Scheme of Examination
B. Tech 7th Sem (Mechanical Engineering)

Sr.No	Subject Name	Code	Teaching Schedule (Hrs)				Examination Schedule (Marks)			Total Marks	Duration of Exam (Hrs)
			L	T	P/D	Total	Sessional	Theory	Practical / viva-voce		
1.	Automobile Engineering	ME 401 E	4	1	---	5	50	100	---	150	3
2	Measurement and control	ME 403 E	4	1	---	5	50	100	---	150	3
3	Elective* -I	ME	4	1		5	50	100	---	150	3
4	Elective* -II	ME	4	1	---	5	50	100	---	150	3
5	Statistical Quality Control & Reliability	ME 405E	4	1	---	5	50	100	---	150	3
6	Measurement (PR)	ME 407E	---	---	2	2	50	---	50	100	3
7	Project-I	ME 409E	---	---	7	7	100	---	100	200	3
8	Seminar	ME 411E	2	---	---	2	-	---	---	---	---
9	In plant Training Report	ME 413E	---	---	---	---	125	---	---	125	---
Total			22	05	9	35	525	500	150	1175	

Under ME-411E some of the students may be evaluated in 7th semester and remaining in 8th Sem. Marks will be added in 8th Sem.
* Refer List of Elective I and II

B.Tech (Seventh Semester) Mechanical Engineering

ME 401 E Automobile Engineering

L	T	P/D	Total.		
4	1		5	Theory	: 100 marks
				Sessional	: 50 marks
				Duration of Exams.	: 03 hours

UNIT I

Brief history of automobiles, Main components of an automobile, Brief description of each component
Brief description of constructional details and working of a four stroke I.C. Engine (S.I. Engines and C.I. Engines) including lately developed overhead cam shaft, Multi-cylinder engines, Introduction to recent developments in I.C. Engines- Direct injection systems, Multi-point fuel injection systems, Microprocessor based fuel supply systems, Multi valve engines, Mechanical balancing, Firing Order, Power balancing, Power overlap, Power flow charts.
Introduction, Brief description of different components of Transmission System.

Clutch

Introduction to Clutch and its different types, Principle of Friction Clutch, Clutch Lining and friction materials used in Friction Clutches, Torque transmitted, Brief description of Cone Clutch, Single Plate and Multiplate Clutches, Dry and wet clutches, Automatic clutch action, Centrifugal clutches, Electromagnetic clutches, Fluid Flywheel.

UNIT II

Gear Box

Air resistance, gradient resistance and rolling resistance coming across a moving automobile, Tractive effort, Variation of tractive effort with speed, Performance curves (object and need of a gear box), Sliding mesh gear box, Control mechanism, Sliding type selector mechanism, Ball type selector mechanism, Steering column gear shift control, Constant mesh gear box, Synchromesh device, Automatic transmission in general, AP automatic gear box, Torque converter, Torque converter with direct drive, Lubrication of Gear Box.

Propeller Shaft:
Functions and requirements of a propeller shaft,
Universal joints, Constructional forms of universal joints, Flexible-ring joints, Rubber-bushed flexible joints. Constant-velocity joints.

Differential:
Principle of operation, Constructional details of a typical Differential unit, Traction control differentials, Multi-plate clutch type traction control device,

The back axle:
Live back axles, The final drive, Single reduction live axles Torque reaction, Driving thrust, Torque and thrust member arrangements Springs serving as torque and thrust member,
Hotchkiss Drive with torque reaction member, Single combined torque-thrust reaction member, with springs taking only vertical and lateral loads

UNIT III

Running System
Wheels and rims, Tyre-its function and constructional details.

Brakes:
Functions and methods of operation, Brake efficiency. Elementary theory of shoe brake, brake shoe adjustments, A modern rear-wheel brake, Disc brakes, Brake linkages, Leverage and adjustment of the brake linkage, Servo- and power-operated brakes, Vacuum brake operation,' Hydraulic Brakes-constructional details and working, Bendix Hydrovac, Direct-action vacuum servos, Power-operated brakes, A dual power air brake system,

Suspension system
Suspension principles, Road irregularities and human susceptibility, Suspension system, Damping, Double tube damper, Single tube damper, Lever arm type damper, Springs-Leaf springs, Coil and torsion springs, variable rate springs, Composite leaf springs, Rubber springs, Air springs, Adjustable and self-adjusting suspensions, Interconnected suspension system, Interconnected air and liquid suspensions, Independent suspension system, Different independent suspension layouts, McPherson strut type, Rear suspension-live axle, McPherson strut rear suspension.

UNIT IV

Steering Mechanism
Steering geometry, Castor, Camber, Kingpin inclination, Combined angle, Toe-in, Steering system-basic aims, Ackerman linkage, Steering linkages for independent suspension, Center point steering, Costarring or trailing action, Cornering power, Self-righting torque, Steering characteristics-over steer and under steer, Axle beam, Stub-axle construction, Steering column, Reversible and irreversible steering, Rack-and-pinion steering mechanism, Effect of toe-in on steering, Power steering, Vickers System.

Recent trends in automobile engineering
Multi fuel automobiles, Automobiles running on alternate sources of energy, Emission control through catalytic converter, Double catalytic converter, Aspects of pollution control in Automobiles.

Reference and Text Books:

1. The Motor Vehicle
   - By Newton, Steeds and Garretle Basic
2. Automobile Engineering
   - By Kirpal Singh
3. Automobile Engineering
   -By K.M. Gupta, Umesh Publications
4. Automotive Mechanics
   - Grouse

NOTE: In the semester examination, the examiner will set 8 questions in all, at least two question from each unit, and students will be required to attempt only 5 questions, at least one from each unit.

B.Tech. (Seventh Semester) Mechanical Engineering

ME 403 E Measurements and Control

L	T	P/D	Total		
4	1		5	Theory	: 100 marks
				Sessional	: 50 marks
				Duration of Exams.	: 03 hours

UNIT I

Introduction:

Definition, application of measurement instrumentation, functional elements' of a generalized measuring system, measuring standards, types of measurement, types of input to measuring instruments and instrument system, classification of measuring instruments, merits and demerits of mechanical measuring systems, comparison of mechanical measuring system with electrical measuring systems, calibration.

Introduction, types of error, types of uncertainties, propagation of uncertainties in compound quantity, Static performance parameters: accuracy, precision, resolution, static sensitivity, linearity, hysteresis, dead band, backlash, and drift., sources of error, selection of a measuring instruments, mechanical and electrical loading,

UNIT II

Fundamentals of dynamic characteristics, generalized mathematical model of measuring systems, types of input, dynamic performance parameters: dynamic error, speed of response etc, dynamic response of a first order mechanical systems with different inputs e.g. step, ramp, sinusoidal and impulse input

Introduction, types of measuring data, statistical attributes, various method of presentation, estimation of presentation and uncertainties, confidence level, precision and statistical treatments of single and multi sample type experimental data, Chauvenet's criteria of rejecting a dubious data, curve fitting, best linear calibration and its precision, significant figures and rounding off. Overall uncertainty estimation of measuring systems, common sense approach, and engineering applications.

UNIT III

Introduction, primary function, classification, electrostatic transducers: principle theory, types, advantages, and limitations, Fixed contact mechano-resistive transducers: classification, and uses, Metallic resistance strain gauge: types, construction theory of operation, Adhesive: property, selection criteria, mounting of strain gauges, Mathematical analysis of ballast and DC Wheatstone bridge circuits

Characteristic and comparison of ballast and DC Wheatstone bridge circuits, temperature effects and their compensation

Measurement of load, force, and thrust using resistant strain gauges, Elastic load cells, proving rings, fluid pressure measurement in pipe and containers, using strain gauges, Measuring of torque in transmission shaft under axial and bending loads in varying ambient conditions.

UNIT IV

Introduction, classification of control systems, control system terminology, servomechanism, process control and regulators, Manual and automatic control systems, physical systems and mathematical models, linear control systems, Laplace transform, transfer function, block diagram, signal flow graphs, system stability, Time and frequency domain.

Introduction, functional operation, desirable characteristics of hydraulic fluids, hydraulic control systems: hydraulic pump, hydraulic control valve, Pneumatic control systems: pneumatic nozzle, relay, advantages and limitation of such control systems.

Reference and Text Books:

1. Mechanical measurements & control
   - By D.S. Kumar, Metropolitan book
2. Instrumentation and Mechanical measurements
   - By A.K. Tayal, Galgotia Publ.
3. Measurements systems application and design
   -By Ernest Doebelin, McGraw-Hill

NOTE: In the semester examination, the examiner will set 8 questions in all, at least two question from each unit, and students will be required to attempt only 5 questions, at least one from each unit.

B.Tech. (Seventh Semester) Mechanical Engineering
ME 405 E Statistical Quality Control and Reliability

L	T	P/D	Total		
4	1		5		

Theory : 100 marks
Sessional : 50 marks
Duration of Exams. : 03 hours

UNIT I

Quality-Basic Concepts: Issues in Quality, factors affecting quality, creating quality by design, product development cycle, economics of quality, Various definitions, ISO definition of quality and its meanings, and various phases till TQM and its meaning to industries, customers and employees, contribution of quality gurus etc. towards quality concepts. Total Quality Management: its scope, application and implementation. Quality Circle: its objectives, structure and techniques. Variability concept in manufacturing-cycle, fishbone diagrams, charts in time philosophy

UNIT II

Basic statistical concepts, various types of distributions, General theory X and R chart. Decision preparatory to the control charts. Trial control limits. Selection of subgroups. Charts with variable subgroups, Reject and Revoke, limits for average on X charts, modified control limits, specification limits, practical limitations. Control charts for fraction defectives, calculation and plotting of control limits, sensitivity of p chart, applications. Control charts for Defects, difference between defect and defective, calculation and plotting of control limits, applications, pi charts and u charts, plotting of charts. Tests of various control charts. Process capability- inherent and potential capability.

