

**NATIONAL INSTITUTE OF TECHNOLOGY, HAMIRPUR (HP) – 177 005**

**B.Tech. Mechanical Engineering, Second Year [3<sup>rd</sup> Semester]**

<b>Sr. No.</b>	<b>Course No.</b>	<b>Subject</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Hours</b>	<b>Credits</b>
1.	[MSS-201]	Financial Management	4	0	0	4	4
2.	[ME-231]	Mechanics of Solids	4	1	0	4	4
3.	[ME-232]	Fluid Mechanics	3	1	0	4	4
4.	[ME-233]	Manufacturing Process	4	0	0	4	4
5.	[AM-234]	Numerical Analysis	3	1	0	4	4
6.	[EE-233]	Electrical Machines Drive & Control	3	0	0	3	3
7.	[ME-231 (P)]	MOS Lab	0	0	2	2	2
8.	[ME-232 (P)]	Fluid Mechanics Lab	0	0	2	2	2
9.	[ME-233 (P)]	Production Lab./Workshop	0	0	2	2	2
10.	[ECA - 231]	Extra Curricular Activity – I	0	0	2	2	1
<b>Total =</b>						<b>31</b>	<b>30</b>

# FINANCIAL MANAGEMENT

MSS – 201

L	T	P/D	Cr
3	0	0	3

- 1. FINANCIAL AND COST ANALYSIS:** Fundamental Principles of Financial Accounting, Rules and Mechanics of Accounting, Valuation, Fixed Assets, Accounting Procedures, Statement Analysis, Cash Flow, Managerial Accounting, Fixed and Variable Expenses, Cost Accounting, Product Costs, Allocation of Indirect Costs, Standard Costs, Operating Decisions, Costs and Theory of Constraints, Case Analyses.
- 2. ENGINEERING ECONOMY:** Introduction to Engineering Economics, Time Value of Money, Present Worth Comparisons, Equivalent Annual Worth Comparisons, Rate of Return Comparisons, Structural Analysis of Alternatives, Replacement Analysis, Analysis of Public Projects Depreciation and Income Tax Considerations, Effects of Inflation, Sensitivity Analysis, Risk Analysis.

## RECOMMENDED BOOKS

- |   |  |
|---|--|
| 1. Engineering Economics  | J. L. Riggs, D. D. Bedworth, &<br>S. U. Randhawa |
| 2. Management Accounting Principles & Practices                             | M. A. Sahaf                                      |
| 3. Financial Management   | I. M. Pandey                                     |
| 4. Financial Management Theory and Practice                                 | Prasanna Chandra                                 |
| 6. Financial and Cost Analysis for Engineering<br>and Technology Management | Henry E. Riggs                                   |

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# MECHANICS OF SOLIDS

ME – 231

L	T	P/D	Cr
3	1	0	4

- 1. SIMPLE STRESSES AND STRAINS:** Basic concepts, Stress, Strain, Elastic constants and their relationship Stresses on oblique plane under biaxial loading, biaxial stresses combined with shear stresses, Principal stresses and planes, Determination of Principal stresses, Mohr's circle-biaxial state of stress accompanied with shear stress.
- 2. BENDING STRESSES IN BEAMS:** Theory of simple bending, Derivation of bending equation, bending stress distribution across beam section, Composite beams, Combined bending and direct stresses.
- 3. SLOPE AND DEFLECTION OF BEAMS:** Introduction, Relationship between slope, deflection and radius of curvature, Slope and deflection of cantilever and simply supported beams with point load, UDL or combination of these by Macaulay's method, Double integration method and Moment area method.
- 4. CURVED BEAMS:** Bending of beams with initial curvature, Division of curved beams on the basis of radius of curvature, Beams with large radius of curvature, Values of link radius ( $h^2$ ) for – Rectangular, Trapezoidal, Circular, T, I and Triangular section, Position of neutral axis, Stresses in a crane hook, Chain link and ring, Variation of stresses across the section.
- 5. COLUMNS AND STRUTS:** Types of columns, Failure of column, Euler's column theory, Slenderness ratio, End conditions for long columns, Equivalent length of columns, Limitation of Euler's formula, Factor of safety, Empirical relations- Rankine's , Straight line and Johnson's parabolic formula.
- 6. UNSYMMETRICAL BENDING AND SHEAR CENTRE:** Definitions, Product of inertia, Parallel axis theorem of Product of inertia, Unsymmetrical bending, Stresses due to unsymmetrical bending - combined bending and axial loads, Shear center - for symmetrical section, Equal leg angle section and channel section.
- 7. THICK PRESSURE VESSELS:** Thick cylindrical shell, Stresses in thick shells, Derivation for radial and circumferential stress for a thick shell subjected to internal fluid pressure, Longitudinal and shear stresses, Distribution of stresses across the shell thickness; Cylindrical shell subjected to both internal and external fluid pressure, Compound cylinders, Distribution of stresses across the thickness of compound cylinder; Thick spherical shells under internal fluid pressure, wire wound cylinders.
- 8. THEORIES OF ELASTIC FAILURE:** Introduction, Maximum Principal Stress Theory; Maximum Principal Strain Theory; Maximum Shear Stress Theory, Maximum Strain Energy Theory, Maximum Distortion Theory, Graphical representation of Theories of Elastic Failure, Application of theories of elastic failure.

