

MAHARSHI DAYANAND UNIVERSITY, ROHTAK

SCHEME OF STUDIES & EXAMINATIONS

B.E 4th YEAR MECHANICAL ENGINEERING, SEMESTER – VIII

Modified 'E' Scheme effective from 2006-07

Course No.	Course Title	Teaching schedule				Marks for class work	Marks for Examination		Total Marks	Duration of Exam
		L	T	P	Total		Theory	Practical		
ME-402 E	Computer Aided Design	3	1	-	4	50	100	-	150	3
ME-404 E	Power Plant Engg.	3	1	-	4	50	100	-	150	3
ME-	Deptt. Elective-I	4	-	-	4	50	100	-	150	3
ME-	Deptt. Elective-II	4	-	-	4	50	100	-	150	3
ME-406 E	CAD Lab.	-	-	3	3	50	-	50	100	3
ME-408 E	Independent Study Seminar	-	-	4	4	50	-	-	50	-
ME-413 E	Project	-	-	8	8	50	-	100	150	3
GFME-402 E	General Fitness for the Profession*	-	-	-	-	50	-	100	150	3
	Total	14	2	15	31	400	400	250	1050	

Deptt. Electives - I

1. ME- 432 E Optimization Methods for Engineering Systems
2. ME- 434 E Computer Aided Vehicle Design
3. ME- 436 E Mechatronics
4. ME- 438 E Flexible Manufacturing System

Deptt. Electives - II

1. ME-442 E Robotics Engineering
2. ME-444 E Ergonomics and Work Place Design
3. ME-446 E Modern Manufacturing Processes
4. ME-448 E Emerging Automotive Technologies

Note :

1. Project load will be treated as 2 hrs. per week for the project coordinator and 1 hour for each participating teacher. Project involving design, fabrication, testing, computer simulation, case studies etc., which has been commenced by students in VIIth semester will be completed in VIIIth Semester.
2. For the subject ME-408 E, a student will select a topic from emerging areas of Mech. Engg. and study it thoroughly and independently. Later he will give a seminar talk on the topic.
3. The evaluation of the student for his/her General Fitness for the Profession shall be carried out by a team consisting of Principal / Director, HOD of concerned department and external examiner appointed by University.
4. Students will be allowed to use the non-programmable scientific calculator. However, sharing of calculator will not be permitted in the examination.
5. *The subject GFME-420-E (General Proficiency) code has been changed to GFME-402-E and will be effective from 2006-07.
- 6.

ME- 402 E COMPUTER AIDED DESIGN

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

- UNIT – I** **Introduction:** Introduction to CAD/CAM, Historical developments, Industrial look at CAD/CAM, Introduction to CIM; Basics of geometric and solid modeling, explicit, implicit, intrinsic and parametric equations, coordinate systems.
- UNIT – II** **Transformations:** Introduction, transformation of points and line, 2-D rotation, reflection, scaling and combined transformation, homogeneous coordinates, 3-D scaling, shearing, rotation, reflection and translation, combined transformations, orthographic and perspective projections, reconstruction of 3-D objects.
- UNIT – III** **Curves:** Algebraic and geometric forms, tangents and normal, blending functions reparametrization, straight lines, conics, cubic splines, Bezier curves and B-spline curves.
- UNIT – IV** **Surfaces:** Algebraic and geometric forms, tangents and normal, blending functions, reparametrization, sixteen point form, four curve form, plane surface, ruled surface, surface of revolution, tabulated cylinder, bi-cubic surface, bezier surface, B-spline surface.
- UNIT – V** **Solids:** Solid models and representation scheme, boundary representation, constructive solid geometry, sweep representation, cell decomposition, spatial occupancy enumeration.
- UNIT – VI** **Automation and Numerical Control:** Introduction, fixed, programmable and flexible automation, types of NC systems, MCU and other components, NC manual part programming, coordinate systems, G & M codes, Part program for simple parts, computer assisted part programming.
- UNIT – VII** **Group Technology:** Part families, part classification and coding, production flow analysis, Machine cell design, Advantages of GT
- UNIT – VIII** **Flexible Manufacturing Systems & Computer aided process planning:** Introduction, FMS components, types of FMS, FMS layouts, planning for FMS, advantages and applications Conventional process planning, types of CAPP, Steps in variant process planning, planning for CAPP.