UNIT III

Purpose of Acceptance by Attributes, Single sampling plans. O.C. curve, selection of sampling plans, Acceptance number, Type A and Type B, O.C. curves, Double sampling plan and its analysis, Multiple and sequential sampling, A.O.Q.L, Acceptance sampling plans under risk. Design of various sampling plans, Dodge-Roming type system for acceptance sampling by attributes (use of various tables). Determination of process average, Acceptance sampling by variables.

UNIT IV

Control of reliability, factors affecting reliability, pattern of failure, mean time to failure, Fundamental of statistical concepts, consideration of reliability in series and parallel system, effect of redundancy and reliability, method of reliability evaluation, reliability optimization, Availability and Maintainability, means to improve reliability, reliability control during manufacture.

Reference and Text Books: 1. Statistical Quality Control - By Grant and Leaven, McGraw-Hill
2. Quality Control and Reliability - By Mahajan, Dhanpat Rai.

3. Quality Control -By Hansen, Prentice- Hall

NOTE: In the semester examination, the examiner will set 8 questions in all, at least two question from each unit, and students will be required to attempt only 5 questions, at least one from each unit.

B.Tech. (Seventh Semester) Mechanical Engineering

ME 407 E Measurement and Control (Practical)

P/D	Total
2	2

Practical : 25 marks
Sessional : 50 marks
Duration of Exams. : 03 hours

List of Experiments

1. Study of a strain gage based cantilever beam and measurement of strain on the beam
2. Study of a LVDT and measurement of linear displacement
3. Study of an inductive pick up and measurement of linear displacement
4. Study of a LDR and measurement of linear displacement
5. Study of capacitive pick up and measurement of angular displacement
6. Study of temperature transducers and measurement of temperature of fluid
7. Study of a LVDT (strain gage based) and measurement of linear displacement.
8. Study of a torque pick up and measurement of torque .
9. Study of a pressure pick up and measurement of pressure of fluid.
10. Study of load cell and measurement of load with load cell
11. Study of non-contact type speed pick up and measurement of rotational speed
12. Comparison of sensitivity of thermocouple, thermister and RTD

Note: **Total Ten experiments must be performed. At least eight experiments should be performed from the above list. Remaining two experiments may either be performed from the above list or outside the list.**

B.Tech. (Seventh Semester) Mechanical Engineering

ME 409 E Project I

P/D	Total	
7	7	**Viva voce : 75 marks**
		Sessional : 100 marks
		Duration of Exams. : 03 hours

The students expected to take up a project under the guidance of teacher from the college. The project must be based on mechanical engineering problems, which can be extended upto the full academic session. The students amy be asked to work individually or in a group not more than four students in a group. Viva- voce must be based on the preliminary report submitted by students related to the project.

B.Tech. (Seventh Semester) Mechanical Engineering

ME 411 E Seminar

P/D	Total	
2	**2**	**Sessional : 50 marks**

Student will give a talk on some technical topics.

Note: The seminar will continue in eighth semester and will be evaluated in eighth semester.

B.Tech. (Seventh Semester) Mechanical Engineering

ME 413 E Practical training report

P/D	Total
-	-

Sessional : 75 marks
Duration of Exams. : 03 hours

Student will submit summer training (about 8 weeks industrial training) report for his/her assessment.

Electives I and II Seventh Semesters
(Mechanical Engineering)

ELECTIVE – I
(For Mechanical Engineering Students)

1. ME 419 E Advanced Manufacturing Technology
2. ME 420 E Finite Element Method
3. ME 423 E Applied Numerical Techniques and Computer Programming
4. ME 425 E Gas Dynamics
5. ME 427 E Machine Tool Design

ELECTIVE - II

1. ME 435 E Renewable Energy Resources
2. ME 437 E Maintenance Engineering
3. ME 439 E Machine Tool Design
4. ME 441 E Computational Fluid Dynamics
5. ME 443 E Mechatronics Engineering

Elective - I & II will be offered as departmental elective for Mechanical Engineering Students.

B.Tech. (Seventh Semester) Mechanical Engineering
ME 419 E ADVANCED MANUFACTURING TECHNOLOGY

L	T	P/D	Total
4	I	_	5

Theory : 100 marks
Sessional : 50 marks
Duration of Exams. : 03 hours

UNIT I

Hot machining, Machining of Plastics, Unit heads, Plastics cooling, electro forming, Surface Cleaning and Surface Treatments, Surface Coatings, Paint Coating and Slushing, Adhesive Bonds, Adhesive Bond Joints, Adhesives, Surface Coating for Tooling, Graphite Mould Coating, Vacuum Mould Process.

Introduction, Types of Composites materials, Agglomerated Materials, Reinforced materials, Laminates, Surface Coated Materials, Production of Composite Structures, Fabrication of particulate composite Structures, Fabrication of reinforced Composite, Fabrication of Laminates, Machining, Cutting and Joining of Composites.

UNIT II

Introduction, Polymers, Polymerization, Addition of Polymers, Plastics, Types of plastics, Properties of Plastics, Processing of Thermoplastic Plastics, Injection Moulding, Extrusion Process, Sheet forming processes, Processing of Thermosetting Plastics, Compression Moulding, Transfer Moulding, Casting of Plastics, Machining of plastics, other processing methods of plastics

Introduction, casting, thread chasing, Thread Rolling, Die Threading and Tapping, Thread Milling, Thread Measurement and Inspection

UNIT III

Theoretical basis of metal forming, classification of metal forming processes, cold forming, hot working, Warm working, Effect of variables on metal forming processes, Methods of analysis of manufacturing processes, Open Die forging, Rolling Power Rolling, Drawing, Extrusion.

UNIT IV

Introduction, Product Application, Limitation of Die Casting, Die Casting Machines, Molten metal Injection systems, I lot chamber machines, Cold chamber machines, Die casting Design, Design of Die casting Dies, Types of Die casting Dies, Die design, Die material, Die Manufacture, Die Lubrication and Coating, Preheating of Dies, Vacuum Die Casting, Recent trends In Die Casting Process.

Definition, Cost accounting or costing, Elements of costing, cost structures, Estimation of cost elements, Methods of estimating, Data requirements of cost estimating, Steps in making cost estimate, Chief factors in cost estimating, Numerical examples, calculation of machining times, Estimation of total unit time.

Reference and Text Books:

1. Principles of Manufacturing
   - By J.S.Campbell, Tata McGraw-Hill
2. Production Engineering Sciences
   - By Pandey and Sinh Standard Pub.
3. A text book of Production Technology
   - By P.C. Sharma S.Chand & Company.
4. Manufacturing Materials and Processes
   - By Lindberg Prentice Hall
5. A text book of Production Engineering
   - By P.C. Sharma S.Chand & Company.

NOTE: In the semester examination, the examiner will set 8 questions in all, at least two question from each unit, and students will be required to attempt only 5 questions, at least one from each unit.

B. Tech. (Seventh Semester) Mechanical Engineering

ME 421 E FINITE ELEMENT METHOD

L	T	P/D	Total		
4	1		5	**Theory**	**:100 marks**
				Sessional	**: 50 marks**
				Duration of Exams. : 3 hrs	

UNIT I

Basic Concept, Historical background, Engineering applications, general description, Comparison with other methods.
Need for weighted-integral forms, relevant" mathematical concepts and formulae, weak formulation of boundary value problems, variational methods, Rayleigh-Ritz method, and weighted residual approach.

UNIT II

Model boundary value problem, finite element discretization, element shapes, sizes and node locations, interpolation functions, derivation of element equations, connectivity, boundary conditions, FEM solution, post-processing, compatibility and completeness requirements, convergence criteria, higher order and isoparametric elements, natural coordinates, Langrange and Hermite polynomials.

UNIT III

External and internal equilibrium equations, one-dimensional stress-strain relations, plane stress and strain problems, axis-symmetric and three dimensional stress-strain problems, strain displacement relations, boundary conditions, compatibility equations, computer programs.

UNIT IV

Variational approach, Galerkin approach, one-dimensional and two-dimensional steady-state problems for conduction, convection and radiation, transient problems.
In viscid incompressible flow, potential function and stream function formulation, incompressible viscous flow, stream function, velocity-pressure and stream function-vorticity formulation, Solution of incompressible and compressible fluid film lubrication problems

Reference and Text Books:

1. The Finite Element Method
   - By Zienkiewicz, Tata McGraw
2. The Finite Element Method for Engineers
   -By Huebner, John Wiley
3. An Introduction to the Finite Element Method
   -By J.N.Reddy, McGraw Hill

NOTE: In the semester examination, the examiner will set 8 questions in all, at least two question from each unit, and students will be required to attempt only 5 questions, at least one from each unit.

