



MATS UNIVERSITY

Raipur (C.G.)

Syllabus Scheme

(4th Semester)

For

Bachelor of Engineering

In

MECHANICAL



**MATS School of Engineering &
Technology**

ARANG , RAIPUR (C.G.)



MATS UNIVERSITY

ARANG, RAIPUR



Subject Code For School of Engineering & Tech.

4th Semester (MECHANICAL)

S.No.	Subject Code	Subject Name
1	BE410	Manufacturing Science- I
2	BE411	Fluid Machinery
3	BE412	Mechanics of Solid-II
4	BE413	Dynamics of Machines
5	BE414	Applied Thermodynamics
6	BE415	Material Science
7	BE416	Applied Thermodynamics Lab
8	BE417	Fluid Machinery Lab
9	BE418	Dynamics of Machines Lab
10	BE419	Machine Drawing Lab



MATS UNIVERSITY

ARANG, RAIPUR



Scheme of Teaching & Examination

B.E. IV SEMESTER MECHANICAL ENGINEERING

S.N.	code	Subject	Periods per week			Scheme of marks		Total Marks
			L	T	P	ESE	IM	
1.	BE410	Manufacturing Science- I	4	1	-	70	30	100
2.	BE411	Fluid Machinery	4	1	-	70	30	100
3.	BE412	Mechanics of Solid-II	4	1	-	70	30	100
4.	BE413	Dynamics of Machines	4	1	-	70	30	100
5.	BE414	Applied Thermodynamics	4	1	-	70	30	100
6.	BE415	Material Science	4	1	-	70	30	100
7.	BE416	Applied Thermodynamics Lab	-		3	20	30	50
8.	BE417	Fluid Machinery Lab	-		3	20	30	50
9.	BE418	Dynamics of Machines Lab	-		3	20	30	50
10.	BE419	Machine Drawing Lab	-		3	20	30	50
Total			24	6	12	500	300	800

L – Lecture, T – Tutorial, ESE – End Semester Examination,

P – Practical, IM – Internal Marks (Include Class Test & Teacher's Assessments)

MATS UNIVERSITY

SEMESTER –IV

BRANCH – MECHANICAL

SUBJECT - MANUFACTURING SCIENCE -I

CODE -BE410

UNIT – I

Introduction to Manufacturing Processes:

Importance of manufacturing processes, classification, economic and technological definitions of manufacturing processes.

Foundry

Pattern making - Types, material, allowances, colour codes, core – types, materials and its properties.

Mould Making - Types of sand moulding, design considerations, moulding machines & moulding procedure, moulding sand – types, properties, composition and applications.

Casting - Procedure, Melting furnaces, casting defects,

Special Casting Processes - Investment casting, centrifugal casting, shell moulding, CO2 moulding, slush casting, die casting.

UNIT – II

Welding

Principles of Welding, survey and allied processes

Arc Welding

Power Source and Consumable, MMAW, TIG and MIG processes and their parameter selection, atomic hydrogen welding, welding of cast iron, welding electrode – types, composition, specification.

Resistance Welding

Principle, equipment and processes. Thermit Welding, brazing & soldering, Internal and external welding defects, Inspection & testing of weld.

UNIT – III

Powder Metallurgy

Powder Manufacturing, compacting and sintering processes, Advantages, limitations and applications of powder metallurgy .

Manufacturing of Plastic Components

Advantages, application and principle of the following processes, extrusion, injection moulding compression moulding, transfer moulding, blow moulding .

UNIT – IV

Machine Tools

Lathe

Introduction, type, specification, construction, work holding devices & tools, mechanism and

attachments for various operations, taper turning, thread cutting operations on Lathe, capstan and turret lathe.

Shaper

Introduction, type, specification, Quick return Mechanisms, Table feed mechanism, work holding devices, shaper operations

Slotter & Planner

Introduction, specification, types of drives, types of machines.

Milling

Introduction, specification, types, mechanisms and attachments for milling, milling operations,

Indexing-simple, compound and differential.

UNIT – V

Drilling

Introduction, drill nomenclature, types of drilling machines, other operations like counter boring, counter sinking, spot facing etc.

Reaming

Introduction, description of reamers, type of reaming operations.

Boring

Introduction, types of boring machines, boring operations, boring tools

Broaching

Introduction, types of broaches, nomenclature of broach, types of broaching machines.

Surface finishing operations

Honing, lapping, super finishing, polishing, buffing, process parameters and attainable grades of surface finish.

