoridation, distribution of water.

CHE 341 A: Open Elective-II: PETROLEUM REFINING TECHNOLOGY

3L **3 Hours, 100 Marks**

SYLLABUS:

Origin occurrence of petroleum, Formation and Evaluation of Crude Oil. Testing of Petroleum Products. Petroleum refining processes, general processing, topping and vacuum distillations. Thermal cracking in vapor, liquid and mixed phase. Overview of Refinery Products

Catalytic cracking - Houdry fixed bed, fluidized bed, T.C.C. Houder flow etc. Catalytic reforming - conversion of petroleum gases into motor fuel with special reference to alkylation, polymerization, hydrogenation and dehydrogenation.

Treatment Techniques: Removal of Sulphur Compounds in all Petroleum Fractions to improve performance, Destruction of Sulphur Compounds and Catalytic Desulphurization, Solvent Treatment Processes, Dewaxing, Clay Treatment and Hydrofining.

Production of aviation gasoline, motor fuel, kerosene, diesel oil, tractor fuel and jet fuel, hydrodesulfurisation, Lubricating oil manufacture, Petroleum waxes and asphalts.

Octane number, Cetane number, Diesel index, their determination and importance Storage of petroleum products: tanks, bullets, special types of spheres etc. Transportation of petroleum products: road, rail, sea and pipeline; Importance of pipeline transportation.

CSE 341A: Open Elective-II: DATA STRUCTURES AND ALGORITHMS

3L **3 Hours, 100 Marks**

SYLLABUS:

Introduction to data structure, String storage representation and manipulation. Markov algorithm and primitive data structures.

Concepts of non primitive data structures. Linear data structure. Array, stack, queue, their applications and implementations using sequential storage representation and linked representation.

Linear linked list, double linked list, circular linear linked list and generalized lists and applications.

Concept of non-linear data structures, Tree, graph, set and their representation, Binary Tree, Threaded tree, different techniques of tree traversal, breadth first search, depth first search, application of tree and graph such that Polish notation, concepts of heap.

Sorting, searching algorithms and comparative study of different sorting and searching techniques such that selection sort, heap sort, bubble sort, quick sort, merge sort and radix sort. Linear search and binary search, hashing. External sorting.

Time and space complexity of the algorithms – Big-O,θ,Ω, and small-o, Asymptotic complexity, Upper and Lower bound time and space trade offs.

SE 341 A: Open Elective-II: STRUCTURAL DYNAMICS

3L **3 Hours, 100 Marks**

SYLLABUS:

Vibrations of single degree of freedom system, sources of vibration, Types of vibration, Degree of freedom, spring action and damping, equation of motion of single degree of freedom system, undamped system of single degree of freedom, combination of stiffnesses, damped system of single degree of freedom, dry friction, damping forced vibration of damped system, introduction to multi degree freedom system.

EE 342 A: Open Elective-II: ARTIFICIAL INTELLGENCE

3L **3 Hours, 100 Marks**

SYLLABUS:

Artificial Intelligence: Introduction to A1 Knowledge-based Expert Systems and I: Introduction. Importance and Definition of A1, ES, ES, building tools and shells.

Knowledge-Representation: Concept of knowledge, Representation of knowledge using logic, cemantic networks, frames and production systems.

Control Strategies: Concept of neuristic search and back-tracking forward and backward chaining, study of the following search, techniques Depth-first search, Breath-first search, Generate and Test.

Hill Climing Best-first search Learning; Concept of learning and knowledge acquisition study of the following learning techniques: Rote learning, Induction, Explanation-based learning.

Neural Networks: Introduction: Evolution, Biological Neurons and Synapses, Characteristics of Artificial Neural Networks (ANN) Types of Activation Functions.

Perceptrons: Perceptron representation: Concept of Linear separability, Limitations of Perceptrons, Single layer and multi layer Perceptrons. Perception learning algorithms.

Basic Concept of Learning in ANN: Supervised learning, Back propagation, Unsupervised learning, Self-Organisation, Kchonen's Network, Hopfield Network: configuration Hardware Implementation, Learning, Stability.

Art Networks: Network configuration, Characteristics, Learning.

Implimationm: Applications

Conclusion: Recent trends and Future Applications.