B.Tech. (Seventh Semester) Mechanical Engineering

ME- 423 E APPLIED NUMERICAL TECHNIQUES AND COMPUTER PROGRAMMING

L	T	P/D	Total			
4	1	-	5	Theory	:	100 marks
				Sessional	:	50 marks
				Duration of Exams.	:	03 hours

Unit I Interpolation and Curve Fitting : Lagrangian Polynomials, Divided differences, Interpolating with a cubic spline, Bezier Curves and B-Spline Curves, Polynomial approximation of surfaces, Least Square approximations, Flow Chart for Computer Programmes.

Unit II Solving Non-Linear Equations: Bisection Method, Linear Interpolation Methods, Newton's Methods, Muller's Methods, Fixed-point Iteration Method, Flow Chart for Computer Programmes.

Solving Sets of Equations: The Elimination Method, Gauss and Gauss Jordan Methods, Other Direct Methods, Iterative Methods, The Relaxation Methods, Flow Chart for Computer Programmes.

Unit III Numerical Differentiation and Integration: Derivatives from difference tables. High Order Derivative, Extra-polation Techniques. The Trapezoidal Rule, Simpson's Rules. Flow Chart for Computer Programmes.

Numerical Solution of Ordinary Differential Equations: The Taylor-Series Method, Euler and modified Euler-Methods, Range-Kutta Methods, Miline's Method. The adams-Moulton Method, Convergence Criteria, Errors and error Propagation. Flow Chart for Computer Programmes.

Unit IV Boundary-Value and Characteristic- Value Problems: The Shooting Method, Rayleigh-Ritz Method, Collocation Method, Galerkin Method, The Power Method for Eigenvalues by Iteration. Flow Chart for Computer Programmes.

Numerical Solution of Partial Differential Equations: (A) P.D.equation representation as a difference equation, Iterative Methods for Laplace's Equation. The Possion Equation, Derivative Boundary Conditions. (B) The Crank- Nicolson Method for Parabolic Partial Differential Equations. Flow Chart for Computer Programmes.

Text Books :

1. Applied Numerical Analysis by Curtis f. Gerald and Patrick O. Wheatley – Published by Addison Wesley.
2. Introductory Methods of Numerical Methods – S.S. Sastry, PHI, New Delhi.

Reference Books :

1. MATHEMATICA – A system for doing mathematics by Computer by Wolfram, Stephen – Published by Addition – Wesley.
2. Applied Numerical Methods by Camahan, Brice,Et.al, Published by Wiley, New York.
3. Numerical Solution of partial differential equations by Smith, G.D. Published by Oxford University Press London.
4. Iterative Methods for the solution of Equations by J.F. Traub – Published by Prentice Hall.
5. Numerical Methods in Engineering and Science by B.S. Grewal- Published by Khanna Publishers.
6. Numerical Methods in Engineering by M.G. Salvadori and M.L. Baron- Published by Prentice Hall India.

Note :

1. The Instructor of the course may cover the use of software MATHEMATICA, in the tutorial class.

2. In the semester examination, the examiner will set eight questions, at least Two question from each unit. The students will be required to attend only 5 questions.

B.Tech. (Seventh Semester) Mechanical Engineering

MET-425 GAS DYANAMICS

L	T	P	total	
4	1		5	

Sessional Marks : 50
Theory: 100
Duration of Exam: 3 Hrs.

Unit - I

Introduction, units, thermodynamics concepts for control mass analysis flow dimensionality and average velocity comment on entropy-pressure energy equation. The stagnation concept, stagnation pressure, energy equation, momentum equation problems.

Introduction, Objectives, speed of propagation of pressure front, Mach Number, sonic velocity, field due to a moving source of disturbance, mach cone mach, angle equation for a perfect gas in terms of mach. number. h. s.& t. s. diagram problems.

UNIT II

Introduction, adiabatic flow with and without losses, the reference concept, isentropic tables, conversant & divergent nozzles, diffuser performance, frictional effects on nozzle flow problems.

Introduction, shock analysis-general fluid, working equations for perfect gas, normal-shocks tables, shocks in nozzles, supersonic wind tunnel operation, thermodynamic directions of a normal shock, Rankins-Hugoniat relation, strength of shock, operation of nozzles, problems.

UNIT III

Introduction, normal shocks tangential velocity superposition -oblique shocks, oblique-shocks, analysis, oblique-shock tables and charge, boundary conditions of flow direction, boundary condition of pressure equilibrium, introduction to Prandtl Mayer expansion, problems. Introduction, analysis for general fluid, working equations for a perfect gas, reference state and fanno tables, application, correlation with shocks, friction chocking, Rayleigh flow. Analysis for a general fluid, working equations for a perfect gas reference state and Rayleigh tables, applications, correlation with shocks, thermal shocking, and summary problems

UNIT IV

Introduction, Brayton cycle, propulsion engines. thrust power and efficiency, thrust consideration power consideration, power conskloiftlion and efficiency consideration, open Brayton cycle for propulsion systems, turbojet, turbo propulsion, ram jet, pulse jet, numerical.

Text Books:

1. Fundamentals of Gas Dynamics- YAHA, S.M. TMI-I, India.
2. Fluid Mechanics-A.K. Mohanty, Prentice Hall of India.

Reference Books:

1. Fundamentals of Fluid Mechanics- YUAN, S.W. Prentice Hall of India.
2. Fundamentals of Gas Dynamics - Robert D. Zucker, Met tire Publication.
3. Gas Dynamics -E-., Radha Krishnan, prentice Hall of India.
4. Gas Dynamics Vol. -I Zucrotuf, Wiley.
5. Gas Dynamics - Shapiro Wiley.

NOTE: In the semester examination, the examiner will set 8 questions in all, at least two question from each unit, and students will be required to attempt only 5 questions, at least one from each unit.

ME 427 E MACHINE TOOL DESIGN

L	T	P/D	TOTAL
4	1	-	5

Sessional marks: 50 Marks
Theory : 100 Marks
Duration of Exam. : 3 hrs.

UNIT I

Definition and classification, Corking and auxiliary motion in m/c tools, parameters of working motion, machine tool drive, selection of electric motor, hydraulic and mechanical transmission and their elements, general requirement of m/c tool design. Engineering design process for m/c tool, and techno-economical consideration for design of new m/c tool.

Aims, stepped and stepless speed regulation, design of speed and feed gear box, m/c tool drives using multiple speed motors, gear box kinematics design, gearing diagram, no. of teeth, no. of teeth on gears in the gear train, classification speed and feed boxes, numerical problems.

UNIT II

Function and requirements, design criteria, criteria of selection of materials, static arid dynamic stiffness, profiles for m/c tool structure, stiffness, design procedure for m/c tool structure, numerical problems.

Function and types, profiles, material and clearance in slide ways, analysis of design of slide ways for wear and stiffness design of hydrostatic guide ways, aerostatic slide ways and antifriction guide or sliding friction power screws for wear, strength, friction bucking stability design of rolling friction, power screw for stiffness, numerical problems.

UNIT III

Function and requirements, material for spindle, effect of m/c tool compliance on machining accuracy, design of spindles for bending, permissible deflection strength, optimum spacing for spindle support, antifriction and different types of sliding bearings and their general characteristic, air lubricated bearing, numerical problems.

UNIT IV

Equivalent Elastic System (EES), general procedure for accessing dynamic stability of EES cutting process closed loop system dynamic characteristics of elements, systems, EES and culling process, stability analysis, forced vibration of machine tools.

Function requirements and classification, control system for forming and auxiliary motion, manual control systems, ergonomic considerations, automatic control systems and adaptive control system.

Text Books:

- Machine Tool Design & Numerical Control by N.K. Mehta, Published by TMH.
- Production Technology by R.K. Jain, Published by Khanna Publishers.

References Books:

1. Design of M/c Tool by S.K. Basu, Allied Publisher, New Delhi.
2. Principles of M/c Tool by Ballacharya A. and Sen. G.C., Published by New Central Book Agency, Calcutta.
3. Machine Tool Design -Vol-IV- by Acherkean N., Published by Mir Publication.
4. Design principles of Metal Cutting Machine Tools by Koenigsberyer F., Published by Pergrnan Press, Oxford.

NOTE: In the semester examination, the examiner will set 8 questions in all, at least two question from each unit, and students will be required to attempt only 5 questions, at least one from each unit.

ME 435 E RENEWABLE ENERGY RESOURCES

L	T	P	Total
4	1		5

Sessional : 50 marks
Theory: 100 marks
Duration of Exam : 3 hrs.

UNIT-I

Introduction and Essential of Fluid Mechanics and Meat Transfer Fundamentals and scientific principles of renewable energy resources, technical and social implications, Bernoulli's, equation, conservation of momentum, viscosity, turbulence, friction and pipe flow, heat circuit analysis and terminology, conductive, convective and radiative heat transfers, properties of transparent materials, heat transfer by mass transport, multimode heat transfer and circuit analysis, problems.

UNIT-II

Extraterrestrial solar radiation, components of radiation, geometry of earth and sun, geometry of collector arid the solar beam, effects of earth's atmosphere, measurements of solar radiation, calculation of heat balance for a solar collector, type of water heaters, selective surfaces, crop heaters, space heating, space cooling, water desalination, solar ponds, solar concentrators, electric power system, problems.
Introduction, the silicon p-n junction, photon absorption solar radiation input, photovoltaic circuit properties and loads, limits to cell efficiency, solar cell construction type and adaptations of photovoltaic, other types of photoelectric and thermo electric generation, problems.