Text Books:

1. CAD/ CAM by Groover and Zimmer, Prantice Hall.
2. CAD/ CAM Theory and Practice by Zeid, McGraw Hill
3. Numerical Control and Computer Aided Manufacturing by Kundra, Rao & Tiwari, TMH.

Reference Books :

- 1 CAD/CAM (Principles, Practice & Manufacturing Management) by Chirs Mc Mohan & Jimmie Browne, Published by Addison- Wesley.

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

ME- 404 E POWER PLANT ENGINEERING

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

- Unit I** Introduction: Energy resources and their availability, types of power plants, selection of the plants, review of basic thermodynamic cycles used in power plants.
- Unit II** Hydro Electric Power Plants : Rainfall and run-off measurements and plotting of various curves for estimating stream flow and size of reservoir, power plants design, construction and operation of different components of hydro-electric power plants, site selection, comparison with other types of power plants.
- Unit III** Steam Power Plants: Flow sheet and working of modern-thermal power plants, super critical pressure steam stations, site selection, coal storage, preparation, coal handling systems, feeding and burning of pulverized fuel, ash handling systems, dust collection-mechanical dust collector and electrostatic precipitator.
- Unit IV** Combined Cycles: Constant pressure gas turbine power plants, Arrangements of combined plants (steam & gas turbine power plants), re-powering systems with gas production from coal, using PFBC systems, with organic fluids, parameters affecting thermodynamic efficiency of combined cycles. Problems.
- Unit V** Nuclear Power Plants: Principles of nuclear energy, basic nuclear reactions, nuclear reactors-PWR, BWR, CANDU, Sodium graphite, fast breeder, homogeneous; gas cooled. Advantages and limitations, nuclear power station, waste disposal.
- Unit VI** Power Plant Economics: load curve, different terms and definitions, cost of electrical energy, tariffs methods of electrical energy, performance & operating characteristics of power plants- incremental rate theory, input-output curves, efficiency, heat rate, economic load sharing, Problems.
- Unit VII** Non-Conventional Power Generation: Solar radiation estimation, solar energy collectors, low, medium & high temperature power plants, OTEC, wind power plants, tidal power plants, geothermal power plants.
- Unit VIII** Direct Energy Conversion Systems: Fuel cell, MHD power generation-principle, open & closed cycles systems, thermoelectric power generation, thermionic power generation.

Text Books :

1. Power station Engineering and Economy by Bernhardt G.A. skrotzki and William A. Vopat – Tata Mc Graw Hill Publishing Company Ltd., New Delhi
2. Power Plant Engineering : P.K. Nag Tata McGraw Hill second Edition 2001.

Reference Books :

1. Power Plant Engg. : M.M. El-Wakil McGraw Hill 1985.

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

ME- 406- E COMPUTER AIDED DESIGN LAB

L T P
- - 3

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

The students will be required to carry out the following exercises using software packages (e.g. 3D modeling package/ Pro Engineer/ I-Deas/ Solid Edge etc.).

1. Implement simple programmes for the graphics representation of
 - (i) Transformation and projections.
 - (ii) Conic Sections, cubic splines, and B-splines.
 - (iii) Surfaces- Bilinear, Bicubic surface patch and Bezier surface.

2. CAD Modelling Assignments.
 - (i) Construction of simple machine parts and components.
 - (ii) Modelling of machine components.
 - Surface of a Diffuser section, Propeller.
 - Gear blank and other mechanical parts.
 - Mechanical assembly of parts.

ME-408- E INDEPENDENT STUDY SEMINAR

L T P
- - 4

Sessional : 50 Marks
Total : 50 Marks

The student will select a topic in emerging areas of Mech. Engg. and study independently. He will give a seminar talk on the same before the committee constituted by the head of the dept. The committee should comprise of at least three faculty members from Thermal, Production & Design specializations.

L T P
- - 8

Class Work : 50 Marks
Practical : 100 Marks
Total Marks : 150 Marks

At the end of each year students will be evaluated on the basis of their performance in various fields. The evaluation will be made by the panel of experts/examiners/teachers to be appointed by the Principal/Director of the College. A specimen perform indicating the weight age to each component/ activity is given below :-

Name : _____ College Roll No. _____
Univ.Roll No. _____
Branch _____ Year of Admission _____.

