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.

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.

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	: 5O 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.

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.

MET-425 **GAS DYANAMICS**

L	T	P	total	Sessional Marks : 50
4	1		5	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.

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 amplifier, 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.