UNIT III

Principles of hydro power, assessing the resource for small installations, an impulse turbine, reaction turbines, hydro electric systems, the hydraulic rain pump, wind turbine types and terms, linear momentum and basic theory, dynamic matching, steam tube theory, characteristics of the wind, power extraction by a turbine, electricity generation, mechanical power, problems.
Introduction, tropic level photosynthesis, photosynthesis at the plant level, thermodynamic considerations, photosynthesis, molecularlevel photosynthesis, synthetic photosynthesis, bio fuel classification, bio-mass production for energy farming, direct combustion for heat, pyrolysis (destructive distillation), alcoholic fermentation, anaerobic digestion for bio-gas, agrochemical fuel extractions, problems.

UNIT IV

Introduction, wave motion, wave energy and power, ;wave patterns, devices, the causes of tides, enhancement of tides flow power, tidal range power, world range power sites, problems.

Principles of Ocean Thermal Energy Conversion (OTEC), heal exchangers, pumping requirements, other practical considerations, introduction to geothermal energy, geophysics, dry rock and hot aquifer analysis, harnessing geothermal resources, problems.

Text Books: Renewable Energy Rsources by John W. Twidell and Anthony D. Weir, published by E.& F. N. Spon Ltd.Lndon.

NOTE: In the semester examination, the examiner will set 8 questions in all, at least two question from each unit, and students will be required to attempt only 5 questions, at least one from each unit.

B.Tech. (Seventh Semester) Mechanical Engineering

ME 437 E MAINTENANCE ENGINEERING

L	T		P
4	1	-	5

Total Sessional : 50 marks
Theory : 100 marks
Duration of Exam : 3 his.

UNIT I

Evolution of maintenance, objective of maintenance, maintenance policies and philosophies, maintenance concept, maintenance management & terotechnology, relationship with other functional areas, importance of maintenance, elements of good maintenance, economics of maintenance, training and safety aspects in maintenance.

Classification of maintenance programs, corrective preventive and predictive maintenance, comparison of maintenance programs, preventive maintenance-concept, functions, benefits, limitations.

UNIT II

Objectives, what to monitor, when to monitor, principles of CBM, condition based maintenance techniques, manual inspections, performance monitoring, vibration monitoring, current monitoring, coil debris/spectroscopy, thermography and corrosion monitoring, steps in implementation of CBM, benefits of CBM.

RCM logic, maintenance and RCM, benefits of RCM, total productive maintenance (TPM), introduction, key supporting elements of TPM, methodology, evaluation and benefits.

UNIT III

Purpose and challenges: Techniques, visual aids-boroscopes, endoscopes, fiber optics scanners, magnetic particles inspection, liquid penetrants, eddy current, ultrasonic radiography, selection of NDT technique, metrits/demerits and applications of various techniques.

Basic ingredients, basic steps in maintenance management, maintenance planning and control system, documentation, maintenance-productivity areas for improvement

UNIT IV

Techniques for improvement of operational reliability, safety and availability of machines and production systems, maintainability criteria, checklist to assess the maintainability of a system, maintainability programs, objectives, key issues in availability improvements program, fault diagnosis, Pareto principle Ishikawa diagram.

Data processing systems for integrated maintenance, maintenance information and reporting systems.

Text Books:

1. Maintenance Planning and Control by Higgin L.R., McGiaw Hill Book Co., 1900.
2. Maintenance Planning and Control by Kelly Anthony, East West Press Private Ltd, New Delhi, 1991.
3. Maintainability principle and practices by Blanchard B.S. and Lowey E.E. McGrawHill Book co.
4. Practical NOT by Raj B. Jaya Kumar T and Thavasimulyi K., Narora Publishing House, New Delhi, 1996.
5. Engineering Maintenance Management by Niebel Benjamin W. Marcel Dekher, 1994.

NOTE: In the semester examination, the examiner will set 8 questions in all, at least two question from each unit, and students will be required to attempt only 5 questions, at least one from each unit.

BTech. (Seventh Semester) Mechanical Engineering
ME 439 E CRYOGENIC ENGINEERING

L	T	P/D	Total
4	1	-	5

Theory : 100 marks
Sessional : 50 marks
Duration of Exams. : 03 hours

UNIT I

Definition of cryogenics, physical properties of various cryogenic fluids and industrial application

UNIT II

Types of insulations, vacuum insulation: gas filled powders and fibrous materials, solid forms, comparison of various insulating materials.

UNIT III

Mechanical properties; Specific heat; Thermal expansion; Electrical resistance; Thermal conductivity; Emissivity; Reflectivity and Absorptive; Thermo-electric e. m. f.

UNIT IV

Types of insulated storage containers, transport techniques, various design considerations, safety aspects of cryogenic systems, flammability hazards, high-pressure gas hazards etc., design and fabrication of transfer line, transfer through non-insulated lines, liquid line indicators, valves for cryogenic "liquids, pumping of cryogenic liquids, other allied equipment.

Reference and Text Books:

Cryogenic Systems - by IJaiion

Refrigeration and Air Conditioning- By Spark and Dilio

NOTE: In the semester examination, the examiner will set 8 questions in all, at least two question from each unit, and students will be required to attempt only 5 questions, at least one from each unit.

B. Tech. (Seventh Semester) Mechanical Engineering

ME 441 E COMPUTATIONAL FLUID DYNAMICS

L	T	P/D	Total	
4	1	-	5	Theory: 100 marks Sessional: 50 marks Duration of Exams. : 3 hrs

UNIT I

Methods of prediction: comparison of experimental investigation Vs theoretical calculation; Mathematical description of physical phenomena; significance of governing differential equations; the general form of governing differential equation.
Classification of problems: Physical classification: Equilibrium problems and Marching problems; Mathematical classification: Elliptic, parabolic and hyperbolic partial differential equations; Nature of co-ordinates; one way and two-way co-ordinates; Proper choice of co-ordinates.

UNIT II

The concept of discretisation; Finite differences; Taylor series formulation; Finite difference discretisation of ordinary and partial derivatives; Truncation error, round-off error, discretisation error; Consistency and stability of numerical schemes; Variation formulation; Method of weighted Residuals, control volume formulation.

UNIT III

Steady one- dimensional Conduction, The inter-face conductivity, Non linearity, Source-Term Linearizsation, Types of Boundary Conditions. Unsteady one-dimensional Conduction: Explicit, Crank-Nicolson and Fully Implicit scheme's Discretisation of two and three-dimensional problems, Stability analysis.

UNIT IV

Steady one dimensional convection and diffusion, The up wind scheme, Generalized Formulation, Discretisation equation for two and three dimensional problems, The outflow Boundary condition, false Diffusion.
Basic difficulty, Vorticity Based methods, Representation of the continuity equation, the staggered grid: the momentum equations, the pressure velocity corrections, and SIMPLE algorithm.

Reference and Text Books:

1. Computational Fluid Dynamics
   - By Anderson, McGraw-Hill
2. Numerical Heat Transfer and fluid flow
   - By Patankar, McGraw-Hill

NOTE: In the semester examination, the examiner will set 8 questions in all, at least two questions from each unit, and students will be required to attempt only 5 questions, at least one from each unit.

B.Tech. (Seventh Semester) Mechanical Engineering

ME 443E MECHATRONICS ENGINEERING

L	T	P	Total		
4	1	-	5	Sessional:	50 marks
				Theory	100 marks
				Duration of Exam:	3 hrs.

UNIT I

What is mechatronics? A measurement system with its constituent elements, open and closed loop systems, sequential controllers, micro processor based controllers, the Mechatronic approach.

A review of displacement, position velocity, motion, force fluid pressure, liquid flow, liquid level, temperature, light sensors/along with performance terminology, selection of sensors, input data by switches, signal conditioning, brief review of operational ampli fier, projection, filtering, wheat stone bridge, digital signals, multiplexers, data acquisition, digital signal processing, pulse modulation, data presentation systems, displays, data presentation elements, magnetic recording, data acquisition systems, testing £ calibration, problems.

UNIT II

Pneumatic and hydraulic systems, directional control valves, valve symbols, pressure control valves, cylinder sequencing, process control valves, rotary actuators, mechanical systems -types of motion, kinematic chains, cams, gear trains, Ratchet & Pawl, belt and chain drives, bearings, mechanical aspects of motor selection, electrical systems, mechanical and solid state switches, solenoids, D.C. & A.C moto4rs, stepper motors, problems.

UNITIII

Continuous and discrete process- lag, steady state error, control modes, two step mode, proportional mode-electronic proportional controllers, derivative control- proportional plus derivative control, integral control-proportional plus integral control, PID controller-operational amplifier PID circuits, digital controllers -implementing control modes, control system performance, controller tuning, process, reaction method and ultimate cycle method, velocity control, adaptive control, problems.

Scale, a pick and place robot, automatic camera, engine management system and bar code recorder.

UNIT IV

A review of number systems and logic gates, Boolean algebra, Karnaugh maps, sequential logic basic structure of programmable logic controllers, input/output processing, programming mnemonics; timest, internal relays and counters, master and jump controls, data handling, analog input/output, selection of a PLC, PROBLEMS.