BCT 341 A: Open Elective-II: TRADITIONAL INDIAN ARCHITECTURE

3L **3 Hours, 100 Marks**

INTENT:

To provide theoretical knowledge base on the uniqueness of Indian traditional Architecture principles, the meaning of space, the manifestation of energy, the selection of site and how 62 integration of built form with site happens at metaphysical level based on articulation of celestial grid.

To introduce the principles of Vastu and relationship between building and site. To familiarize the students with the units of measurement in traditional architecture. To introduce concepts of orientation and cosmogram according to the Vasthu Purusha Mandala. To study the detailing and design of various building components and their material and method of construction.

SYLLABUS:

MODULE I INTRODUCTION

Vastu - its definition and classification - Relationship to eart. Features of good building site - good building shapes - macro, micro, enclosed and material spaces - relationship between built space, living organism and universe - impact of built space on human psyche.

MODULE II SITE PLANNING AND COSMOGRAM

Orientation of building, site, layout and settlement - positive and negative energies - importance of cardinal and ordinal directions - The celestial grid or mandala and its types. The Vaastu Pursha Mandala and its significance in creation of patterns, and lay-outs, Types of lay-outs. Simple design of residential buildings.

MODULE III COMPONENTS AND DETAILING

Building heights -Base and basement - wall and roof specifications - column and beam designs - Pitched roof and domical roofs - significance of pyramid.

MODULE IV MATERIALS AND CONSTRUCTION

Use of wood, stone, metal, brick and time - marking technology, corbelling technology, jointing technology - foundations for heavy and light structures - Landscaping in and around buildings - Aesthetics in Indian Architecture.

References :

1. Dr.V.Ganapati Sthapati - :Sthapatya Veda" Dakshina Publishing House, Chennai-41, India, 2001.
2. Stella Kramrisch - The Hindu Temple Vol.I Motital Banarsidass Publishers Pvt. Ltd., Delhi - 1991.
3. K.S.Subramanya Sastri - Maya Matam - Thanjavur Maharaja Sarjoji Saraswathi Mahal Library - Thanjavur - 1966.
4. Dr.V.Ganapati Sthapati - :Sthapatya Veda" Dakshina Publishing House, Chennai-41, India, 2001

MI 341A: Open Elective-II: APPLICATION OF GIS AND REMOTE

SENSING IN ENGINEERING

3L **3 Hours, 100 Marks**

SYLLABUS:

Remote Sensing: Introduction to Remote Sensing, Terminology in Remote Sensing, Types of Remote sensing, advantage and disadvantage of remote sensing data, Electromagnetic radiation atmospheric. Windows remote sensing platforms and sensors systems, path-row referencing system, remote sensing data product, procedure for obtaining satellite data. Hardware and software related to remote sensing.

Different types of platforms, sensors and their characteristics, Orbital parameters of a satellite, Multi concept in remote sensing.

Image Interpretation and analysis: Elements of visual image interpretation, Digital image pre-processing, radiometric correction, geometric correction, resolution of remote sensing data, image enhancement, contract enhancement, spatial filtering band rationing image classification supervised and unsupervised classification, remote sensing applications in forestry, geology, hydrogeology, Land use and land cover mapping.

Principles of interpretation of aerial and satellite images, equipments and aids required for interpretation, ground truth – collection and verification, advantage of multidate and multiband images. Digital image Processing concept.

Geographic Information System (GIS): Fundamental of GIS: Basis concept including definition and history of GIS, Essential Elements of GIS, Uses and users of GIS, General GIS Applications, Geodesy, Grids, Datum's and projection systems, GIS Data structure, Data Formats, GIS layers and Digitization overview of GPS and its application, Hardware and software related to GIS.

Raster and vector Based GIS: Raster based GIS, Definition of Raster Based GIS, Spatial Referencing Definition and Representation of Raster Data. Vector based GIS, Definition and concept of vector based GIS, Data structure, Data Capture and Basic operations of spatial analysis, advantages and disadvantage in raster and vector based GIS, Introduction to network in GIS, GIS Project Planning Management and Implementation.

Application of GIS :in Map revision, Land use, Agriculture, Forestry, Archaeology, Municipal, Geology, water resources, soil Erosion, Land suitability analysis, change detection, Use of GIS in Mining.

EC 341A: Open Elective-II: **MICROPROCESSORS AND MICROCONTROLLERS**

3L **3 Hours, 100 Marks**

SYLLABUS:

Microprocessor Architecture: Architecture of 8-bit 8085 Microprocessor; instruction set and addressing modes. Assembly language programming of Intel's 8085 Microprocessor. Introduction to assemblers.