TEXT BOOKS

1. Manufacturing Technology (Vol. – I & II) – P.N. Rao – Tata McGraw Hill Pub. Company, New Delhi
2. A Text Book of Production Technology(Manufacturing Processes) – P.C. Sharma – S. Chand and Company Ltd., New Delhi

REFERENCE BOOKS

1. Manufacturing Science – A. Ghosh & A.K. Mallik – East West Press Pvt. Ltd., New Delhi
2. Manufacturing Engineering and Technology – S. Kalpakjian & S.R. Schmid – Addison Wesley Longman, New Delhi
3. Production Technology – R.K. Jain – Khanna Publishers, New Delhi
4. A Text Book of Production Technology (Vol. I & II) – O.P. Khanna – Dhanpat Rai & Sons, New Delhi
5. Manufacturing Science – Paul DeGarmo

MATS UNIVERSITY
SEMESTER –IV
BRANCH – MECHANICAL
SUBJECT - FLUID MACHINERY
CODE- BE411

UNIT – I

Boundary Layer Theory

Boundary layer definition and characteristics, momentum equation, Laminar and turbulent boundary Layer, Total drag, separation and control.

Flow around submerge bodies

Force exerted by flowing fluid on a body: Drag and lift; stream lined and bluff body, Drag on sphere and cylinder, circulation and lift on circular cylinder, lift of an air foil.

UNIT – II

Impact of Free Jets

Impulse momentum principle, force exerted by the jet on stationary flat and curved plate, hinged plate, moving plate and moving curve vanes, jet propulsion of ship.

Impulse Turbine

Classification of turbine, impulse turbine, Pelton wheel, Construction working, work done, head efficiency and Cavitations in turbines Design aspects, governing of impulse turbine.

UNIT – III

Reaction Turbine

Radial flow reaction turbine, Francis turbine: construction, working, work done, efficiency, design aspect, advantages & disadvantages over pelton wheel.

Axial flow reaction turbine

Propeller and Kaplan turbine, bulb or tubular turbine, draft tube, specific speed, unit quantities, cavitation, degree of reaction, performance characteristics, surge tanks, governing of reaction turbine.

UNIT-IV

Centrifugal Pumps

Classification of Pumps, Centrifugal pump, Construction, working, work done, heads, efficiencies, multistage centrifugal pump, pump in series and parallel, specific speed, characteristic, net positive suction head, cavitation.

UNIT – V

Reciprocating Pumps

Classification, component and working, single acting and double acting, discharge, work done and power required, coefficient of discharge, indicator diagram, air vessels.

Fluid system

Hydraulic accumulator, Hydraulic intensifier, Hydraulic Press, hydraulic crane, hydraulic lift, hydraulic Ram, hydraulic coupling, hydraulic torque converter, air lift pump, jet pump.

TEXT BOOKS

1. Hydraulic Machines - Jagdish Lal – S.K. Kataria & Sons
2. Hydraulics and Fluid Mechanics – Modi P.N, Seth S.M. – Standard Book House
3. Esposito. A., *Fluid Power with Applications*, 5th ed., Pearson Education, 2003.

REFERENCE BOOKS

1. A text of Fluid Mechanics – R. K. Rajput – S. Chand & Company Ltd.
2. Fluid Mechanics and Fluid Power Engineering – D.S. Kumar– Kataria & Sons
3. Mechanics of Fluid – Massey B.S. – English Language Book Society (U.K.)
4. Introduction to Fluid Mechanics and Fluid Machines – S.K. Som & G. Biswas – TMH
5. *Industrial Hydraulics*, Vickers - Sperry Manual, 2002.

MATS UNIVERSITY
SEMESTER –IV
BRANCH – MECHANICAL
SUBJECT - MECHANICS OF SOLID-II
CODE -BE412

UNIT-I

Energy Methods:

Introduction, principles of superposition, strain energy, reciprocal relations, Maxwell Betti theorem, elastic strain energy relation in tension and compression, strain energy in beams subjected to bending and shaft to torsion. impact loading in tension and bending, first theorem of Castigliano and its applications

UNIT- II

Fixed Beams

Fixed beam subjected to different types of loads and couples, calculations of fixing moments and reactions at supports, deflection, effect of sinking of support.