I. Academic Performance (15 Marks) :

(a) Performance in University Examination :-

Sem.	Result	%age of Marks obtained	Number of Attempt in which the Sem. exam. has been cleared
I			
II			
III			
IV			
V			
VI			
VII			

II. Extra Curricular Activities (10 Marks) :

Item	Level of Participation	Remarks (Position Obtained)
Indoor Games (Specify the Games)	_____ _____ _____	_____ _____
Outdoor Games (Specify the Games)	_____ _____ _____	
Essay Competition	_____ _____	
Scientific Technical	_____ _____	

Exhibitions	_____
Debate	_____ _____ _____
Drama	_____ _____ _____
Dance	_____ _____ _____
Music	_____ _____ _____
Fine Arts	_____ _____ _____
Painting	_____ _____ _____
Hobby Club	_____ _____ _____
N.S.S.	_____ _____ _____
Hostel Management Activities	_____ _____ _____
Any other activity (Please Specify)	_____ _____ _____

III. Educational tours/visits/Membership of Professional Societies (5 Marks)

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

IV. Contribution in NSS Social Welfare Floor Relief/draught relief/Adult Literacy

**mission/Literacy Mission/Blood Donation/Any other Social Service
(5 Marks)**

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

**V. Briefly evaluate your academic & other performance & achievements in the Institution
(5 Marks)**

VI. Performance in Viva voce before the committee (10 Marks)

*Marks obtained I.()+II()+III()+IV()+V()+VI()=

**Total Marks :

Member

Member

Member

Member

Member

ME- 432- E OPTIMIZATION METHODS FOR ENGINEERING SYSTEMS

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

- Unit I** Introduction: Engineering Applications; Statement of the Optimal Problem: Classification; Optimization Techniques.
- Unit II** Classical Methods: Single Variable Optimization; Multivariable Optimization without any Constraints with Equality and Inequality Constraints.
- Unit III** One-Dimensional Minimization Methods: Uni-model Function; Elimination Methods – Dichotomous Search, Fibonacci and Golden Section Methods; Interpolation Methods – Quadratic and Cubic Interpolation Methods.
- Unit IV** Unconstrained Minimization Methods: Univariate, Conjugate Directions, Gradient and Variable Metric Methods.
- Unit V** Constrained Minimization Methods: Characteristics of a constrained problem; Direct Methods of feasible directions; Indirect Methods of interior and exterior penalty functions.
- Unit VI** Geometric Programming : Formulation and Solutions of Unconstrained and Constrained geometric programming problems.
- Unit VII** Dynamic Programming: Concept of Sub-optimization and the principle of optimality; Calculus, Tabular and Computational Methods in Dynamic Programming; An Introduction to Continuous Dynamic Programming.
- Unit VIII** Integer Programming : Gomory’s Cutting Plane Method for Integer Linear Programming; Formulation & Solution of Integer Polynomial and Non-linear problems.

Text Books :

1. Optimization (Theory & Applications) – S.S. Rao, Wiley Eastern Ltd., New Delhi.
2. Optimization Concepts and Applications in Engineering - Ashok D.Belegundu and Tirupathi R Chandrupatla -- Pearson Education.

Reference Books :

1. Optimization: Theory and Practice, C.S.G. Beveridge and R.S. Schechter, MGH, New York.

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

ME- 434- E COMPUTER AIDED VEHICLE DESIGN

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

PART-A

- Unit I** Vehicle Frame and Suspension: Study of Loads-Moments and Stresses on Frame Members. Computer Aided Design of Frame for Passenger and Commercial Vehicles. Computer Aided Design of Leaf Springs-Coil Springs and Torsion Bar Springs.
- Unit II** Front Axle and Steering Systems: Analysis of Loads-Moments and Stresses at different sections of Front Axle. Determination of Bearing Loads at Kingpin Bearings. Wheel Spindle Bearings. Choice of Bearings. Determination of Optimum Dimension and Proportions for Steering Linkages ensuring minimum error in Steering.
- Unit III** Drive Line and Rear Axle : Computer Aided Design of Propeller Shaft. Design of Final Drive Gearing. Design details of Full-floating, Semi-floating and Three Quarter Floating, Rear Axle Shafts and Rear Axle Housings.