Microprocessor interfacing: Interfacing of address, data and control buses, Memory and I/O devices, Interrupt and DMA for 8085 microprocessor.

Introduction to Microcontrollers: Architecture and instruction set of MCS-51 series of microcontrollers. Applications of Microcontrollers.

16 and 32-bit Microprocessors: CPU architecture, addressing modes and features of 16 and 32 bit microprocessors – 8086. Salient features of 80286, 80386, 80486 and Pentium series microprocessors.

Bus standards: Introduction to Multibus , VME, RS-232-C, IEEE 488, PCI, USB, RS 422 and 485.

CE 391 A: Open Elective-III: ECOSYSTEM AND BIODIVERSITY

3L **3 Hours, 100 Marks**

SYLLABUS:

Concept of an ecosystem, structure & function of ecosystem, Bio-Geo chemical cycles (Hydrological, carbon, oxygen, nitrogen, phosphorus & sulphur cycle), energy flow in ecosystem, food chain

Major ecosystems (Description only) : Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystem, Riverine and stream ecosystem, Marine ecosystem, Estuarine ecosystem.

Biodiversity : Definition and its importance. Biodiversity at global, national & local level. Hot spots of biodiversity, Threats to biodiversity & causes of biodiversity loss. Conservation of biodiversity.

Value of biodiversity: Consumptive use, productive use, social value, ethical value, aesthetic value& optional value.

Bio-geographical classification of India. India as mega- diversity nation

CHE 391 A: Open Elective-III: NANOTECHNOLOGY

3L **3 Hours, 100 Marks**

SYLLABUS:

Introduction to Nanotechnology: Introduction to nanotechnology and materials, Nanomaterials, Introduction to nano sizes and properties comparison with the bulk materials, different shapes and sizes and morphology.

Fabrication of Nanomaterials: Wet Chemical Synthesis Methods, Colloidal Nanoparticles Production, Sol Gel Methods, Microwave and Atomization, Gas phase Production Methods : Chemical Vapour Depositions.

Kinetics at Nanoscale: Nucleation and growth of particles, Issues of Aggregation of Particles, Layers of surface Charges, Zeta Potential and pH.

Carbon Nanomaterials: Synthesis of carbon buckyballs, List of stable carbon allotropes extended fullerenes, metallofullerenes solid C60, bucky onions nanotubes.

Nanomaterials characterization: Instrumentation Fractionation principles of Particle size measurements, Particle size and its distribution, XRD, Zeta potential Microscopies SEM, TEM, Atomic Forced Microscopy, Scanning and Tunneling Microscopy

Applications in Chemical Engineering: Self-assembly and molecular manufacturing : Surfactant based system Colloidal system applications, ZnO,TiO_2, Silver Nanoparticles Functional materials Applications, Production Techniques of Nanotubes, Carbon arc, bulk synthesis, commercial processes of synthesis of nanomaterials, Nanoclay, Commercial case study of nano synthesis - applications in chemical engineering.

CSE 391A: Open Elective-III: WEB TECHNOLOGIES

3L **3 Hours, 100 Marks**

SYLLABUS:

Understanding Microsoft .NET Framework and ASP.NET, Creating components in Visual C#. CLR, Framework Class Library, Undocumented Types.

Programming the .NET Framework, Common Types, Math, Strings, Collections, Regular Expressions. Core Types, Serialization, Remoting, Graphics, Rich Client Applications, Globalization, Configuration, Advanced Component Services.

Multithreading, Thread Synchronization, Inter-thread Communication and Monitor. Delegates & Events. Validating User Input.

Creating a Connection to the Database, Displaying a DataSet, List-Bound Control, Paging and Selection, DataGrid Control, Accessing Data with DataReaders and SqlDataReader. Overview of Stored Procedures.

Managing State, State management, Application and Session Variables, Cookies and Cookieless Sessions. Configuring, Optimizing. Using the Cache object.

Reading and Writing XML Data, Overview of XML Architecture, DataSet Object, XML Web Server Control, Reading, Transforming, and Displaying XML, Nested Data. Creating an XML Web Service.

Securing a Microsoft ASP.NET Web Application, Web Application Security Overview, Windows-Based Authentication, Forms-Based Authentication, Passport Authentication, Registering New Users, Permitting Users to Sign Out.