## BOOKS RECOMMENDED

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|--|--------------------------|
| 1. Mechanics of Materials Vol, I & II              | E.J. Hearn               |
| 2. Strength of Material                            | Timoshenko               |
| 3. Advanced Mechanics of Solids                    | Srinath                  |
| 4. Mechanics of Materials                          | Beer, Johnston, & DeWolf |
| 5. Advanced Mechanics of Materials                 | Boresi and Schmidt       |
| 6. Strength of Material                            | Sadhu Singh              |
| 7. Engineering Mechanics and Strength of Materials | R. K. Bansal             |
| 8. Mechanics of Materials                          | Kirpal Singh             |
| 9. Solid Mechanics                                 | Kazimi                   |

# FLUID MECHANICS

ME – 232

L	T	P/D	Cr
4	1	0	4

1. **FLUID STATICS:** Brief History of Fluid Mechanics, Fluid & Their properties, Viscosity, Pressure measurement, Basic equation of fluid statics, absolute and gauge pressures, Pressure measuring devices, manometers, forces on submerged surfaces, stability of floating and submerged bodies.
2. **FLUID KINEMATICS:** Flow Kinematics, Concepts of streamline, streakline etc, Velocity, Acceleration, Euler's equation, circulation, vorticity and rotation, Irrotational flow, velocity potential stream function, Continuity Equation.
3. **FLUID DYNAMICS:** Reynolds transport theorem, Integral form of continuity, momentum and energy equation, Bernoulli's equation and its application, venturimeter, orifice, mouth pieces, weirs and notches, linear momentum equation and its applications, forces on pipe junction, bends, stationary flat and curved vanes, moment of momentum equation, Dimensional homogeneity, dimensionless ratios, dimensions and units, dimensionless parameters, similitude and model studies.
4. **VISCOUS FLOW:** Equation of motion for laminar flow through pipes-Hagen Poiseuille formula, Flow between parallel flat plates, couette flow, Plane Poiseuille flow, Flow through pipes, minor and major losses, Transition from laminar to turbulent, Reynolds experiment, Eddy viscosity, Mixing length concept and velocity distribution in turbulent flow, unsteady motion of flat plates,.
5. **BOUNDARY LAYER CONCEPTS:** Boundary layer equations, estimation of laminar boundary layer thickness for flat plate and drag by momentum integral method, boundary layer separation.
6. **COMPRESSIBLE FLOW:** Compressibility, Mach number, Areal velocity relation, isentropic relations, 1-D compressible flow, Normal Shock.

## RECOMMENDED BOOKS

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|---|------------------|
| 1. Fluid Mechanics                      | V.L.Streeter     |
| 2. Fluid Mechanics and Its Applications | V.K.Gupta et.al. |
| 3. Fluid Mechanics                      | F.M.White        |
| 4. Fluid Mechanics                      | Yunus Cengel     |

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# MANUFACTURING PROCESSES

ME – 233

L	T	P/D	Cr
4	0	0	4

- 1. ENGINEERING MATERIALS AND MANUFACTURABILITY:** Classification, selection of materials for mechanical design, mechanical, physical and thermal properties, common ferrous and non-ferrous metals, introduction of ceramics & composite materials.
- 2. METAL CASTING PROCESSES:** Scope, Pattern, Pattern allowances, molding metal, solidification, gate and rise ring, casting techniques sand mould, permanent mould, cold and hot chamber die casting, shell, investment and centrifugal casting, casting defects and their remedy, Casting process Considerations, Casting design principles, Economic considerations.
- 3. FORMING:** Scope, Fundamentals of forming, hot & cold working, process rolling, extension, wire drawing, forging, fundamentals of sheet metal operation, clearance, punching, high energy rate forming process.
- 4. INTRODUCTION TO MACHINING:** Scope, cutting tool, fundamentals of metal cutting, metal cutting operations, turning, milling, drilling, shaping, planning, grinding, (principles & capabilities), jigs & fixtures, Principles of clamping & location, economic aspects of production tooling.
- 5. POWDER TECHNOLOGY:** Scope, steps in production of Metal powders: Mixing, Compaction, Sintering, powder characteristics, Special treatment, Design considerations of Powder metallurgy, Advantages and disadvantages, Economics of powder metallurgy, Processing of Metal Matrix composites.
- 6. JOINING AND FASTENING PROCESSES:** Scope, classification, fundamental of welding, SMA, TIG, MIG, SAW, PAW and gas welding process (principles & applications), Heat affected zone, welding metallurgy and its effect on performance of weldment, residual stresses and distortion of weldment, Mechanical fastening, Design consideration in Joining, Economic Considerations, Brazing, Soldering, Adhesive joints, Weldability of metals.

