

**MAHARSHI DAYANAND UNIVERSITY, ROHTAK**  
**SCHEME OF STUDIES & EXAMINATIONS**  
**B.E 2<sup>nd</sup> YEAR (SEMESTER – IV) MECHANICAL ENGINEERING**  
**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		
HUM-202 E	Fundamentals of Management (EE, EL, EI, IC, ME, CHE)	3	1	-	4	50	100	-	150	3
ME-202 E	Manufacturing Technology	3	1	-	4	50	100	-	150	3
ME-204 E	Material Science	3	1	-	4	50	100	-	150	3
ME-206 E	Strength of Materials – II (ME, AE)	3	1	-	4	50	100	-	150	3
ME-208 E	Fluid Mechanics	3	1	-	4	50	100	-	150	3
ME-210 E	Energy Conversion	3	1	-	4	50	100	-	150	3
ME-212 E	Material Science Lab	-	-	2	2	25	-	25	50	3
ME-214 E	Fluid Mechanics Lab	-	-	2	2	25	-	25	50	3
ME-216 E	Energy Conversion Lab	-	-	2	2	25	-	25	50	3
ME-218 E	Manufacturing Practice	-	-	3	3	25	-	25	50	3
GPME-202 E	General Proficiency	-	-	-	-	50	-	-	50	-
	<b>TOTAL</b>	<b>18</b>	<b>6</b>	<b>9</b>	<b>33</b>	<b>450</b>	<b>600</b>	<b>100</b>	<b>1150</b>	

**Note:**

1. Each student has to undergo Practical training of 6 weeks during summer vacation and its evaluation in 5<sup>th</sup> semester w.e.f. the session 2006-07
2. Students will be allowed to use Non-Programmable Scientific Calculator. However, sharing of calculator will not be permitted in the examination.
3. The subject GPME-220-E (General Proficiency) code has been changed to GPME-202-E and will be effective from 2006-07.

L T P  
3 1 -

Class Work : 50 Marks  
Theory : 100 Marks  
Total : 150 Marks  
Duration of Exam. : 3 Hrs.

### **UNIT-I**

Meaning of management, Definitions of Management, Characteristics of management, Management Vs. Administration. Management-Art, Science and Profession. Importance of Management. Development of Management thoughts. Principles of Management. The Management Functions, Inter-relationship of Managerial functions.

### **UNIT-II**

Nature and Significance of staffing, Personnel management, Functions of personnel management, Manpower planning, Process of manpower planning, Recruitment, Selection; Promotion - Seniority Vs. Merit. Training - objectives and types of training.

### **UNIT-III**

**Production Management : Definition, Objectives, Functions and Scope, Production Planning and Control; its significance, stages in production planning and control. Brief introduction to the concepts of material management, inventory control; its importance and various methods.**

### **UNIT-IV**

Marketing Management - Definition of marketing, Marketing concept, objectives & Functions of marketing. Marketing Research - Meaning; Definition; objectives; Importance; Limitations; Process. Advertising - meaning of advertising, objectives, functions, criticism.

### **UNIT-V**

**Introduction of Financial Management, Objectives of Financial Management, Functions and Importance of Financial Management. Brief Introduction to the concept of capital structure and various sources of finance.**

#### **BOOKS RECOMMENDED :**

##### TEXT BOOKS :

1. Principles and Practice of Management - R.S. Gupta, B.D.Sharma, N.S. Bhalla. (Kalyani Publishers)
2. Organisation and Management - R.D. Aggarwal (Tata Mc Graw Hill)

##### REFERENCE BOOKS :

1. Principles & Practices of Management – L.M. Prasad (Sultan Chand & Sons)
2. Management – Harold, Koontz and Cyrilo Donell (Mc.Graw Hill).
3. Marketing Management – S.A. Sherlikar (Himalaya Publishing House, Bombay).
4. Financial Management - I.M. Pandey (Vikas Publishing House, New Delhi)
5. Management - James A.F. Stoner & R.Edward Freeman, PHI.

NOTE: Eight questions are to be set atleast one question from each unit and the students will have to attempt five questions in all.