AJAX.NET Architecture, Working with AJAX Pro and Controls, Accordion, Calendar, CascadingDropDown, CollapsiblePanel, Filtered TextBox, Numeric Up Down, Modal Popup, Popup Control. Page_Load Event and Click Event Procedure, Adding server controls to an ASP.NET Web Form basics, handling text and numbers.

CSE 392A: Open Elective-III: DATABASE MANAGEMENT SYSTEMS

3L **3 Hours, 100 Marks**

SYLLABUS:

Purpose of data base system, data abstraction, data models, data independence, data definition language, data manipulation language, data base manager, data base administrator, data base users, overall system structure.

E-R Models, entities and entity sets, relationships and relationship sets, attributes, mapping constaraints, keys, E-R diagrams, reducing E-R diagrams to tables, generation, aggregation, design of an E-R data base scheme

Basic concept of object oriented model, New database applications, object structure, class hierarchy, multiple inheritance, object identity, object containment, physical organization, object oriented queries, scheme modification.

File and system structure, overall system structure, file organization, logical and physical file organization, sequential, random, hierarchical, inverted, multilist, Indexing and hashing, B-tree index files

Introduction to distributed database. Introduction to SQL Query and SQL joins.

CSE 393A: Open Elective-III: INFORMATION AND NETWORK SECURITY

3L **3 Hours, 100 Marks**

SYLLABUS:

Introduction to Cryptography: Simple substitution ciphers, divisibility and greatest common divisions, prime numbers and unique factorization, cryptography before computer age.

Discrete Logarithms and Diffie-Hellman: Public Key cryptography, groups, discrete logarithm problem and its hardness, Diffie-Hellman key exchange, Chinese remainder theorem.

Integer Factorization and RSA: Euler's formula, RSA Public Key Crypto System, implementation and security issues, primality testing.

Digital signature, Hash functions, modern symmetric crypto systems: DES and AES.

Computer Security overview.

Common attacks and Detense Mechanisms; Evesdropping, cryptoanalysis, password pilfering, Identity spoofing, Buffer-overflow, Repudiation, intrusion & IDS system Traffic analysis, DOS attacks, Malicious software.

Basic Security models and Security resources.

Network Perimeter Security. Packet Filters, Circuit Gateways, Application Gateways, Trusted Systems, Firewall Configurations.

Ma 391 A: Open Elective-III: ADVANCED NUMERICAL ANALYSIS

3L **3 Hours, 100 Marks**

SYLLABUS:

Solution of Algebraic and Transcendental Equations: Newton-Raphson method for real multiple roots, for complex roots and for system of non-linear equations; Synthetic Division, Birge-Vieta Method.

Solution of simultaneous Linear Equations and Eigen Value Problems: Direct methods: Gauss-elimination, Gauss-Jordan, Iterative Methods: Jacobi iteration, Gauss-seidel iteration and Successive Relaxation method. Eigen value Problems: power method

Curve fitting and Function Approximation: Chebyshev approximations, Chebyshev Expansion, Chebyshev Polynomials. Economization of Power Series.

Numerical Solution of Partial Differential Equations: Finite difference Approximation to partial derivatives. Solution of Laplace and poisson equations, Solution of one and two dimensional heat and wave equation by the method of separation of variables.

EE 391 A: Open Elective-III: SOFT COMPUTING TECHNIQUES

3L **3 Hours, 100 Marks**

SYLLABUS:

Soft Computing: Introduction of soft computing, soft computing vs. hard computing, various types of soft computing techniques, applications of soft computing.

Artificial Intelligence : Introduction, Various types of production systems, characteristics of production systems, breadth first search, depth first search techniques, other Search Techniques like hill Climbing, Best first Search, A* algorithm, AO* Algorithms and various types of control strategies. Knowledge representation issues, Prepositional and predicate logic, monotonic and non-monotonic reasoning, forward Reasoning, backward reasoning, Weak & Strong Slot & filler structures, NLP.

Neural Network : Structure and Function of a single neuron: Biological neuron, artificial neuron, definition of ANN, Taxonomy of neural net, Difference between ANN and human brain, characteristics and applications of ANN, single layer network, Perceptron training algorithm.

Fuzzy rule base system: fuzzy propositions, formation, decomposition & aggregation of fuzzy rules, fuzzy reasoning, fuzzy inference systems, fuzzy decision making & Applications of fuzzy logic.