Control, microcomputer structure, micro-controllers, applications, programming languages, instruction sets, assembly language programs, subroutines, Why C Language? A review of program structure, branches, loops, arrays, pointers, examples of programs, interfacing, input/output, interface requirements. Peripheral interface adapters, serial communication interface, examples of interfacing, problems.

Text Book:

1. Mechatronics by W. Bolton, published by Addition Wesley.

NOTE: In the semester examination, the examiner will set 8 questions in all, at least two question from each unit, and students will be required to attempt only 5 questions, at least one from each unit.

B.Tech. (Seventh Semester) Mechanical Engineering

ME 407 E Measurement and Control (Practical)

P/D	Total	
2	2	Practical : 25 marks
		Sessional : 50 marks
		Duration of Exams. : 03 hours

List of Experiments

1. Study of a strain gage based cantilever beam and measurement of strain on the beam
2. Study of a LVDT and measurement of linear displacement
3. Study of an inductive pick up and measurement of linear displacement
4. Study of a LDR and measurement of linear displacement
5. Study of capacitive pick up and measurement of angular displacement
6. Study of temperature transducers and measurement of temperature of fluid
7. Study of a LVDT (strain gage based) and measurement of linear displacement.
8. Study of a torque pick up and measurement of torque .
9. Study of a pressure pick up and measurement of pressure of fluid.
10. Study of load cell and measurement of load with load cell
11. Study of non-contact type speed pick up and measurement of rotational speed
12. Comparison of sensitivity of thermocouple, thermister and RTD

Note: **Total Ten experiments must be performed. At least eight experiments should be performed from the above list. Remaining two experiments may either be performed from the above list or outside the list.**

Scheme of Examination
B. Tech 8th Sem (Mechanical Engineering)

Sr.No	Subject Name	Code	Teaching Schedule (Hrs)				Examination Schedule (Marks)			Total Marks	Duration of Exam (Hrs)
			L	T	P/D	Total	Sessional	Theory	Practical / viva-voce		
1.	Entrepreneurship	ME 402 E	3	1	---	4	50	100	---	150	3
2	Elective* -III	ME	4	1			50	100	---	150	3
3	Elective* -IV	ME	3	1			50	100	---	150	3
4	Power Plant Engineering	ME 404E	4	1	---	5	50	100	---	150	3
5	Operation Research	ME 406E	3	1	-	4	50	100	---	150	3
6	Entrepreneurship (PR)	ME 408 E	-	-	2	2	50	---	25	75	3
7	Project-II	ME 410E	---	---	9	9	100	---	100	200	3
8	Seminar	ME 411E	2	---	---	2	25	---	---	25	-
9	Comprehensive	ME 412E	---	---	---	---	50	---	---	50	3
10	General Fitness & Professional Aptitude	ME 414 E	---	---	---	---	---		75	75	3
Total			19	5	11	35	425	500	200	1175	

* Refer List of Elective

Under ME-411E some of the students may be evaluated in 7th semester and remaining in 8th Sem. Marks will be added in 8th Sem.

B.Tech. (Eighth Semester) Mechanical Engineering

ME 402 E ENTERPRENURSHIP

L	T	P/D	Total		
3	1		4	Thoory	: 100 Marks
				Sessional	: 50 Marks
				Duration of Exams. : 03 hrs	

UNIT I

Definition and concept, Importance of economics for engineers, present value and future value, Wealth, Goods, Wants, Value and price, capital, money, utility of consumer and producer goods.

Introduction, Elements of cost, Prime cost, Overhead, Factory cost, Total cost, Selling price, Nature of cost, Types of cost.

Definition and concept, Causes of depreciation, Methods of calculating depreciation.

UNIT II

Introduction, Nature of selection problem, Nature of replacement problem, Replacement of items which deteriorate, Replacement of machines whose operating cost in crease with time and the value of money also changes with time, methods used in selection of investment and replacement alternatives.

Entrepreneurship, Role of Entrepreneur in Indian economy, Characteristics of an entrepreneur, Types of entrepreneurs, some myths and realities about entrepreneurship

UNIT III

Introduction, Role and scope of small scale industries, concept of small scale and ancillary industrial undertakings, How to start a small scale industry, Steps in launching own venture, procedure for registration of small scale industries, various developmental agencies-their functions and role in industrial and entrepreneurship development, Infrastructure facilities available for entrepreneurship development in India.

Introduction, Requirement of a good product design, product development approaches, Product development process, Elements of concurrent engineering, quality function development, Rapid prototyping, Various controlling agencies involved -their role and formalities for getting clearance before starting individual venture

UNIT IV

Financial concept for small-scale industries, financial requirements

Financial support programmer of banks, government financial agencjes,

Hire-purchase facilities alternate sources of finance.

The modern concept of marketing, Definitions, functions and principle of marketing, Marketing research, Advertising, Market survey, Pre-feasibility and feasibility of project. Identification and evaluation of business opportunity, risk involved and preparation of business plan.

Tools for evaluation of techno economic feasibility project report, SWOT analysis

Reference and Text Books:

1. The practice of Entrepreneurship
   - By G. G. Meredikh, R.E. Nelson and P.A. Neck
2. Handbook of Entrepreneurship
   - By Rao and Pareek

3. Automobile Engineering
-By K.M. Gupta, Umesh Publications
3. Engineering Economics
-By Tarachand
4. Industrial Engineering and Management
-By Ravi Shankar
5. Industrial Engineering and Organization Management
-By S.K.Sharma and Sawita Sharma
6. Industrial Engineering and Management
-By O.P. Khanna

NOTE: In the semester examination, the examiner will set 8 questions in all, at least two questions from each unit, and students will be required to attempt only 5 questions, at least one from each unit

B.Tech. (Eighth Semester) Mechanical Engineering
ME 404 E Power Plant Engineering

L	T	P/D	Total			
4	1		5	Thoory	: 100 Marks	
				Sessional	: 50 Marks	Duration of Exams. : 03 hrs

UNIT I

Conventional and non-conventional sources of energy; Importance of electrical energy; Geothermal power plants; Tidal power plants; Windmills; Solar power plants; Direct energy conversion systems; Energy sources in India; Recent developments in power plants.

Hydrology: rainfall, runoff, hydrographs, flow duration curves; Site selection for hydro power plants; Classification of hydro power plants; Storage type hydro power plant and its operation; Estimation of power availability; Selection of water turbines; Combination of hydro power plants with steam plants; advantages and disadvantages of hydro power plants.

UNIT II

Analysis of steam power cycles for power plant application; High pressure boilers- La-Mont boiler, Benson boiler, Loeffler boiler; Velox boiler; Super pressure steam power plants; Economizers; Air-preheaters; Super heaters and reheaters; Feed water heaters. General layout of thermal power plant; Site selection for thermal power plant; Coal as fuel, classification of coals, analysis of coal; Coal handling; Dead and live storage; Combustion of coal: coal burning methods, overfeed stokers, underfeed stokers, pulverized fuels and burners. Ash handling and disposal; Dust collectors. Heat balance sheet for thermal power plants.

Introduction; Field of use; Outline of diesel electric power plant; Different systems of diesel power plant; Supercharging of diesel engines; Performance of diesel power plant; Advantages and disadvantages of diesel plants over thermal power plants.

UNIT III

Elements of plant; Thermal refinements; Performance of plants; Gas turbine characteristics; Comparison with other plants; Combined steam and gas turbine power plants.

Basic theory and terminology; Nuclear fission and fusion processes; Fission chain reaction; Moderation; Fertile materials; Nuclear fuels; General components of nuclear reactor; Different types of leactors; Breeder reactors; Nuclear power plants in India; Disposal of nuclear waste.

UNIT IV

Introduction; Load curves; Different terms and definitions; Effects of variable loads on power plant design and operation

Cost of electrical energy; Selection of type of generation; selection of generating equipment; performance and operating characteristics of power plants; Load division among generators; Tariffs methods for electrical energy.

Reference and Text Books:

1. Power Plant Engineering
   - By Morse

2. Power Plant Engineering
   - By Domkundwar
3. Power Plant Engineering
   -By P.C. Sharma
4. Power Plant Technology
   -Rv El-Wakil

NOTE: In the semester examination, the examiner will set 8 questions in all, at least two questions from each unit, and students will be required to attempt only 5 questions, at least one from each unit

B.Tech. (Eighth Semester) Mechanical Engineering

ME 406 E Operation Research

L	T	P/D	Total		
3	1		4	Thoory	: 100 Marks
				Sessional	: 50 Marks

Duration of Exams. : 03 hours

UNIT I

Development of operations Research, characteristics and scope of operations Research, operations Research in Management, Models in operations Research, Model Formulation, Types of mathematical models, Limitations of operations Research.

L.P. models, simplex method, the algebra of simplex method. (Minimization and Minimization problems), The big M method, post oplimality analysis, essence of duality theory, Application of sensitivity analysis.

UNIT II

Introduction to model, matrix terminology, Formulation and solution of Transportation model (least cost method, Voyel's Approximation method), Least time transportation problem, Assignment problems.

Introduction to net work logic, Numbering of events (Fulkersen Rule), PERT calculations - Forward path, back-ward path. Slack, probability, comparison with PERT, Critical path, Floats. Project cost, crashing the net work, updating (PERT and CPM).

UNIT III

Introduction, applications of simulation, advantages and limitations of simulation technique, generation of random numbers, Time-flow mechanism, simulation languages.