## ME-202 E MANUFACTURING TECHNOLOGY

L T P  
3 1 -

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

- Unit I** Metal Casting Processes: Advantages and limitations, sand mold making procedure. Patterns and Cores: Pattern materials, pattern allowances, types of pattern, color coding. Molding materials: Molding sand composition, sand preparation, sand properties and testing, Sand molding processes
- Unit II** Cores: Types of cores, core prints, chaplets, and chills. Gating systems: Gates and gating systems risers. Melting practice: Cupola, charge calculations. Casting cleaning and casting defects, Fettling, defects in castings and their remedies, methods of testing of castings for their soundness.
- Unit III** Special Casting Processes: Shell molding, precision investment casting, permanent mold casting, die casting, centrifugal casting, continuous casting,
- Unit IV** Metal Forming Processes: Nature of plastic deformation, hot working and cold working .Principles of rolling, roll passes, roll pass sequences. Forging: Forging operations, smith forging, drop forging, press forging, forging defects.
- Unit V** Extrusion and other processes: Extrusion principle, hot extrusion, cold extrusion, wire drawing, swaging, tube making. Sheet metal operations: Press tools operations, hearing action, drawing dies, spinning, bending, stretch forming, embossing and coining.
- Unit VI** Gas and Arc Welding: Classification: oxy- acetylene welding equipment and techniques. Electric arc welding: Electrodes, manual metal arc welding, inert gas shielded arc welding, tungsten inert gas welding (TIG), metal inert gas welding(MIG), submerged arcwelding (SAW).
- Unit VII** Resistance Welding: Principles, resistance spot welding, resistance seam welding, upset welding, flash welding,
- Unit VIII** Other Welding Processes: Introduction thermit welding, electro slag welding, electron beam welding, forge welding, friction welding, diffusion welding, brazing and soldering.

### Text Books:

1. Principles of Manufacturing Materials & Processes – Campbell J. S., Publisher – Mc Graw Hill.
2. Manufacturing Science - Ghosh A; Mallik A.K. Affiliated East-West Press Pvt. Ltd., New Delhi

### Reference Books:

1. Foundry Technology - K.P. Sinha, D.B. Goel, Roorkee Publishing House.
2. Welding and Welding Technology, Richard L. Little Tata McGraw Hill Ltd.
3. Principle of Metal casting - Rosenthal, Tata McGraw Hill, New Delhi
4. Manufacturing Processes and Systems: Ostwald Phillip F., Munoz Jairo, John Wiley & Sons
5. Manufacturing Technology-Foundry, Forming and Welding - P.N. Rao, Tata McGraw Hill
6. Elements of Manufacturing Processes – B.S. Nagendra Parasher, RK Mittal, PHI N. Delhi

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

## ME- 204 E MATERIAL SCIENCE

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

- Unit I** Crystallography: Review of crystal structure, space lattice, crystal planes and crystal directions, co-ordination number, number of atoms per unit cell, atomic packing factor, Numericals related to crystallography.
- Unit II** Imperfection in metal crystals: Crystal imperfections and their classifications, point defects, line defects, edge & screw dislocations, surface defects, volume defects & effects of imperfections on metal properties.
- Unit III** Solid solutions and phase diagram: Introduction to single and multiphase solid solutions and types of solid solutions, importance and objectives of phase diagram, systems, phase and structural constituents, cooling curves, unary & binary phase diagrams, Gibbs's phase rule, Lever rule, eutectic and eutectoid systems, peritectic and peritectoid systems, iron carbon equilibrium diagram and TTT diagram.
- Unit IV** Heat Treatment: Principles, purpose, classification of heat treatment processes, annealing, normalizing, stress relieving, hardening, tempering, carburizing, nitriding, cyaniding, flame and induction hardening. Allotropic transformation of iron and steel, Properties of austenite, ferrite, pearlite, martensite.
- Unit V** Deformation of Metal: Elastic and plastic deformation, mechanism of plastic deformation, twinning, conventional and true stress strain curves for polycrystalline materials, yield point phenomena, strain ageing, work hardening, Bauschinger effect, season cracking. Recovery, re-crystallization and grain growth.
- Unit VI** Failures of metals: Failure analysis, fracture, process of fracture, types of fracture, fatigue, characteristics of fatigue, fatigue limit, mechanism of fatigue, factors affecting fatigue.
- Unit VII** Creep & Corrosion: Definition and concept, creep curve, mechanism of creep, impact of time and temperature on creep, creep fracture, creep testing and prevention against creep. Corrosion: Mechanism and effect of corrosion, prevention of corrosion.
- Unit VIII** Plastic, Composite and Ceramics: Polymers, formation of polymers, polymer structure and crystallinity, polymers to plastics types, reinforced particles-strengthened and dispersion strengthened composites. Ceramic materials: Types of ceramics, properties of ceramic, ceramic forming techniques, mechanical behavior of ceramic.