PART-B

- Unit IV** Clutch: Torque capacity of Clutch. Computer Aided Design of Clutch Components. Design details of Roller and Sprag Type of Clutches.
- Unit V** Gear Box : Computer Aided Design of Three Speed and Four Speed Gear Boxes.

Note : Use of Software Packages for Analysis and Design of Mechanical Systems may be used for Design Problem.

Text Books :

1. Dean Avern, Automobile Chassis Design, Illiffe Books
2. Heldt, P.M., Automotive Chassis, Chilton Co., New York

Reference Books:

1. Steeds.W., Mechanics of Road Vehicles, Illiff Books Ltd., London
2. Giles, J.G. Steering, Suspension and Tyres, Illiff Books Ltd., London,.
3. Newton, Steeds & Garret, Motor Vehicle, Illiff Books Ltd., London,.
4. Heldt, P.M. Torque Converter, Chilton Book Co., New York,

Note : In the semester examination, the examiner will set eight questions in all, taking two questions each from Units I, II, III & one question each from Units IV & V. The students will be required to attempt 3 questions from PART-A & two questions compulsorily from Part-B.

ME- 436- E MECHATRONICS

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

- Unit I** Introduction and Basics: What is Mechatronics?; A Measurement System with its constituent elements; Open and Closed Loop Systems; Sequential Controllers; Micro-processor Based Controllers; The Mechatronic Approach.
- Unit II** Hardware of Measurement Systems; A review of Displacement, Position Velocity, Motion, Force, Fluid Pressure, Liquid Flow, Liquid Level, Temperature, Light Sensors / alongwith Performance Terminology; Selection of Sensors; Input Data by Switches; Signal Conditioning; Brief Review of Operational Amplifier; Protection; 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 III** Pneumatic, Hydraulic, Mechanical and Electrical Actuation Systems: 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 & Chain Drives, Bearings, Mechanical Aspect of Motor Selection; Electrical Systems; Mechanical & Solid State Switches; Solenoids; D.C. & A.C. Motors; Stepper Motors; Problems.
- Unit IV** System Modeling and Performance: Engg. Systems; Rotational – Translational Systems; Electro-mechanical Systems; Hydraulic – Mechanical Systems; A review of modeling of First and Second Order Systems and Performance Measures; Transfer Functions for first order System, Second Order System, Systems in series & Systems with Feedback Loops; Frequency Response of First Order and Second Order Systems; Bode Plots: Performance Specifications: Stability; Problems.
- Unit V** Closed Loop Controllers: Continuous and Discrete Processes – 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 & Ultimate Cycle Method; Velocity Control; Adaptive Control; Problems.
- Unit VI** Digital Logic and Programmable Logic Controllers : A Review of Number Systems & Logic Gates; Boolean Algebra; Karnaugh Maps; Sequential Logic; Basic Structure of Programmable Logic Controllers; Input/ Output Processing; Programming; Timers, Internal Relays and Counters; Master & Jump Controls; Data Handling; Analogue Input/ Output; Selection of a PLC; Problems.

Unit VII Microprocessors and Input/Output Systems: 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, Pointer; Examples of Programs; Interfacing; Input/ Output; Interface Requirements; Peripheral Interface Adaptors; Serial Communication Interface; Examples of Interfacing; Problems.

Unit VIII Design and Mechatronics: Design Process; Traditional and Mechatronics Design; Possible Mechatronics design solutions for Timed Switch, Wind Screen Wiper Motion, Bath Room Scale, A Pick & Place Robot, Automatic Camera, Engine Management System & Bar Code Recorder.

Text Books :

1. Mechatronics by W. Bolton, Published by Addison Wesley.
2. Mechatronics System Design – Devdas Shetty and Richard A. Kolx Brooks/ Cole 1997.