## RECOMMENDED BOOKS

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|---|---------------|
| 1. Manufacturing Technology                               | P.N.Rao       |
| 2. Manufacturing Engineering & Technology                 | Kalpakkajian  |
| 3. Manufacturing Science                                  | Amitabh Ghosh |
| 4. ASM Handbooks on Casting, Welding, Machining & Forming | ASM           |
| 5. Advanced Manufacturing Process                         | Degarmo       |
| 6. Automation, Production system and CIM                  | MP Grover     |

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# NUMERICAL ANALYSIS

AM- 234

L	T	P/D	Cr
3	1	0	4

- 1. NUMERICAL COMPUTATIONAL AND ERRORS ANALYSIS:** Introduction, Numbers and their accuracy, Floating point arithmetic, errors in numbers, Computational methods for error estimation, General error formulae approximation of a function, series approximations and error propagation in computation.
- 2. ALGEBRAIC AND TRANSCENDENTAL EQUATIONS:** Revision of some basic concepts on polynomial equations, Bisection method, iterative method, Regula-falsi method, Newton-Raphson method, secant method, generalized Newton's method for multiple roots, solution of non-linear simultaneous equations and finding complex roots by Newton-Raphson method.
- 3. SYSTEM OF SIMULTANEOUS ALGEBRAIC EQUATIONS:** Revision of basic properties of matrices and determinants, Matrix inversion and solution of transcendental and system of algebraic equations-Gauss elimination method, Jacobi's method and Gauss-Seidal method, Eigen values and eigen vector-Power method, Jacobi's method and House-holder method.
- 4. INTERPOLATION AND FUNCTION APPROXIMATIONS:** Least square curve fit and trigonometric approximations, Approximations by trigonometric polynomials and quality of approximations. Finite differences and difference operators, Newtons interpolation formulae, Gauss forward and backward formulae Striling, Bessel's and Evertte's formulae, Interpolation with unevenly spaced data points-Lagrange's interpolation.
- 5. NUMERICAL DIFFERENTIATION AND INTEGRATION:** Numerical differentiation, errors in numerical differentiation, Maximum and minimum values of a tabulated function, Numerical integration-Trapezoidal, Simpson's 1/3 and 3/8 rules, Boole's and Weddle's rules, Romberg integration-recuusive formulae, Evaluation of double integrals by Trapezoidal and Simpson's rules.
- 6. ORDINARY DIFFERENTIAL EQUATIONS:** Taylor's series method, Picard's method, Euler's method, Modified Euler's method, Runge-Kutta methods of 2nd and 4th order, Adams- Moltan and Miline methods, Solution of simultaneous and higher order equations.

## RECOMMENDED BOOKS

1. Numerical Methods for Engineers and Scientists J.N.Sharma
2. Numerical Analysis F.B. Hildbrand

## REFERENCE BOOKS

1. Numerical Method for Engineers and Scientists M.K.Jain, S.R.K.Iyngar & R.K.Jain
2. Introductory Methods of Numerical Analysis S.S.Sastry

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# ELECTRICAL MACHINES DRIVES AND CONTROL

EE – 233

L	T	P	Cr
3	0	0	3

1. **D. C. MACHINES:** Basic parts of electric machines, EMF equation, Generator Characteristics, Types of DC Motors, Torque speed characteristics, types of starters and speed control, losses and efficiency.
2. **THREE-PHASE A.C. MACHINES:** Construction, Principle of working, Rotating magnetic field production, Slip, Equivalent circuit, Torque-slip characteristics, Speed control and method of starting, Alternators, EMF equation and regulations, Synchronous motor.
3. **INDUSTRIAL APPLICATIONS:** Case study of motor drive system for steel mills/ paper mills/ machine tool application.
4. **CONTROL SYSTEMS:** Types of Control Systems - Open Loop & Closed Loop Systems With Examples; Control System Terminology.
5. **TRANSFER FUNCTION, BLOCK DIAGRAMS, SIGNAL FLOW GRAPHS & STABILITY CRITERION:** Physical system and mathematical models, linear control system, Laplace transform and Transfer function, Block diagram, signal flow graphs, system stability – characteristic root locus, Routh stability criterion, Hurwitz stability criterion, Bode Plot, Niquist Criterion.

## RECOMMENDED BOOKS

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|-------------------------------|----------------|
| 1. Electric Machines          | Ashfaq Hussain |
| 2. Electrical Machinery       | P. S. Bhimbra  |
| 3. Electrical Machinery       | Chapman        |
| 4. Modern Control Engineering | Ogata          |

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