

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

B.Tech. Mechanical Engineering, Second Year [4th Semester]

Sr. No.	Course No.	Subject	L	T	P	Hours	Credits
1.	MA-223	Numerical Analysis	3	1	0	4	4
2.	ME-221	Machine Drawing	1	0	3+3	7	4
3.	ME-222	I.C Engine	4	0	0	4	4
4.	ME-223	Manufacturing Process-II	3	0	0	3	3
5.	ME-224	Kinematics of Machine	3	1	0	4	4
6.	ME-225	Fluid Mechanics	3	1	0	4	4
7.	ME-222 (P)	Thermal Lab –II	0	0	2	2	1
8.	ME-223 (P)	Production Lab-III	0	0	2	2	1
9.	HS-203	Professional Ethics & Human Values	0	0	2	2	1
Total =						32	26

Total Credit = 3rd & 4th = 28 + 26= 54

1. **SHAFT COUPLINGS:** Drawing of muff coupling, flanged coupling, pin type flexible coupling
2. **KEYS, COTTER JOINTS & PIN JOINTS:-** Sketch of taper- keys, sunk taper- keys, saddle keys, Round or pin key, Gib head, parallel, or- feather keys, spline shafts, woodruff key, Drawing of cotter and outer joint, knuckle joint.
3. **FASTENERS:** Form and proportions of screws, nuts, locking arrangements, foundation bolts, washers, bolts, proportions of rivets, riveted joints, welding symbols and welded joints
4. **PIPE JOINTS:** Drawing of flanged joint for C.I. pipes, sketch of spigot and socket joint.
5. **ASSEMBLY OF FOLLOWING MACHINE PARTS TO BE DRAWN:**
 - (a) Plumber block, foot step bearing
 - (b) Steam engine stuffing box, stop valve, cross head.
 - (c) I.C.Engine connecting rod
 - (d) Lathe tail stock.

Surface finish, fits and tolerances to be indicated on working drawings as per-BIS conventions.
Practical assignments on modeling of machine components using software.

BOOKS RECOMMENDED:

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| 1. Machine Drawing | N.D.Bhat |
| 2. Machine Drawing | Narayana, Kannaiah, Reddy |
| 3. Machine Drawing | P.S.Gill |
| 4. Machine Drawing | R.K.Dhawan |
| 5. Machine Drawing | G.R.Nagpal |
| 6. Geometrical & Machine Drawing | Parkinson |

L	T	P	Cr
4	0	0	4

1. **INTRODUCTION:** Otto, Diesel, dual and Stirling cycle, Comparison of cycles, Actual cycles and their analysis, Classification of IC Engine, two stroke and four stroke cycle engines, Difference between C.I. and S.I. engines, Engine Design and operating parameters
2. **COMBUSTION OF S.I. ENGINES:** Combustion in S.I. Engines, Flame front propagation, Flame speed, Ignition delay, Abnormal combustion, Combustion chambers for S.I. engines
3. **COMBUSTION OF C.I. ENGINES:** Combustion in C.I. Engines, Ignition delay, Combustion knock, combustion chamber for C.I. engines, fuel injection testing
4. **TESTING AND PERFORMANCE** Parameters, Engine power, Engine efficiencies, Type of tests and characteristic curves, Variables affecting performance characteristics, Methods of improving engine performance
5. **CARBURETION, LUBRICATION, COOLING AND IGNITION SYSTEM:** Simple and complete carburetors, Gasoline Injection, combustion design for S.I. Engines, Friction and lubrication, Types of lubrication systems, Engine cooling Ignition systems, Magneto and Battery ignition systems, Ignition timing
6. **EMISSION:** Engine economy, Air pollution due to IC engines, Engine emissions, Particulates, Emission control methods, EGR (Exhaust gas recirculation)
7. **FUELS:** Fuels and their properties, Stoichiometric and actual air requirements, Flue gas analysis, Alternate fuels
8. **MODELLING OF IC ENGINE SYSTEM:** Classification of models, governing equations for open thermodynamic system.
9. **MODERN DEVELOPMENTS**

BOOKS RECOMMENDED:

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| 1. Internal combustion Engine | Sharma & Mathur |
| 2. Internal combustion Engine | V.Ganeshan |
| 3 I.C.Engine | Rogowsky |
| 4. I.C.Engine Analysis and Practice | E.F.Obert |
| 5. I.C. Engines and Air Pollution | R. Yadav |
| 6. I.C. Engines Fundamentals | J. B. Heywood |