Steps in decision theory approach, Decision Machinery environment, Decision machining under certainty and uncertainty, Decision machining under condition of risk, Decision trees, Minimum enchained criteria, Advantages and limitations of decision tree solutions, post optimality Definition of arguments models, comparison with transport model, Mathematical representation of assignment model, Formulation and solution of argument models, variation of the argument model, Alternate optimal solutions

UNIT IV

Introduction, Applications of queuing Theory, Waiting time and idle time costs, single channel queuing theory and multi channel queuing theory with Poisson. arrivals and exponential services, Numerical on single channel and multi channel queuing theory.

Theory of games, competitive games, Rules and Terminology in game Theory, Rules for game theory- saddle point, dominance, mixed strategy (2 x2 games) , mixed strategy (2 x n games or m x 2 games), mixed strategy (3 x3 games), two person zero sum games, n-person zero sum games.

Reference and Text Books:

1. Introduction to operation research
   - By Hillier and Lieberman, McGraw-Hill
2. Operations Research

- By P.K. Gupta and D.S. Hira

3. Linear Programming

-By N.P. Loomba

NOTE: In the semester examination, the examiner will set 8 questions in all, at least two questions from each unit, and students will be required to attempt only 5 questions, at least one from each unit

B.Tech. (Eighth Semester) Mechanical Engineering

ME 408 E Entrepreneurship (Practical)

P/D	Total		
2	2	Viva-voce	: 25 Marks
		Sessional	: 50 Marks
		Duration of Exams	: 3 Hrs

1. Exercise on assessing the industrial potentiality of any particular area.
2. Exercise on market survey for product identification and demand estimation of the product.
3. Exercise on preparation of techno economic feasibility project report.
4. Presentation and group discussion on techno economic feasibility project report.

B.Tech. (Eighth Semester) Mechanical Engineering

ME 410 E Project-II

L	T	P/D	Total		
		9	9		

Theory : 75 marks

Sessional : 100 marks

Duration of Exams. : 03 hours

The student is expected to finish the remaining portion of the project.

Electives (I) and Electives (II) Eight Semesters
(Mechanical Engineering)

ELECTIVE – III

ME 420 E Non Conventional Manufacturing
ME 422 E Industrial Robotics
ME 424 E Manufacturing Management
ME 426 E Total Quality Management
ME 428 E Piping Engineering

ELECTIVE - IV

ME 430 E Energy Management
ME 432 E Management Information System
ME 434 E Pneumatics & Hydraulics Control
ME 436 E Design of Air conditioning Systems
ME 438 E Automatic controls

Elective –III & IV will be offered as departmental elective for Mechanical Engineering Students.

B.Tech. (Eighth Semester) Mechanical Engineering
ME 420 E Non-Conventional Manufacturing

L	T	P/D	Total	
4	1	-	5	Theory : 100 marks Sessional : 50 marks Duration of Exams. : 03 hour

UNIT I

Unconventional machining processes, Rapid prototyping processes, their classification, considerations in process selection.

Ultrasonic Machining

Elements of process, design of cutting tool, metal removal mechanism, effect of parameters, economic considerations, limitations and applications, surface finish.

UNIT II

Electrochemical Machining

Elements of process, process chemistry, metal removal mechanism, tool design, accuracy, surface finish and work material characteristics, economics advantages, limitations and applications, Electrochemical grinding, debarring and honing, Chemical machining.

Electric Discharge Machining

Principle and mechanism of metal removal, generators, electrode feed control, electrode material, tool electrode design, EDM wire cutting, surface finish, accuracy and applications.

UNIT III

Jet Machining

Principal and metal removal mechanism of abrasive and water jet machining, process variables, design of nozzle, advantages, limitations and applications.

Plasma arc machining, Electron beam machining, laser beam machining, their principles and metal removal mechanism, process parameters, advantages and limitations, applications.

UNIT IV

Rapid Prototyping

Fundamentals, process chain, physics of processes, principles and process mechanism of SLA, SGC, LOM, FDM and SLS processes, their advantages and limitations, applications of RP processes, RP data formats, STL file format, STL file problems, STL file repair, other translators and formats.

Rapid Tooling Process

Introduction, fundamentals, classification, indirect RT processes, Principles of Silicone Rubber Molding, Epoxy Tooling, Spray Metal Tooling, Pattern for Investment Casting, Vacuum Casting, and Vacuum forming processes, direct RT processes, Shape Deposition manufacturing, their advantages, limitations and applications.

Reference and Text Books:

1. Modern machining processes
   -By P.C. Pandey and M.S. Shan, 1 Ml I.
2. Machining Science
   -By Ghosh and Mallik, Affiliated East West
3. Nontraditional Manufacturing processes
   -By G.F. Benedict, Maicel Dekker.
4. Advanced Methods of Machining
   -By J.A. McGeongh, Chapman and Hall.
5. Electrochemical Machining of Metals
   -By Rurnyantsev and Davydov, Mir Publis.
6. Rapid prototyping: Principles and applications in Manufacturing

NOTE: In the semester examination, the examiner will set 8 questions in all, at least two question from each unit, and students will be required to attempt only 5 questions, at least one from each unit.

B.Tech (Eighth Semester) Mechanical Engineering
ME 422 E Industrial Robotics

L	T	P/D	total		
4	1		5	Theory	: 100 marks
				Sessional	: 50 marks
				Duration of Exams.	: 03 hours

UNIT I

Automation and robots, Robot classification, Applications, Robot specifications.

Dot and Cross products, Coordinate frames, , Homogeneous coordinates, Link Coordinates, The arm equation, Five-axis articulated robot (Rhino XR-3), Four-axis SCARA robot (Adept One), Six-axis articulated robot (Intelledex 660).

UNIT II

The Inverse kinematics problem, General properties of solutions, Tool Configuration, Inverse kinematics of Five-axis articulated robot (Rhino XR-3), Inverse Kinematics of Four-axis SCARA robot (Adept One), inverse kinematics of Six-axis articulated robot (Intelledex 660), and Inverse kinematics of a three-axis planar articulated robot, a robotic work cell.

Workspace analysis, Work envelope of a five-axis articulated robot (Rhino XR-3), Work envelope of a four-axis SCARA robot (Adept One), Workspace fixtures, The pick and place operations, Continuous path motion, Interpolated motion, Straight line motion.

UNIT III

The tool configuration and Jacobean matrix, Joint space singularities, Generalized inverses, Resolved motion rate controls, rate control of redundant robots, rate control using {1)-inverses, The manipulator Jacobean, Induced joint torque and forces.

Lagrange's equation, Kinetic and potential energy, Generalized force, Lagrange-Euler dynamic model, Dynamic model of a two-axis planner articulated robot, Dynamic model of a three-axis SCARA robot, Direct and inverse dynamics, Recursive Newton-Euler formulation, Dynamic model of a one-axis robot (inverted pendulum).

UNIT IV

The control problem, State equations, Constant solutions, Linear feedback systems, Single axis PID control, PD gravity control, Computed torque control, Variable structure control

image representation, template matching, polyhedral objects, shape analysis, Segmentation, Iterative processing, Perspective transformations, Structured Illumination, Camera Calibration.

Task level programming, Uncertainty, Configuration space, Gross motion planning, Grasp Planning, Fine motion planning, Simulation of planar motion.

Reference and Text Books:

1. Industrial Robotics
   -By M.P. Groover, McGraw Hill
2. Industrial Robotics and Automation
   -By S.R.Deb Tata McGraw Hill

NOTE: In the semester examination, the examiner will set 8 questions in all, at least two question from each unit, and students will be required to attempt only 5 questions, at least one from each unit

B.Tech (Eighth semester) Mechanical Engineering

ME 424 E MANUFACTURING MANAGEMENT

L	T	P
4	1	-

Theory : 100 Marks
Sessional : 50 Marks
Total : 150 Marks
Duration of Exam: 3 Hrs

Unit I Manufacturing Systems Designs: Definition, Systems, Subsystems, Systems Approach Fundamentals, Systems Approach for designing, Manufacturing Systems, Systematic Layout Planning (SLP), Computerized Plant Layout-CRAFT, ALDEP, CORELAP, Assembly Line balancing, Problems and solutions of assembly lines, Group Technology & Cellular Systems, Classification & Grouping, overview of FMS. Strategic consideration for comparison of various systems.
Manufacturing Systems Economics: Concept of time value of money, Preparation
of time profile of project, Single payment, Equal Series payment, various machine and project selection & evaluation techniques: Payback period, Present worth, Equivalent annual cost, Cost- benefit ratio, Evaluation for both equal & unequal life. Depreciation concept various methods-straight line, declining balance, Sum of the digits, Sinking fund.