Reference Books :

1. Introduction to Mechatronics and Measuring System : david G. Alciation and Michael B. Hist and Tata McGraw Hill
2. Mechtronics – Sensing to Implementation - C.R.Venkataraman, Sapna

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

ME- 438- E FLEXIBLE MANUFACTURING SYSTEMS

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

- Unit I** Automation: Types of automation, reasons for automating, automation strategies, Detroit-type automation: Automated flow lines, methods of work part transport, Transfer mechanisms, buffer storage, automation for machining operations.
- Unit II** Automated assembly systems: Design for automated assembly, types of automated assembly systems, part feeding devices, quantitative analysis of the delivery system operation, analysis of a single-station assembly machine, numericals.
- Unit III** Group Technology: Part families, parts classification and coding, types of classification and coding systems. Machine cell design: The composite part concept, types of cell designs, determining the best machine arrangement, benefits of group technology.
- Unit IV** Flexible Manufacturing Systems: Components of an FMS, types of systems, where to apply FMS technology, FMS work stations. Material handling and storage system: Functions of the handling system, FMS layout configurations. Material handling equipment. Computer control system: Computer function, FMS data file, system reports. Planning the FMS, analysis methods for FMS, applications and benefits.
- Unit V** Robotic technology: Joints and links, common robot configurations, work volume, types of robot control, accuracy and repeatability, other specifications, end effectors, sensors in robotics.
- Unit VI** Robot programming: Types of programming, lead through programming, motion Programming, interlocks, advantages and disadvantages. Robot languages: Motion programming, simulation and off-line programming, work cell control.
- Unit VII** Robot applications: Characteristics of robot applications, robot cell design, types of robot applications: Material handling, processing operations, assembly and inspection.

Text Books:

1. Automation, Production Systems and Computer Integrated Manufacturing. Groover M.P, Prentice Hall of India.
2. CAD/CAM – Groover M.P, Zimmers E.W, Prentice Hall of India.

Reference Books:

1. Approach to Computer Integrated Design and Manufacturing Nanua Singh, John Wiley and Sons, 1998.
2. Production Management Systems: A CIM Perspective Browne J, Harhen J, Shivnan J, Addison Wesley, 2nd Ed. 1996.

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

ME- 442- E ROBOTICS ENGINEERING

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

- Unit I** Robotic Manipulation: Automation and Robots; Robot Classification – Drive Technologies, Work-Envelope Geometries, Motion Control Methods, Applications; Robot Specifications – No. of Axes, Capacity and Speed, Reach and Stroke, Tool Orientation, Repeatability, Precision, Accuracy, Operating Environment, An Example; Rhino X-3.
- Unit II** Direct Kinematics: The Arm Equation Homogenous Co-ordinates – Frames, Translations and Rotations, Composite Homogenous Transformations; Screw Transformations; Link Co-ordinates; The Arm Equation; A Five-Axis Articulated Robot; A Four-Axis Scara Robot; A Six-Axis Articulated Robot; Problems.
- Unit III** Inverse Kinematics: Solving the Arm Equation: The Inverse Kinematics Problem; General Properties of Solutions; Tool Configuration; Inverse Kinematics of a Five-Axis Articulated Robot, Four-Axis Scara Robot, Six-Axis Articulated Robot and Three-Axis Planer Articulated Robot; A Robotic Work Cell; Problems.
- Unit IV** Work Space Analysis and Trajectory Planning : Work Space Analysis; Work Envelope of a Five-Axis Articulated Robot; Work Envelope of a Four Axis Scara Robot; Work Space Fixtures; The Pick and Place Operation; Continuous Path Motion; Interpolated Motion; Straight Line Motion; Problems.
- Unit V** Differential Motion and Statics : The Tool Configuration Jacobian Matrix; Joint – Space Singularities; Generalised Inverses; Resolved – Motion Rate Control; $n > 6$; Rate Control of Reduntant Rebots : $n > 6$; Rate Control using (1) – Inverses; The Manipulator Jacobian; Induced Joint Torques and Forces; Problems.
- Unit VI** Manipulator Dynamics : Lagrange’s Equation; Kinetic & Potential Energy; Generalised Force; Lagrange – Euler Dynamic Model; Dynamic Models of a Two-Axis Planer Articulated Robot and A Three-Axis SCARA Robot; Direct & Inverse Dynamics; Recursive Newton - Euler Formulation; Dynamic Model of a One-Axis Robot; Problems.
- Unit VII** Robot Control : The Control Problems; State Equations; Constant Solutions; Linear Feedback Systems; Single-Axis PID Control; PD-Gravity Control; Computed –Torque Control; Variable-structure Control; Impedance Control; Problems.