Continuous beams

Continuous beams subjected to different type of loads and couples, beams with overhang, beams with one end fixed, Clapeyron's theorem, effect of sinking of supports

UNIT-III

Bending of curved bars

Bending of curved bars in plane of loading, Winkler Bech theory, crane hooks, chain links, bending of curved beams built in its initial plane, bending of circular bars subjected to symmetric loading, bending of circular rings, stresses in circular rings

UNIT-IV

Unsymmetrical Bending

Introduction to unsymmetrical bending, stresses due to unsymmetrical bending, deflection of beam due to unsymmetrical bending, shear center for angle, channel, and I-sections

Columns

Short Column (Strut), Eccentric loading on Strut, Stability of columns, Euler's formula for different end conditions, equivalent load, eccentric loading, Rankine's formula.

UNIT – V

Pressure Vessels

Thin Pressure Vessels circumferential and longitudinal stresses in thin cylindrical shells and thin spherical shell under internal pressure, Stresses in thick and compound cylinders.

TEXT BOOKS

1. Strength of Material – Dr. Sadhu Singh – Khanna Publishers
2. Elements of Strength of Material – Timo Shenko & Young – EWP Press
3. Strength of Material – R.K. Rajput – Dhanpat Rai & Sons

REFERENCE BOOKS

1. Strength of Material – Rider – ELBS
2. Mechanics of Material – F.P. Bear & E.E. Johnston – McGraw Hill
3. Mechanics of Material – J.M. Gera & Time Shenko – CBS Publishers
4. Introduction to Solid Mechanics – I. H. Shames – PHI
5. Engineering Mechanics of Solids – E.P. Popov – PHI
6. Strength of Material – Shaums Outline Series – McGraw Hill

MATS UNIVERSITY
SEMESTER –IV
BRANCH – MECHANICAL
SUBJECT - DYNAMICS OF MACHINES
CODE -BE413

UNIT I

Static & Dynamic Force Analysis

Static equilibrium of two/three force members, Static equilibrium of member with two forces and torque, Static force analysis of linkages, D'Alembert's principle, Equivalent offset inertia force, Dynamic force analysis of four link mechanism and slider crank mechanism, Engine force analysis-Piston and crank effort

Turning Moment & Flywheel

Turning moment on crankshaft, Turning moment diagrams-single cylinder double acting steam engine, four stroke IC engine and multi-cylinder steam engine, Fluctuation of energy, Flywheel

UNIT II

Balancing of Machines

Static and dynamic balancing, Balancing of several masses in the same plane and different planes, Balancing of reciprocating masses, Balancing of primary force in reciprocating engine, Partial balancing of two cylinder locomotives, Variation of tractive force, swaying couple, hammer blow

UNIT III

Governors

Terminology, Centrifugal governors-Watt governor, Dead weight governors-Porter & Proell governor, Spring controlled governor-Hartnell governor, Sensitivity, Stability, Hunting, Isochronism, Effort and Power of governor, Controlling force diagrams for Porter governor and Spring controlled governors

UNIT IV

Gyroscopic Motion

Principles, Gyroscopic torque, Effect of gyroscopic couple on the stability of aero planes & automobiles

Mechanical Vibrations

Types of vibrations, Degrees of freedom, Single degree free & damped vibrations, Forced vibration of single degree system under harmonic excitation, Critical speeds of shaft

UNIT-V

Inertia force analysis

Effective force and inertia force of a link, Inertia forces in the reciprocating engine, Inertia forces in four bar chain.

Turning moment diagram for single and multi cylinder internal combustion engine, coefficient fluctuation of speed, coefficient of fluctuation of energy, flywheel.

Books and References:

1. Theory of Machines - Thomas Bevan
2. Theory of Machines and Mechanisms- Shigley
3. Theory of Machines and Mechanisms-Ghosh & Mallik
4. Theory of Machines and Mechanisms- Rao & Dukkipati
5. Theory of Machines - S.S. Rattan
6. Theory of Machines – R.K. Bansal
7. Mechanics of Machines – V. Ramamurti
8. Theory of Machines – Khurmi & Gupta
9. Theory of Machines – P.L. Ballaney
10. Theory of Machines – V. P. Singh

MATS UNIVERSITY
SEMESTER –IV
BRANCH – MECHANICAL
SUBJECT - APPLIED THERMODYNAMICS
CODE- BE414

UNIT - I

Second Law Analysis

Limitations of first law of thermodynamics, Introduction to the second law of Thermodynamics, the Clausius inequality, entropy, principle of increase in entropy, T-ds relation. Availability – Second law analysis of Closed system, second law analysis of steady – flow system, Irreversibility.

UNIT - II

Thermodynamic Relationships

Helmholz and Gibbs functions, coefficient of Volume expansion and isothermal compressibility, Differential relations of internal energy, Maxwell's Relation, Cp Cv relations, T-ds equations, Clapeyron equation, Kelvin coefficient.