### Text Books:

1. Elements of Material Science and Engineering: VanVlack, Wesley Pub. Comp.
2. Material Science - Narula, Narula and Gupta. New Age Publishers

### Reference Books:

1. Material Science & Engineering –V. Raghvan, Prentice Hall of India Pvt. Ltd, New Delhi
2. A Text Book of Material Science & Metallurgy – O.P. Khanna, Dhanpat Rai & Sons
3. Material Science and Engineering-An Introduction - Callister; W.D., John Wiley & Sons., Delhi.
4. Engineering Materials: Kenneth G. Budinski, Prentice Hall of India, New Delhi

**Note: In the semester examination the examiner will set 8 questions, at least one question from each unit. Students will be required to attempt 5 questions.**

## ME- 206 E STRENGTH OF MATERIALS-II

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

- Unit I** Strain Energy & Impact Loading: Definitions, expressions for strain energy stored in a body when load is applied (i) gradually, (ii) suddenly and (iii) with impact, strain energy of beams in bending, beam deflections, strain energy of shafts in twisting, energy methods in determining spring deflection, Castigliano's & Maxwell's theorems, Numericals.
- Unit II** Theories of Elastic Failure: Various theories of elastic failures with derivations and graphical representations, applications to problems of 2- dimensional stress system with (i) Combined direct loading and bending, and (ii) combined torsional and direct loading, Numericals.
- Unit III** Unsymmetrical Bending: Properties of beam cross section, product of inertia, ellipse of inertia, slope of the neutral axis, stresses & deflections, shear center and the flexural axis Numericals.
- Unit IV** Thin Walled Vessels : Hoop & Longitudinal stresses & strains in cylindrical & spherical vessels & their derivations under internal pressure, wire wound cylinders, Numericals.
- Unit V** Thick Cylinders & Spheres : Derivation of Lamé's equations, radial & hoop stresses and strains in thick, and compound cylinders and spherical shells subjected to internal fluid pressure only, wire wound cylinders, hub shrunk on solid shaft, Numericals.
- Unit VI** Rotating Rims & Discs: Stresses in uniform rotating rings & discs, rotating discs of uniform strength, stresses in ( I) rotating rims, neglecting the effect of spokes, (ii) rotating cylinders, hollow cylinders & solids cylinders. Numericals.
- Unit VII** Bending of Curved Bars : Stresses in bars of initial large radius of curvature, bars of initial small radius of curvature, stresses in crane hooks, rings of circular & trapezoidal sections, deflection of curved bars & rings, deflection of rings by Castigliano's theorem stresses in simple chain link, deflection of simple chain links, Problems.
- Unit VIII** Springs: Stresses in open coiled helical spring subjected to axial loads and twisting couples, leaf springs, flat spiral springs, concentric springs, Numericals.

### Text Books:

1. Strength of Materials – G.H.Ryder, Third Edition in SI Units 1969 Macmillan, India.
2. Mechanics of Materials – (Metric Edition) : Ferdinand P. Beer and E. Russel Johnston, Jr. Second Edition, McGraw Hill.

### Reference Books :

1. Book of Solid Mechanics – Kazmi, Tata Mc Graw Hill
2. Strength of Materials – D.S. Bedi - S. Chand & Co. Ltd.
3. Advanced Mechanics of Solids and Structures – N. Krishan Raju and D.R.Gururaje- Narosa Publishing House.
4. Strength of Materials – Andrew Pytel and Fredinand L. Singer Fourth Edition, Int. Student Ed. Addison – Wesley Longman.

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

## ME- 208 E FLUID MECHANICS

L T P  
3 1 -

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

- Unit I** Fluid Properties and Fluid Statics: Concept of fluid and flow, ideal and real fluids, continuum concept, properties of fluids, Newtonian and non-Newtonian fluids. Pascal's law, hydrostatic equation, hydrostatic forces on plane and curved surfaces, stability of floating and submerged bodies, relative equilibrium. Problems.
- Unit II** Fluid Kinematics: Eulerian and Lagrangian description of fluid flow; stream, streak and path lines; types of flows, flow rate and continuity equation, differential equation of continuity in cylindrical and polar coordinates, rotation, vorticity and circulation, stream and potential functions, flow net. Problems.
- Unit III** Fluid Dynamics: Concept of system and control volume, Euler's equation, Bernoulli's equation, venturimeter, orifices, orificemeter, mouthpieces, kinetic and momentum correction factors, Impulse momentum relationship and its applications. Problems.
- Unit IV** Potential Flow: Uniform and vortex flow, flow past a Rankin half body, source, sink, source-sink pair and doublet, flow past a cylinder with and without circulation. Problems.
- Unit V** Viscous Flow: Flow regimes and Reynold's number, Relationship between shear stress and pressure gradient, uni-directional flow between stationary and moving parallel plates, movement of piston in a dashpot, power absorbed in bearings. Problems.
- Unit VI** Flow Through Pipes: Major and minor losses in pipes, Hagen-Poiseuilli law, hydraulic gradient and total energy lines, series and parallel connection of pipes, branched pipes; equivalent pipe, power transmission through pipes. Problems.
- Unit VII** Boundary Layer Flow: Boundary layer concept, displacement, momentum and energy thickness, von-karman momentum integral equation, laminar and turbulent boundary layer flows, drag on a flat plate, boundary layer separation and control. Streamlined and bluff bodies, lift and drag on a cylinder and an airfoil, Problems.
- Unit VIII** Turbulent Flow: Shear stress in turbulent flow, Prandtl mixing length hypothesis, hydraulically smooth and rough pipes, velocity distribution in pipes, friction coefficients for smooth and rough pipes. Problems.