EE 392 A: Open Elective-III: ENERGY CONSERVATION

3L **3 Hours, 100 Marks**

SYLLABUS:

Elements of Energy Conservation and Management : General energy problem, Sector wise Energy consumption, demand supply gap, Scope for energy conservation and its benefits, Energy conservation Principle Maximum energy efficiency, Maximum cost effectiveness. Mandatory provisions of EC act Features of EC act Standards and labeling, designated consumers, Energy Conservation Building Codes (ECBC). Energy management concept and objectives Initializing Planning, Leading, Controlling, Promoting, Monitoring and Reporting, energy management programmes.

Energy Conservation Approaches In Industries : energy saving opportunities in electric motors Benefits of Power factor improvement and its techniques Shunt capacitor, Synchronous Condenser etc., Effects of harmonics on Motors, and remedies leading to energy conservation Energy conservation by VSD Methods and techniques of energy conservation in ventilation and air conditioners compressors pumps, fans and blowers Area Sealing, Insulating the Heating / cooling fluid pipes, automatic door closing Air curtain, Thermostat / Control Energy conservation in electric furnaces, ovens and boilers lighting techniques Natural, CFL, LED lighting sources and fittings

Energy Conservation in Power Generation, Transmission and Distribution : Performance improvement of existing power plant: cogeneration, small hydro, DG Set. Demand side management Load response programmes Types of tariff and restructuring of electric tariff Technical measures to optimize T and D losses.

SE 391 A: Open Elective-III: FINITE ELEMENT METHOD

3L **3 Hours, 100 Marks**

SYLLABUS:

Introduction to Finite Element Method, Basic Concept of Finite Element Method, Analysis of continuum:- Structural, thermal, Potential etc., Finite Element Analysis of an elastic continuum:- Displacement approach, Direct Formulation, Energy Integral, Co and C1 continuity, Convergence criteria.
Elements:- Types and Properties. Conforming and Non conforming.
Shape Functions:- Langrangian and Serendity family for one and two dimensional cases.
Pascal triangle, Super / Sub and Iso parametric elements.
Steps in Finite Element Analysis of an elastic continuum.

PI 391A: Open Elective-III: QUALITY MANAGEMENT

3L **3 Hours, 100 Marks**

SYLLABUS:

Introduction: History of Quality, Objectives , importance and need of quality, Contributions of Quality Gurus- Juran, Deming, Crosby, Feigenbaum, Ishikawa, Taguchi etc., Impact of Quality on business performance.

Process and Statistical Quality Control: Quality System; Quality control techniques; Process capability; Control Charts- Theory of control charts, control limits and specification limits, Control charts for variables-X R Charts, Control Charts for attributes p, np, c and u charts.

Acceptance Sampling : Fundamental concepts of acceptance sampling; OC Curves; Single , Double and multiple sampling;

Quality Management: Introduction to Quality management; quality control and quality assurance; Quality control tools; cost of quality and cost of poor quality.
ISO 9000: ISO 9000 series; terminologies; need for ISO 9000 certification; basic procedure and work instructions; steps in ISO 9000 registration; Internal and third party audit for registration; Clauses of ISO 9000-2000 .

Introduction to - Quality Circles; Taguchi Loss function; Total Productive maintenance; JIT, Kanban, Kaizen, 5S, Benchmarking, Total Employee involvement, Six signal, Re-engineering, Quality Function Deployment.

BCT 391 A: Open Elective-III: CLIMATE RESPONSIVE ARCHITECTURE

3L **3 Hours, 100 Marks**

OBJECTIVE:

Understanding Climate and its impact on architectural design, fundamentals of climatology and environmental studies.

OUTLINE:

Module 1: (Contact Hours - 07)

Introduction – Elements of Climate, measurement and representation of climatic data. Classification of climate, major climatic zones of India.

Module 2: (Contact Hours - 09)

Thermal Comfort: Effect of climatic elements on Thermal comfort; indices for Thermal comfort Thermal performance of building elements: Thermal and physical properties of building materials and their effect on indoor environments.

Module 3: (Contact Hours - 07)

Natural ventilation: Functions, effects of openings and external features on internal air circulation. Design considerations for achieving natural ventilation.