Unit II New Product Development (NPD): Product Development, Customer Need, Strategies for New Product Development, Product life cycle, Product status. Corporate Design Strategies, Japanese Approach to NPD. PUGH total Design approach, PAHL & BEITZ Approach, Project Approach, Cross functional Integration –Design, manufacturing, Marketing, Concurrent Engineering, Modular Design, Standardization Value Engineering & Analysis.
Manufacturing Planning & Control Systems: Overview of Aggregate Planning Models, Linear Decision Rules, Management Coefficient, Direct Search Methods, Master Production Schedule, Modular Bill and Materials, Capacity planning & control, language, medium range, short range capacity planning, Toyota Production System, Just- in Time (JIT), Manufacturing –Philosophy, Elements, KANBAN, effects on layout, workers & vendors, optimized production technology (OPT).
Unit III Forecasting Methods: Forecasting Framework, Forecasting cost and accuracy, Forecasting Uses and Methods – Delphi, Exponential Smoothing, Forecasting Errors – MAD, Regression Methods-Linear Model for single & multiple variables, Brief idea of computerized forecasting systems.
Material Requirements Planning (MRP): Definition of MRP systems. MRP versus Order point, MRP Elements, Types of MRP – MRP I & II. Structured Bill of Materials. Regenerative & Net change MRP, Operating an MRP, Integration of Production & Inventory Control.
Unit IV Maintenance & Reliability: Concept of preventive & breakdown maintenance, maintenance cost, optimal preventive maintenance simple replacement models-individual and group replacement, MAPI - methods, reliability definitions, failure analysis and curve, systems reliability- series parallel, redundancy, methods of improving reliability, MTBF, MTTR, Maintainability, availability, brief concept of terotechnology.

Text books:
1. Operations management – Schoroeder, Mc Graw Hill International
2. Production operations management – chary, TMH, New Delhi.
Reference books:

1. Production Operations Management – Adam & Ebert, PHI, New Delhi
2. Operational Management –Monks, Mcgraw Hill, Int.
3. Production & Operations Management – I. Hill, Prentice Hall Int.
4. Production Planning & Inventory Control – Narasimham etal, PHI, New Delhi
5. Production & Operation Management- Panneerselvam, PHI, New Delhi
6. Managing for Total Quality-Logothetis, PHI, New Delhi
7. Concept of Reliability Engineering –L.S. Srinath, Affiliated East West.
8. Revolutionizing Product Development – Wheelwright & Clark, Free press.
9. Management In Engineering – Freeman-Ball & Balkwill, PHI, New Delhi.
10. Production & operations management – Martinich, John Wiely , New Delhi.
11. The goal by Eliyahu M. Goldratt & Jeff Cox, Productivity Press India Ltd, Bangalore
12. Toyota Production System by Taichi Ohno, Productivity Press India Ltd, Bangalore

Note :In the semester examination the examiner will set 8 questions, at least two question from each unit. Students will be required to attempt five questions.

B. Tech (Eighth Semester) Mechanical Engineering
ME-426 E Total Quality Management

L	T	P/D	Total		
4	1		5	Theory	: 100 marks
				Sessional	: 50 marks
				Duration of Exams.	: 03 hours

UNIT I

Concept of Quality, Quality as the basis of market competition, Historical review, Quality philosophy of Deming, Juran, crossby etc., Obstacles, Integrating productivity and Quality.

Organization of Quality, Quality council, Total Quality Culture, Quality leadership, Quality awards, Total employee involvement, Quality circles, Attitude of top management, executives and workers, Operators responsibility of Quality, causes of operator's errors, Motivation.

UNIT II

Introduction lo TQM, Models for TQM. TQM implementation, Advantages of TQM, Obstacles to TQM, TQM in service sector.

Concepts of Quality function deployment, cause and effect diagram, SWOT analysis, Continuous improvement, PDCA cycle, Supplier partnership, Supplier certification, Pareto diagram, Scalier diagram, Benchmarking, Taquchi's Quality Engineering, Failure mode and effect analysis, Total productive maintenance, Introduction to JIT, JIT Quality management, SQC, SPC.DPR, Kaizen, Six sigma concept.

UNIT III

Introduction to ISO 9000 series of standards, other quality systems, Implementation, Documentation, Internal audits', Registration, Closing Comments.

UNIT IV

Beyond ISO 9000 horizon, Introduction to ISO 14000, Series standards, Concepts of ISO 14001, EMS Benefits, ISO 10011- 10014, Quality systems .

Suggested Books:

1. Total Quality Management: By Bosterfied el al. Pearson Education India, 2001.
2. The Essence of Total Quality Management: By Johan Bank, Prentice Hall of India 2000.
3. Managing for Total Quality: By Logothelis Prentice Hall of India, 2000.
4. Total Quality Management: By Sundra Raju,

Tala Mcgraw Hills publishing company, 1997.
5. TQM and ISO 9000: By K.C. Arora,
S.K. Kalaria & Sons 2000.

6. ISO 9000 Quality System: By Dalde & Saurabh,
Standard Publishing, 1994.

NOTE: In the semester examination, the examiner will set 8 questions in all, at least two question from each unit, and students will be required to attempt only 5 questions, at least one from each unit

B.Tech. (Eight Semester) Mechanical Engineering

ME428 E Piping Engineering

L	T	P/D	Total		
4	1	-	5	Theory	: 100 marks
				Sessional	: 50 marks
				Duration of Exams.	: 03 hours

UNIT I

Basics of fluid mechanics: viscosity, pressure, head, and hydraulic gradient, types of fluid flow, Remolds number. Euler's equation of motion, continuity equation, Bernoulli's equation, Gas laws and compressibility factor.

Determination of pipe size and pressure losses, thrusts in pipe line, water hammer in pipeline, design of gas pipeline, measurement of flow in pipes, Transportation of solid materials through pipelines.

UNIT II

Selection of materials, physical properties of pipe materials, recommended pipe materials

Standards and specifications, steel pipes, steel pipe fittings, cast iron pipes, cast iron fittings, joining of cast iron pipes, tubes of other materials, design of flanges and flanged joints

UNIT III

Load on structural supports, supporting structures of pipeline, pipe supports design considerations, platforms and ladders, foundation, supporting span of overhead pipe line, stiffening ribs, pipe clamping and supporting devices, flexible hanger supports

Valves, function of valves, valve materials and method of construction, pressure drop involves, valve size, Types of valves, valve fittings.

Codes and standards, piping construction, welding joints in pipe line, welding processes used in pipe fabrication, preparation of pipe edged,

UNIT IV

Piping systems, pipe expansion, methods of compensation, thermal force calculation, Permissible equivalent stresses by additional external loads, expansion devices, calculation of anchor force using a bellow, bellow material and life, use of hinged compensators

Kellogg method, Method of analysis, multi-line pipeline with two-fixed end
Corrosion control In critical task, corrosion process, types of corrosion, fluid and cavitation corrosion.

Reference and Text Books:

1. Handbook of piping design - By Sahu, New age Int. Pubs.
2. Design of piping systems - By Kellogg, Wiley & sons

NOTE: In the semester examination, the examiner will set 8 questions in all, at least two question from each unit, and students will be required to attempt only 5 questions, at least one from each unit

B. Tech (Eighth Semester) Mechanical Engineering

ME 430 E ENERGY MANAGEMENT

L	T	P	Total			
4	- 1	-	5	Sessional Marks	:	50 Marks
				Theory	:	100 Marks
				Duration of Exams:		3 Mrs.

UNIT I

Inerlialion phase, audit and analysis phase, implementation phase, general methodology for building and site energy audit, site survey, methodology, site survey-electrical system, steam and water systems, building survey methodology, basic energy audit instrumentation, measurement for building surveys.

General principles, the requirements for human comfort, description of typical systems-dual duct HVAC system. Multi zone HVAC systems, variable and volume systems, terminal repeat system, evaporative systems, package system, basic principle governing HVAC system, package system, basic principle governing HVAC system operation, energy management opportunities in HVAC systems, modeling of heating and cooling loads in buildings, problems.

UNIT II

General principles, illumination and human comfort, basic principles of lighting system, typical-illumination syst3em and equipment, fundamentals of single phase and 3 phase A.C. circuits, energy management opportunities for lighting systems, motors and electrical heat, electrical and analysis and their parameters, peak, demand control, problems.

General principles, process heat, combustion, energy saving in condensate return, steam generation and distribution, automotive fuel control, hot water and water pumping, direct and indirect fired furnaces over, process electricity, other process energy forms-compressed air and manufacturing processes, problems.

UNIT III

General consideration, life cycle costing, break-even analysis, cost of money, benefit/cost analysis, pay back period analysis, prospective rate of to return, problems.

Environmental conformation, passive design, conservation building envelope design consideration, integration of building system, energy storage problems.

UNIT IV

Energy management principle involving computers, basics of computer use, analysis-engineering and economic calculations, simulation, forecast, CAD/CAM controls - microprocessor and minicomputers, building cycling and control, peak demand limiting and control: industrial power management, problems.

Text Book:

1. Energy Management Principles by Criag B. Smith, Published by Pergamon Press.
2. Energy systems and developments – Jyoti Parikh, Oxford University Press.

Reference Books:

1. Energy – resources, demand and conservation with reference to India – Chaman Kashkari, Tata Mc Graw Hill Co. Ltd.
2. Integrated renewable energy for rural development – Proceedings of Natural solar energy convention, Calcutta.

NOTE: In the semester examination, the examiner will set 8 questions in all, at least two question from each unit, and students will be required to attempt only 5 questions, at least one from each unit

B.Tech (Eighth Semester) Mechanical Engineering

ME 432 E MANAGEMENT INFORMATION SYSTEM

L	T	P/D	Total		
4	1		5	Theory	: 100 marks
				Sessional	: 50 marks
				Duration of Exams.	: 03 hums

UNIT I

What is MIS? Decision support systems, systems approach, the systems view of business, MIS, MIS organization within the company management organizational theory and the systems approach. Development of organizational theory, management and organizational behavior, management information and the system approach.