### Text Books:

1. Fluid Mechanics – Streeter V L and Wylie E B, Mc Graw Hill
2. Mechanics of Fluids – I H Shames, Mc Graw Hill

### References Books:

1. Introduction to Fluid Mechanics and Fluid Machines – S.K. Som and G. Biswas, TMH
2. Fluid Mechanics and Fluid Power Engineering – D.S. Kumar, S.K. Kataria and Sons
3. Fluid Mechanics and Machinery – S.K. Agarwal, TMH, New Delhi

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

## ME- 210 E ENERGY CONVERSION

L T P  
3 1 -

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

- Unit I Fuels and Combustion:** Classification of fuels- solid, liquid & gaseous fuels, Combustion equations, Stoichiometric air-fuel ratio, Excess air, Exhaust gas analysis, Orsat apparatus. Enthalpy and internal energy of combustion, Enthalpy of formation, Adiabatic flame temperature, Gibb's and Helmholtz functions, Calorific values of fuel, Problems.
- Unit II Steam Boilers and Draft:** Classification, comparison between fire and water tube boilers, Essentials of a good boiler, Constructional and operational details of Locomotive& Lancashire Boilers, High pressure boilers- Benson, Lamont, Loeffler and Velox boilers, Boiler mountings and accessories, Boiler performance, Natural& Artificial drafts, Chimney height, Maximum draft and chimney efficiency, Boiler heat balance sheet, Problems.
- Unit III Vapour Power Cycles:** Carnot and Rankine vapour cycles, effect of operating conditions on thermal efficiency of Rankine cycle, Rankine cycle with superheat, reheat and regeneration, Binary vapour cycle, Problems..
- Unit IV Flow Through Nozzles:** Velocity and heat drop, mass discharge through a nozzle, critical pressure ratio and its significance, effect of friction and nozzle efficiency, supersaturated flow, design pressure ratio, Problems.
- Unit V Steam Turbines:** Classification, Impulse Turbine- Flow through blades, velocity diagram, power output and efficiency, maximum blade efficiency of single stage impulse turbine, blade friction, compounding of impulse turbine. Reaction Turbine-Flow through impulse reaction blades, degree of reaction, velocity diagram, power output, efficiency and blade height, comparison of impulse and impulse reaction turbines. Losses in steam turbines, stage efficiency, overall efficiency and reheat factor. Governing of steam turbines, Problems.
- Unit VI Steam Condensers:** Elements of a condensing plant, types of condensers, comparison of jet and surface condensers. Condenser vacuum, sources of air leakage & its disadvantages, vacuum efficiency and condenser efficiency, Problems.
- Unit VII Air Compressors:** Working of a single stage reciprocating air compressor; calculation of work input; Volumetric efficiency; Isothermal efficiency; Advantages of multi stage compression; Two stage compressor with Inter-cooling; Perfect Inter cooling; Optimum intercooler pressure, Problems.

### Text Books :

1. Thermal Engineering – P L Ballaney, Khanna Publishers
2. Thermodynamics and Heat Engines vol. II – R Yadav, Central Publishing House

### Reference Books :

1. Applied Thermodynamics for Engineering Technologists – T D Eastop and A McConkey, Pearson Education
2. Heat Engineering – V P Vasandani and D S Kumar, Metropolitan Book Co Pvt Ltd

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

## ME- 212 E MATERIAL SCIENCE LAB.

L     T     P  
-     -     2

Sessional        : 25 Marks  
Theory            : 25 Marks  
Total              : 50 Marks  
Duration of Exam: 3 Hrs

### List of Experiments:

1. To study crystal structures of a given specimen.
2. To study crystal imperfections in a given specimen.
3. To study microstructures of metals/ alloys.
4. To prepare solidification curve for a given specimen.
5. To study heat treatment processes (hardening and tempering) of steel specimen.
6. To study microstructure of heat-treated steel.
7. To study thermo-setting of plastics.
8. To study the creep behavior of a given specimen.
9. To study the mechanism of chemical corrosion and its protection.
10. To study the properties of various types of plastics.
11. To study Bravais lattices with the help of models.
12. To study crystal structures and crystals imperfections using ball models.