Sun path diagram, use of solar charts, types of shading devices

Day light factor: components, design considerations for indoor spaces

Module 4: (Contact Hours - 08)

Micro Climate: factors and effects

Construction techniques for improving thermal performance of walls and roofs. Passive cooling techniques: traditional and contemporary

Module 5: (Contact Hours - 08)

Design considerations for buildings and settlements in tropical climates with special reference to hot-dry, warm-humid and composite climates; Mahoney Tables.

Exercises:

Design of shading devices.

Layout of Residence for hot - dry, warm-humid and composite climates.

MI 391A: Open Elective-III: PROJECT ENVIRONMENT CLEARANCE

3L **3 Hours, 100 Marks**

Brief introduction of Environment Protection Act 1986 and other relevant legal provisions applicable to get environment clearance in India.

Impact of major engineering projects on various components of the environment: Socio-Economy, Land, Water, Air, Noise and others.

Preparation of Environment management plan: Public hearing, collecting baseline data, Environment impact assessment and predication, Environment management plan, environment monitoring and management.

EC 391 A: Open Elective-III: ELECTRONICS INSTRUMENTATION

3L **3 Hours, 100 Marks**

SYLLABUS:

Transducers: Construction, characteristics and circuits for common types of resistive, capacitive, inductive, magneto-structive; piezo-electric. Photo-electric and thermo-electric transducers for measurement of process physical variables. Various sensing elements and transducers for measurement of Force, Pressure, Humidity, Moisture, strain, Velocity, Acceleration and pH. Inductive and Capacitive proximity switches. Physical and electrical loading of and by the transducer Systems.

Signal Conditioning: Analog and digital signal conditioning for instrumentation. Objectives of DAS, components of analog DAS and digital Data acquisition system, digital data recording system, multi channel DAS, modern digital acquisition system.

Electronic Displays: Principle of LED numeric, matrix and alpha-numeric displays, flat panel CRT, LCD, electro-luminiscent and electrophoretic and touch screen displays.

B.E. (Mechanical Engineering) Open Elective:

IV SEMESTER	
ME- 291A	**RENEWABLE ENERGY SOURCES (M)**
ME-292A	**AUTOMOBILE ENGINEERING (M)**
V SEMESTER	
ME 341A	**ECONOMICS ANALYSIS AND MANAGEMENT OF OPERATIONS**
ME 342A	**SYSTEMS DESIGN AND ANALYSIS**
VI SEMESTER	
ME 391A	**DESIGN PLANNING AND CONTROL OF PRODUCTION SYSTEM**
ME 392 A	**FINITE ELEMENTS METHOD**

ME- 291A: RENEWABLE ENERGY SOURCES (M)

3L **3 Hours, 100 Marks**

SYLLABUS:

Principal types of fossil fuel fired power plants and their effects on livestock and environment; Concepts of NCES, Criteria for assessing the potential of NCES, Limitations of RES.

Solar Energy - Solar radiation data, solar energy conversion into heat, Analysis of Flat plate and Concentrating collectors, Testing procedures, Paraboloid Dish, Central Receiver; concept of collector tracking, energy storage systems; Solar thermal systems for residential water heating, Solar Pond, industrial process heating and power generation. Photo voltaic: p-n junctions, I-V characteristics of solar cells, Calculation of energy for photovoltaic power generation; Battery Characteristics, DC Power Conditioning Converters, AC Power Conditioning -Inverters.

Wind Energy: Energy available from wind, General formula, Lift and drag. Basis of Wind energy conversion, Effect of density, Frequency variances, Angle of attack, Wind speed, Determination of torque coefficient, Principle of Operation of wind turbines, types of wind turbines and characteristics, Generators for Wind Turbines, Control strategies.

Biomass and Biofuels: Conversion routes- combustion, pyrolysis of biomass to produce solid, liquid and gaseous fuels; Constructional details of gasifier; Aerobic and anaerobic digestion, Biofuels and their production; biofuels, Biomass systems for thermal applications and power generation.

Geothermal Energy: Definition and classification of resources, typical geothermal gradient; Dry, flash and binary steam systems; Utilization for electricity generation and direct heating, Wellhead power generating units. Basic features: Atmospheric exhaust and condensing, Exhaust types of conventional steam turbines.

An overview of other renewable devices- Fuel cells: principle, types, applications; Ocean thermal energy conversion (OTEC), Thermoelectric, MHD, Wave energy, Tidal energy, etc.

Economic Viability: Calculation of the cost of energy supply from renewables, Payback period, Carbon footprints; Comparison with conventional fossil fuel driven systems in terms of costs and emissions; Calculation of carbon dioxide reduction and incremental costs for renewable options.