Evolution of an information systems, basic information systems, decision making and MIS, MIS as a technique for making programmed decision assisting information systems (r) strategic and project planning for MIS : General business planning, appropriate MIS planning-general, MIS planning -details.

UNIT II

Define the problems, set system objectives, establish system constraints, determine information needs, determine information sources, develop alternative conceptual ;designs and select one document the system concept, prepare the conceptual ;design report.

UNIT III

Inform and involve the organization, aim of detailed design, project management of MIS detailed design, identify dominant and trade off criteria, define the subsystems, Sketch the detailed operating subsystems and information flow. Determine the degree of automation of each operation, inform and involve the organization again, inputs, and processing, early system testing, software, hardware and tools, propose an organization to operate the system, document the detailed design, revisit the manager -user.

UNIT IV

Plan the Implementation , acquire floor space and plan space layouts, organize for implementation, develop, procedures for implementation, train (ho operating personnel, computer related acquisitions, develop forms for data collection and information dissemination, develop the files, test

the system, cutover, document the system, evaluate the MIS control and maintain the system (r). Pitfalls in MIS development : Fundamental weakness, soft spots in planning, design problems, implementation: The TARPIT.

Text Books:

I. Management Information system by W.S. JawadeKar - Tata McGraw Hill.

NOTE: In the semester examination, the examiner will set 8 questions in all, at least two questions from each unit, and students will be required to attempt only 5 questions, at least one from each unit

B. Tech (Eighth Semester) Mechanical Engineering

ME 434 E Pneumatics & Hydraulics Control

L	T	P/D	Total		
4	1	-	5	Theory	: 100 marks
				Sessional	: 50 marks

Duration of Exams. : 03 hours

UNIT I

Hydraulic systems, pneumatic systems, uses of fluid power, fluid power at work, standard symbols for hydraulic & pneumatic components -ANS

Graphical symbols -composite symbols.

Pressure applied in one direction, pressure applied in both directions, pressure applied and intensified in both directions, advantages of pressure boosters installation, causes of failure of boosters, maintenance

Positive displacement or pressure type reciprocating compressors, velocity or dynamic type compressors, location and installation, air intake, after cooler, air receivers, safety valves, compressor regulators or controls planning a compressed air plant, compressor selection.

UNIT II

Petroleum base fluids, synthetic base fluids, quantity requirement, maintenance, selection of hydraulic fluid, specific weight, viscosity, Say-bolt universal viscometer, viscosity problems, viscosity index, lubricating value, pour point, oxidation and contamination.

Rigid pipe, semi-rigid, flexible piping, general features of piping installation, planning a compressed air distribution system, Installation of rigid, semi-rigid and flexible piping -manifolds, causes of piping failures.

General features, air filters, pressure regulators, lubricators, combination units, protection of filters and lubricator bowls, mufflers.

UNIT III

Two-way valves, manual control, manual operation, mechanical operation, electrical operation, pilot control, installation, causes of failure, repair & maintenance, three way valves, actuation, maintenance of three way valves four way valves, installation & maintenance.

Types of flow control, parts names, installation causes of failure, repair and maintenance, pressure relief valves, sequence valves, unloading valves, other types of pressure controls.

General types, characteristics of air motors, General features of pneumatic tools, drills, hammers, hoists, rock drills and paving breakers.

UNIT IV

Gear type motors, Vane type motors, piston type motors, split speed, Schematic diagrams of various types of pneumatic and hydraulic circuits, common causes of failure, dirt, heat, misapplication, improper fluids, faulty installation, maintenance, improperly designed circuits.
Control systems, differential sensing or error-detecting devices, types of servo systems, characteristics of servo-systems.

Reference and Text Books:

1. Pneumatics and Hydraulics
   -By Stewart, Taraporevala Sons & Co. Pvt. Ltd,
2. Industrial Hydraulics
   -By Pippinger & Hicks, McGraw Hill, New York.
3. Hydraulic and Pneumatic Power for Production
   -By H.L. Stewart, Industrial Press Inc, New York.
4. Hydraulic Servo Systems
   -By M. Guillon.

NOTE: In the semester examination, the examiner will set 8 questions in all, at least two question from each unit, and students will be required to attempt only 5 questions, at least one from each unit

B. Tech (Eighth Semester) Mechanical Engineering
ME- 436E DESIGN OF AIR CONDITIONING SYSTEMS

Sessional : 50 Marks
Theory : 100 Marks
L T P Total : 150 Marks
4 1 - Duration of Exam: 3 Hrs.

Unit I Application of Air Conditioning: Medium and large sized buildings, industrial air conditioning, residential air conditioning, air conditioning of vehicles and aircrafts.

Psychometry: Psychometric chart, combined heat and mass transfer, adiabatic saturation, enthalpy potential. Air Conditioning Load: Comfort and design conditions, thermal transmission, infiltration and ventilation loads, heating and cooling loads, solar radiation properties, periodic heat transfer through walls and roofs.

Unit II Air Conditioning Systems: Thermal distribution systems, classic single-zone systems, outdoor air control, single-zone system design, multiple-zone systems, terminal reheat systems, dual duct or multizone system, variable air-volume systems, hydronic systems, unitary systems, passive air conditioning systems.

Unit III Vapour Compression Cycle: Compressors: Reciprocating, rotary, screw, scroll vane and centrifugal compressors. Condensers and evaporators – heat transfer, pressure drop, extended surfaces, condensing capacity, condenser design, boiling in shell and tubes, evaporator performance, defrosting methods. Expansion devices – capillary tube design, constant pressure expansion valve, float valves, superheat controlled thermostatic expansion valve.

Refrigerants: Primary and secondary refrigerants, halocarbons, azeotropes, ozone depletion, eco friendly refrigerants.

Unit IV Equipment Design: Fan and duct systems, fan laws, air-distribution in rooms, ventilation systems, diffusers and induction, fan coil units. Cooling and dehumidifying coils – Heat and mass transfer, moisture removal, coil performance, Controls: Pneumatic, electric and electronic controls, thermostats, dampers, outside air control, freeze protection, humidistat, acoustics and noise control.

Text Books :

1. Refrigeration and air conditioning – W.F. Stoecker, J.W. Jones, McGraw Hill Book Co.

2. Air conditioning Engineering – W.P. Jones, Edward Arnold

Reference Books:

1. Hand book of air conditioning system design – Carrier Air conditioning Co., McGraw Hill Book co
2. Thermal Environmental Engg. – James L. Threlkeld, Prentice Hall, Inc
2. Refrigeration and Air conditioning – C P Arora, Tata McGraw Hill Pub. Co Ltd.
4. Refrigeration and Air conditioning – P L Ballaney, Khanna Publishers

Note : In the semester examination, the examiner will set eight questions, at least two questions from each unit. The students will be required to attempt only 5 questions.

ME- 438 E AUTOMATIC CONTROLS (THEORY AND APPLICATIONS)

L T P — Sessional Marks : 50

3 1 - — Theory Marks : 100

Total Marks : 150

Duration of Exam : 3 hrs.

Unit I Introduction And Applications: Types of control systems ; Typical Block Diagram :Performance Analysis; Applications – Machine Tool Control, Boiler Control, Engine Governing, Aerospace Control, Active Vibration Control; Representation of Processes & Control Elements – Mathematical Modeling, Block Diagram Representation, Representation of Systems or Processes, Comparison Elements; Representation of Feedback Control systems – Block Diagram & Transfer Function Representation, Representation of a Temperature, Control System, Signal Flow Graphs, Problems. Types Of Controllers: Introduction: Types of Control Action; Hydraulic Controllers; Electronic Controllers; Pneumatic Controllers; Problems.

Unit II Transient And Steady State Response: Time Domain Representation; Laplace Transform, Representation; System with Proportional Control; Proportional – cum – Derivative control; Proportional – cum – Integral Control; Error Constants; Frequency Response Analysis: Introduction; Closed and Open Loop Transfer Function; Polar Plots; Rectangular Plots; Nichols Plots: Equivalent Unity Feed Back Systems; Problems.

Unit III Stability Of Control Systems: Introduction; Characteristic Equation; Routh's Criterion; Nyquists Criterion, Gain & Phase Margins, Root Locus Method: Introduction; Root Ioci of a Second Order System; General Case; Rules for Drawing Forms of Root Ioci; Relation between Root Locus Locations and Transient Response; Parametric Variation; Problems.

Unit IV Digital Control System : Introduction; Representation of Sampled Signal; Hold Device; Pulse Transfer Function; Block Diagrams; Transient Response; Routh's Stability Criterion; Root Locus Method; Nyquists Criterion; State Space Analysis of Control Systems: Introduction; Generalized State Equation; Techniques for Deriving System State – Space Equations; Transfer Function from State Equations; Solution of State Vector Differential Equations; Discrete Systems; Problems.

Text Books :

1. Theory & Applications of Automatic Controls by B.C. Nakra, Published by New Age International Pvt. Ltd. Publishers, New Delhi 1998.

2. Modern Control Engg. By Ugata, Prentice Hall of India, New Delhi.

Reference Books:

1. Automatic Control Systems by Kuo' Published by Prentice Hall of India, New Delhi.
2. Control System Engineering, I. J. Nagrath and M. Gopal, New Age International limited.
Note : In the semester examination, the examiner will set eight questions in all, at least two questions from each unit & students will be required to attempt only 5 questions.