Equation of state:

Ideal gas equation of state, Real gas deviation with ideal gas, Vander waals equation, evaluation of its constants, Virial expansions, limitations of the equation. The law of corresponding states.

UNIT – III

Vapour and Vapour Power Cycle

Properties and processes in ideal vapour, use of steam tables and Mollier's diagram in determination of steam properties, energy and entropy calculations. Carnot and Rankine cycle as applied to steam power plants, Reheat cycle, ideal regenerative cycle, practical regenerative cycle, characteristics of ideal working fluids, binary vapour cycle.

Steam Condensers

Classification of condenser, efficiency, vacuum efficiency and measurement. Effect of air leakage, Thermodynamic analysis. Benefits of using condenser in steam power cycles.

Unit – IV

Refrigeration Cycle

Reversed Carnot cycle, simple vapour compression refrigeration cycle, Analysis with T-S & p-h cycles diagram.

Reciprocating Air Compressors

Classification of air compressors, Advantages, disadvantages of reciprocating compressors, working of reciprocating compressor, equation of work (with & without clearance) volumetric efficiency, multistage compressors, efficiency of compressor, Effect of atmospheric condition on

output of Compressors, Thermodynamic analysis of reciprocating compressor, Intercooler & External cooler. Minimum work done condition for two stage compressors, equation for n stages.

Unit – V

Thermodynamics of Compressible Fluids

Isentropic flow, stagnation conditions, stagnation enthalpy, temperature, pressure, density, flow through available area, duct, converging nozzle, Convergent divergent nozzle, operation of convergent divergent nozzle for different back pressures. Flow with friction and heat transfer, Fanno flow, Rayleigh flow. Flow of steam through nozzle, throat area for maximum discharge, supersaturated Flow in nozzle. Steam flow equations for subsonic, sonic and supersonic velocities.

TEXT BOOKS

1. Engineering Thermodynamics – P.K. Nag – TMH Publishers
2. Thermodynamics & Thermal Engineering – J. Selwin Rajadurai – New Age International Publishers

REFERENCES BOOKS

1. Thermodynamics – C.P. Arora – TMH Pub.
2. Thermal Science & Engineering – D.S. Kumar – S.K. Kataria & Sons
3. Thermodynamics – S.C. Gupta – Pearson Education
4. Thermodynamics- An Engineering Approach – Cengel & Boles – McGraw Hill
5. Engineering Thermodynamics – K. Ramakrishna – Anuradha Agencies

MATS UNIVERSITY
SEMESTER –IV
BRANCH – MECHANICAL
SUBJECT - MATERIAL SCIENCE
CODE- BE415

UNIT – I

Structure of Materials:

Crystalline structure of solid: Concept of unit cell and space lattice, Miller Indices, Crystal structure determination by X-ray diffraction, Crystal imperfections.

Solidification of Metals and Alloys

Mechanism of solidification, nucleus formation and crystal growth, Metal ingot structure-dendritic and columnar grains, grain boundaries, grain growth, effect of grain size on properties of metals, polytropic transformation.

UNIT- II

Elastic and Plastic Deformation:

Material properties like strength, hardness, toughness, ductility, brittleness etc. and their importance in manufacturing. Quantitative evaluation of these properties with destructive testing methods.

Mechanism of plastic deformation, role of dislocations, slip and twinning. Strain hardening, Seasonal cracking, Baushinger effect, yield point phenomena and related effects, Cold working and Hot working processes, effect on properties like recovery, recrystallization, grain growth, grain size etc.

Unit - III

Phase Diagrams:

Phase and phase equilibrium : solidification of pure metals and alloys, phase diagrams of monotectic Eutectic, eutectoid, Peritectic and peritectoid & other systems. Allotropy of iron and Fe-C diagram.

Unit - IV

Heat Treatment

Introduction, purpose of heat treatment, T-T-T curve and micro constituents in steel heat treatment processes like hardening, tempering, annealing, normalizing, Effects of heat treatment on properties of materials. Surface treatment processes.

Unit - V

Engineering Materials

Classification, structure, general properties and applications of Cast Iron, Steel, brass, Bronze, bearing metals, light metal alloys, sintered carbide.