ME-292A: AUTOMOBILE ENGINEERING (M)

3L **3 Hours, 100 Marks**

SYLLABUS:

Power Unit: Automobile engine types, classification; Engine parts: cylinder head, block and crank case, piston and rings; Carburation, fuel injection, valve operation; Fuel combustion, mechanical power and engine performance characteristics; Engine cooling and thermal stresses in parts,.

Chassis and Suspension: Load on frame, general considerations for strength and stiffness, engine mounting; Dampers, leaf and coil springs, various arrangements of suspension systems.

Transmission System: Clutches, flywheels, torque convertors; Gear-box: simple, synchromesh and overdrive; Type of universal joints, propeller shaft, differential; Rolling, air, gradient resistances and propulsive power calculation.

Steering: Steering geometry, Ackermann and Davis steering mechanisms; Telescopic steering; Steering shaft, gear-box, linkages, steering angles, front and rear axles; Vehicle longitudinal, static and dynamic balancing and electronic stability; Power steering: types and mechanism; Effect of caster, camber, toe-in and toe-out on tyre wear.

Brakes and Tyres: Servo-action, brake components; Bendix and Gerling system lock-head, hydraulic, vacuum, air and power brakes, and retarders; Pneumatic and tubeless tyres;

Features of a Modern passanger Car: Introduction to ABS, Front and side air bags, EBD, Climatizer, ESP, night-vision dashboard system; sun-roofing, collision warning system, Hybrid cars.

ME 341A ECONOMICS ANALYSIS AND MANAGEMENT OF OPERATIONS

3L **3 Hours, 100 Marks**

SYLLABUS:

Business Goals & Form of Business Organization, Introduction to Management- Elements of Management, Principle of Management.

Concept of Costing- Breakeven Analysis, Deprecation & Estimation.

Marketing- 5Ps of Marketing- Product, Price, Promotion, Person and Place. Demand Forecasting, Concept of Advertising and It's Objective.

Financial Analysis-Statement and Financial Ratio.

Introduction to Privatization Liberalization, Globalization & Their Impact on Economy.

ME 342A SYSTEMS DESIGN AND ANAYSIS

3L **3 Hours, 100 Marks**

SYLLABUS:

System Fundamental Concept: System definition, systems approach, Classification- General Systems, Discrete Systems, Controlled systems.

Procedure for engineering a system: Defining system objective, formulation of objective criteria, Development of system alternatives.

Systems Optimization: Formulation of system, Design problem and application of search methods, linear programing and dynamic programing for optimum solutions.

System Schedule: Time models, resource allocation, Time cost trade-off, system cost economic flow graph.

ME 391A DESIGN PLANNING AND CONTROL OF PRODUCTION SYSTEM

3L **3 Hours, 100 Marks**

SYLLABUS:

Production Planning: Planning horizon, product exploring, Make and buy decisions, operations planning, demand forecasting, conversion of forecast into production goal.

Scheduling: Operation sequencing and balancing, Scheduling for mass production and job order production, MRP, ERP.

Inventory System: Cost factors relevant to operations and inventory control, EOQ with shortages and uniform production, quantity discount.

Project Planning and Control:Network control, control cost consideration and optimization, Resource allocation and levelling, Aggregate production planning, decision rules.

Supply Chain Management:: Strategic framework of Supply chain – meaning, scope and performance of supply chain, supply chain drivers and obstacles. Role of e-business in a supply chain.

ME 392A FINITE ELEMENTS METHOD

3L 3 Hrs. MM: 100

SYLLABUS:

Introduction: Basic concept of Finite element method; Rayleigh-Ritz and weighted residual method of variational approximation, Numerical Solution of equilibrium problem by Gaussian elimination. Finite Element Analysis of One-dimensional Problem; Basic Concepts, derivation of elements equations, connectivity of elements, imposition of boundary conditions, Solution of equations, Application in One dimensional problem of Solid mechanics and heat transfer. Finite Element Analysis of Two Dimensional Problem: Single variable problems: finite element discertization, interpolation, function, numerical integration and modeling considerations for triangular, rectangular, Quadrilateral, Isoparametric and Plane frame elements, Evaluation of equation and their solutions, Application in Two Dimensional Problem of Solid mechanics, Heat Transfer and Eigen value problems.