Text Books:

1. Fundamental of Robotics (Analysis & Control) by Robert J.Schilling, Published by PHI, Pvt. Ltd., New Delhi.
2. Introduction to Robotics (Mechanics & Control) by John J. Craig, Published by Addition Wesley (Intl. Student Edition).

Reference Books:

1. Analytical Robotics & Mechatronics by Wolfram Stadler, Published by Mc-Graw Hill, Inc., New Delhi.
2. Industrial Robotics - Technology, Programming & Applications by Mikell P. Grover, Weiss, Nagel and Ordef , Published by Mc-Graw Hill International Edition.
3. A Robot Engg. Test Book - Mohsen Shahinpoor, Harper & Low, Publishing New York.
4. Robotic Engineering – An Integrated Approach : Richard D.Klafter, Thomas A. Chmielewski and Michael Negin PHI 1989.
5. Foundations of Robotics Analysis and Control - Tsuneo Yashikawa MIT Press 1990, Indian Reprint 1998.
6. Robots and Control - R.K.Mittal and I.J.Nagrath - Tata McGraw Hill 2003.

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

ME- 444- E ERGONOMICS AND WORK PLACE DESIGN

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

- Unit I** Basic Principles of Ergonomics, Anthropometry, Posture and Health; Anthropometry Practical; Displays, Controls and HMI; Tools and Equipment Design; Workplace Design and Assessment; Task Analysis; Questionnaire and Interview Design; Product Design and Evaluation; Designing for manufacture and maintenance; Health and Safety Legislation and Ergonomics.
- Unit II** Application of Ergonomics Principles, Cognitive Ergonomics, Human Information Processing; Memory; Reading; Perception; Navigation; Problem Solving; Decision Making, Human-Computer Interaction, Input/Output Technology, Usability; Evaluation; Health problems.
- Unit III** Future Systems, Job Design, Scientific Management, Enrichment, Enlargement, Rotation, Cells, Shift work, Management Style and Job Design, Change Management. New Technology, Unemployment, Deskilling, Introducing new technology. Questionnaire design and assessment. Task analysis techniques. Measurement of human error and risk. Use of simulation and prototypes. Product Evaluation. Experimental Design.
- Unit IV** Case Studies: A set of case studies will be used to demonstrate how ergonomics has lead to changes in work activity, safety and product design. Case studies will include advanced computer applications, workplace assessment and re-design, accident analysis and industrial inspection, and in manufacturing. Students will be required to apply the principles to a real life ergonomic design as applied to a product, service or computer application.

Text Books:

1. Work Design: Industrial Ergonomics – Knoz, Stephan A., Johnson, Steven, Holcomb Hathaway, Scottsdale, AZ.
2. Human factors in engineering and design – Sanders, M.S. & McCormick, E.J., 6th ed., McGraw-Hill, New York.

Reference Books:

1. Ergonomics: Man in his working environment- Murrell, K.F.H, Champan & Hall, London.
2. Man – Machine Engineering – Chapanis A: Wordsworth Publishing Co.
3. The Practice and Management of Industrial Ergonomics – Alexander, D.C., Prentice-Hall, Englewood Cliffs, NJ.
4. Textbook of Work Physiology – Astrand, P.O. & Rhodahl, K.– McGraw-Hill, New York.
5. Human Factors in Lighting – Boyce, P.R. Macmillan, New York.
6. The Ergonomics of Workspaces and Machines : A design manual – Clark, T.S. & Corlett, E.N. Taylor & Francis, London.
7. Ergonomics at work. Osborne, D Wiley, London.
8. Bodyspace–Anthropometry, Ergonomics and Design. – Pheasant, S. Taylor & Francis,.

Note: In the semester examination, the examiner will set eight questions in all , taking at least two question from each unit. The students have to attempt 5 questions.