- 1. MACHINING PROCESSES AND MACHINE TOOLS:** Introduction, Types of motions in Machining, Types of machines, Machining operations and Machining Parameters related quantities for: Turning, Milling, Boring, Shaping, Planing, Slotting, Drilling, Reaming, Broaching, Grinding. Fine finishing operations, Gear cutting and gear finishing machines; Cutting speeds, Feeds and depth of cut used generally in Machining.
- 2. DESIGN PRINCIPLES OF CUTTING TOOLS, JIGS AND FIXTURES:** Design of Single point turning, parting and boring tools. Design of form tools: broach design, milling cutter, drill bit for milling, twist drill. Design of thread cutting tools, reamers, Jigs and Fixtures, Clamps
- 3. DESIGN FEATURES OF MACHINE TOOLS:** Introduction, A single Machine tool Manufacturing system, Performance criterion of machine tools, essential steps in design of machine tools, Design of machine tool drives, Design of machine tool spindle, Design of spindle bearings, design of sideways and guide ways, Design of controls and displays, Devices for automatic lubrication, safety devices, Machine tools testing
- 4. NON CONVENTIONAL MACHINING:** Introduction, Ultra sonic machining, Abrasive jet machining, Electrical Discharge machining, Electrical Discharge wire cut machining, Laser beam machining, Electron beam machining, Chemical machining, Electrochemical grinding; Thermal and non thermal analysis and applications
- 5. NON- DESTRUCTIVE TESTING:** Introduction, Selection of Non destructive (N-D) method, Visual inspection, Dye penetration testing, Magnetic particle inspection, Eddy current testing, Ultrasonic inspection and Radiography inspection
- 6. METROLOGY:** Introduction, Interchangeability, Comparators, Gauges, Sine Bars, Surface finish measurements, Limit Gauges, Autocaulimeters, Angle measurement, Laser metrology, Tool Maker's microscope, Profile projector.

BOOKS RECOMMENDED:

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| 1.Fundamental of Metal cutting and Machine tools | B.L.Juneja |
| 2.Manufacturing Process for Engineering Material | Kalpakjian;Person Pub. |
| 3.Manufacturing Engineering and Technology | Kalpakjian;Person Pub. |
| 4.Manufacturing Engineering and Technology | Groover;TMH Pub. |
| 5.ASM Hand Books on Machining and Testing of materials | |
| 6. The testing Instruction of Engineering Material | Davis H.E. Troxel, "Mc grawHill |
| 7. Metal Cutting Theory and Practice | Bhattacharya New central book agency Pub. |

1. **INTRODUCTION:-** Plain motion, kinematic concepts of links; basic terminology and definitions; inversion of kinematic chain.
2. **MOTION, AND FORCE ANALYSIS:-** Absolute and relative motion, kinematic and dynamic quantities and their relationship, vector diagram, instantaneous centres, velocity and acceleration polygons, special graphical methods for slider crank mechanism.
3. **KINEMATIC SYNTHESIS OF MECHANISMS:** Introduction, Movability of four bar linkage, Freudenstein's Equation, Function Generation, Errors in synthesis problems, Chebyshev spacing of Precision points.
4. **POWER TRANSMISSION:-** Flat belts and the kinematic design of pulleys, V-belts, length of belts, transmission of power by belts, condition for maximum power transmissions, initial tension.
5. **GEARS:-** Fundamental law of gearing, classification and basic terminology, involute tooth profile and its kinematic considerations, type of gears, standards in tooth forms, gear trains, simple, compound, reverted and epicyclic gear train.
6. **FRICTION DEVICES:-** Coulomb friction, pivots and collars, power screws, plate and cone clutches.
7. **BRAKES AND DYNAMOMETERS:-** Types of brakes, band, block, band and block, internal expanding shoe brake, determination of pressure and torque on internal expanding shoe brakes, Dynamometers, types : absorption and transmission dynamometers, prony brake dynamometer, rope brake dynamometer, belt transmission dynamometer, torsion dynamometer.
8. **LUBRICATION:** Theory of lubrication, hydrodynamic & hydrostatic lubrication.

BOOKS RECOMMENDED:

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| 1. Theory of Machines | J Lal |
| 2. Theory of Machines | P.L.Ballaney |
| 3. Theory of Machines | V.P.Singh |
| 4. Theory of Machines | S. S. Rattan |
| 5. Mechanism & Machine Theory | Rao & Dukkupati |
| 6. Theory of Machines | Mallib |
| 7. Theory of Machines | Abdulta Sharif |
| 8. Theory of Machines | R.K.Bansal |

L	T	P/D	Cr
3	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, Navier Stokes equation
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, Area velocity relation, isentropic relations, 1-D compressible flow, Normal Shock.

BOOKS RECOMMENDED:

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| 1. Fluid Mechanics and Its Applications | V.K.Gupta |
| 2. Fluid Mechanics | F.M.White |
| 3. Fluid Mechanics | Yunus Cengel |