### Note:

1. **At least ten experiments are to be performed in the semester.**
2. **At least eight experiments should be performed from the above list. Remaining two experiments may either be performed from the above list or designed & set by the concerned institute as per the scope of the syllabus.**

## ME- 214 E FLUID MECHANICS LAB

L T P  
- - 2

Sessional : 25 Marks  
Practical/Viva : 25 Marks  
Total : 50 Marks  
Duration of Exam. : 3 Hrs.

### List of Experiments:

1. To determine the coefficient of impact for vanes.
2. To determine coefficient of discharge of an orificemeter.
3. To determine the coefficient of discharge of Notch ( V and Rectangular types ).
4. To determine the friction factor for the pipes.
5. To determine the coefficient of discharge of venturimeter.
6. To determine the coefficient of discharge, contraction & velocity of an orifice.
7. To verify the Bernoullis Theorem.
8. To find critical Reynolds number for a pipe flow.
9. To determine the meta-centric height of a floating body.
10. To determine the minor losses due to sudden enlargement, sudden contraction and bends.
11. To show the velocity and pressure variation with radius in a forced vortex flow.

### Note:

1. **At least ten experiments are to be performed in the semester.**
2. **At least eight experiments should be performed from the above list. Remaining two experiments may either be performed from the above list or designed & set by the concerned institute as per the scope of the syllabus.**

## ME- 216 E ENERGY CONVERSION LAB

L T P  
- - 2

Sessional : 25 Marks  
Practical/Viva : 25 Marks  
Total : 50 Marks  
Duration of Exam. : 3 Hrs.

### List of Experiments:

1. To study low pressure boilers and their accessories and mountings.
2. To study high pressure boilers and their accessories and mountings.
3. To prepare heat balance sheet for given boiler.
4. To study the working of impulse and reaction steam turbines..
5. To find dryness fraction of steam by separating and throttling calorimeter.
6. To find power out put & efficiency of a steam turbine.
7. To find the condenser efficiencies.
8. To study and find volumetric efficiency of a reciprocating air compressor.
9. To study cooling tower and find its efficiency.
10. To find calorific value of a sample of fuel using Bomb calorimeter.
11. Calibration of Thermometers and pressure gauges.

### Note:

1. **At least ten experiments are to be performed in the semester.**
2. **At least eight experiments should be performed from the above list. Remaining two experiments may either be performed from the above list or designed & set by the concerned institute as per the scope of the syllabus.**

## ME- 218 E MANUFACTURING PRACTICE

L T P  
- - 3

Sessional : 25 Marks  
Practical/Viva : 25 Marks  
Total : 50 Marks  
Duration of Exam : 3 Hrs

### List of Experiments:

1. To make a pattern for a given casting with all the necessary allowances, parting line, running system details. Prepare the mold and make the casting. Investigate the casting defects and suggest the remedial measures.
2. To make a component involving horizontal and vertical welding and study the welding defects and suggests their remedies.
3. To prepare a job on surface grinder/cylindrical grinder and measure the various parameters of the finished piece.
4. To cut external threads on a lathe.
5. Manufacture and assembly of a unit consisting of 2 to 3 components to have the concept of tolerances and fits (shaft and bush assembly or shaft, key and bush assembly or any suitable assembly).
6. Leveling of machine tools and testing their accuracy.
7. Disassembly and assembly of small assemblies such as tail stock, bench vice, screw jack etc.
8. Development and manufacture of complex sheet-metal components such as funnel etc.
9. Multi slot cutting on milling machine by indexing.
10. Drilling and boring of a bush.
11. Modeling of 3D runner system and creation of drawing for manufacturing of the casting patterns.
12. Development of blank size for complex sheet metal components using CAD/CAE software and compare results with manual calculation method.

### Note:

1. At least ten experiments are to be performed in the semester.
2. At least eight experiments should be performed from the above list including exercises 11 and 12. Remaining two experiments may either be performed from the above list or designed & set by the concerned institute as per the scope of the syllabus.