ME- 446 E MODERN MANUFACTURING PROCESSES

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

- Unit I** Mechanical Processes: Ultrasonic Machining- Elements of process, cutting tool system design, effect of parameters, economic considerations, applications, limitations of the process, advantages and disadvantages. Abrasive Jet Machining- Variables in AJM, metal removal rate in AJM. Water Jet Machining- Jet cutting equipments, process details, advantages and applications.
- Unit II** Electrochemical and Chemical Metal Removal Processes: Electrochemical Machining- Elements of ECM process, tool work gap, chemistry of the process, metal removal rate, accuracy, surface finish and other work material characteristics, economics, advantages, applications, limitations. Electrochemical Grinding - Material removal, surface finish, accuracy, advantages, applications.
- Unit III** Thermal Metal Removal Processes: Electric Discharge Machining (EDM) or spark erosion machining processes, mechanism of metal removal, spark erosion generators, electrode feed control, dielectric fluids, flushing, electrodes for spark erosion, selection of electrode material, tool electrode design, surface finish, machining accuracy, machine tool selection, applications. Wire cut EDM. Laser beam machining (LBM)- Apparatus, material removal, cutting speed and accuracy of cut, metallurgical effects, advantages and limitations.
- Unit IV** Plasma Arc Machining (PAM): Plasma, non thermal generation of plasma, mechanism of metal removal, PAM parameters, equipments for D.C. plasma torch unit, safety precautions, economics, other applications of plasma jets. Electron Beam Machining (EBM) - Generation and control of electron beam, theory of electron beam machining, process capabilities and limitations.

Text Books :

1. Modern Machining Processes – P.C.Pandey, H.S.Shan, Tata McGraw Hill
2. Machining Science- Ghosh and Malik, Affiliated East-West Press

Reference Books :

1. Non Traditional Manufacturing Processes- Benedict G.F, Marcel Dekker
2. Advanced Methods of Machining- Mc Geongh J.A, Chapman and Hall

Note: In the semester examination, the examiner will set eight questions in all , taking at least 2 questions from each unit. The students will be required to attempt only five questions.

ME- 448- E EMERGING AUTOMOTIVE TECHNOLOGIES

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

UNIT I The Future Of The Automotive Industry : Challenges and Concepts for the 21st century. Crucial issues facing the industry and approaches to meet these challenges.

UNIT II Fuel Cell Technology For Vehicles : What is fuel cell, Type of fuel cell, Advantages of fuel cell. Current state of the technology. Potential and challenges. Advantages and disadvantages of hydrogen fuel.

UNIT III Latest Engine Technology Features : Advances in diesel engine technology. Direct fuel injection Gasoline engine. Diesel particulate emission control. Throttling by wire. Variable Valve Timing, Method used to effect variable Valve Timing. Electromagnetic Valves, Camless engine actuation.

UNIT IV 42 Volt System : Need, benefits, potentials and challenges. Technology Implications for the Automotive Industry. Technological evolution that will occur as a result of the adoption of 42 volt systems.

UNIT V Electrical And Hybrid Vehicles : Types of hybrid systems, Objective and Advantages of hybrid systems. Current status, Future developments and Prospects of Hybrid Vehicles

UNIT VI Integrated Starter Alternator: Starts stop operation, Power Assist, Regenerative Braking. Advanced lead acid batteries, Alkaline batteries, Lithium batteries, Development of new energy storage systems, Deep discharge and rapid charging ultra capacitors.

UNIT VII X-By Wire Technology : What is X-By Wire, Advantage over hydraulic systems. Use of Automotive micro controllers. Types of sensors. Use of actuators in an automobile environment.

UNIT VIII Vehicles Systems : Constantly Variable Transmission, Benefits, Brake by wire, Advantages over power Braking System. Electrical assist steering, Steering by wire, Advantages of Steering by wire. Semi-active and fully-active suspension system. Advantages of fully active suspension system.

Text & Reference Books :

1. Advanced Vehicle Technologies by Heinz Heisler-SAE International Publication.
2. Electric and Hybrid Electric vehicles by Ronald K. Jurgen.- SAE International Publication
- 3 .Electronic Braking, Traction and Stability control-SAE Hardbound papers.
1. Electronics steering and suspension systems- SAE Hardbound papers.
2. 42 Volt system by Daniel J. Holt- SAE International Publication
3. Diesel Particulate Emission by J.H. Johnson- SAE Hardbound papers.
7. Fuel Cell Technologies for vehicles by Richard Stobart- SAE Hardbound papers.

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