TEXT BOOKS

1. Engineering Physical Metallurgy – Lakhtin – CBS Publishers & Distributors
2. Materials Science- Narang – CBS Publishers & Distributors

REFERENCES

1. Elements of Material Science & Engg. - Van Vlack. – Addison – Wesley longman, 6th Edn., New York
2. Physical Metallurgy - Clark & Varney, East West Edn., New Delhi
3. Engineering Materials - Woulf series.
4. Material Science & Engg. – A first course – V. Raghavan – PHI (P) Ltd., Delhi, 2003
5. Physical Metallurgy Principles – Robert E Reed Hill – Affiliated East-West Press Pvt. Ltd., New Delhi, 2004
6. A Text Book of Material Science & Metallurgy – O.P. Khanna – Dhanpat Rai & Sons – New Delhi

MATS UNIVERSITY
SEMESTER –IV
BRANCH – MECHANICAL
SUBJECT - APPLIED THERMODYNAMICS LAB
CODE- BE416

EXPERIMENTS TO BE PERFORMED

1. To study Mountings & Accessories of a Boiler.
2. To study the Cochran Boiler and it's Accessories and Mountings.
3. To study the Lancashire and it's Accessories and Mountings.
4. To study the Babcock Wilcox and it's Accessories and Mountings.
5. To study a Simple Steam Engine.
6. To study a Simple Steam Engine With D-Slide Valve.
7. To study a Compound Steam Engine.
8. To study Meyer's Expansion Valve of Steam Engine.
9. To study Drop Valve of Steam Engine.
10. To study Two Stroke Petrol Engine.
11. To study Four Stroke Petrol Engine.
12. Determination of vacuum efficiency and condenser efficiency of a surface steam condenser.
13. Performance and testing of steam jet condenser.
14. Study of Steam Turbines
15. Study of Reciprocating Compressor

LIST OF EQUIPMENTS/MACHINES REQUIRED

1. Cornish Boiler or its model with mountings and accessories.
2. Cochran Boiler or its model with mountings and accessories.
3. Lancashire Boiler or its model with mountings and accessories.
4. Babcock Wilcox Boiler or its model with mountings and accessories.
5. Reducing Valve
6. Expansion Steam Trap
7. Steam Injector
8. Green Economizer
9. Super Heater
10. Steam Engine with D-Slide Valve
11. Spring Loaded Safety Valve
12. Throttle Valve
13. Stop Valve Hopkins's Type
14. Blow off Cock
15. Feed Check Valve
16. Lever Safety Valve
17. Dead Weight Safety Valve
18. Pressure Gauge
19. Fusible Plug
20. High Steam Low Water Safety Valve
21. Antipriming Pipe
22. Model of Two Stroke Petrol Engine
23. Model of Four Stroke Petrol Engine
24. Surface Steam Condenser experimental setup
25. Jet Condenser experimental setup
26. Reciprocating Compressor
27. Steam Turbine

MATS UNIVERSITY
SEMESTER –IV
BRANCH – MECHANICAL
SUBJECT - FLUID MACHINERY LAB
CODE- BE417

EXPERIMENTS TO BE PERFORMED

1. Performance characteristics of Pelton wheel turbine.
2. Performance characteristics of Francis turbine.
3. Performance characteristics of Kaplan turbine.
4. Performance characteristics of variable speed centrifugal pump.
5. Performance characteristics of rated speed centrifugal pump.
6. Performance characteristics of multistage centrifugal pump.
7. Study of Wind Tunnel (Open Circuit blower type)
8. Determination of Lift and drag force over an air foil.
9. To study the working of fluidic devices (Analog and Digital)
10. To study the Hydraulic Accumulator
11. To study the Hydraulic Intensifier
12. To study the Hydraulic Crane
13. To study the Hydraulic lift
14. To study the Hydraulic Ram
15. To study the Jet Pump
16. To study the Air Lift Pump
17. To determine the coefficient of discharge of a Venturi-flume.

LIST OF EQUIPMENTS/MACHINES REQUIRED

1. Pelton Wheel Turbine
2. Francis Turbine Test Rig
3. Kaplan Turbine Test Rig
4. Variable Speed Centrifugal Pump Test Rig
5. Rated Speed Centrifugal Pump Test Rig
6. Multi Stage Centrifugal Pump Test Rig
7. Reciprocating Pump Test Rig
8. Complete setup of Wind Tunnel (Open circuit blow type) with minimum wind speed not less than 30m/sec.
9. Fluidic devices (Analog and Digital)
10. Aerofoil with the provision of measurement of pressure distribution over the surface.
11. Cut section model of Hydraulic Accumulator
12. Cut section model of Hydraulic Intensifier
13. Cut section model of Hydraulic Crane
14. Cut section model of Hydraulic Lift
15. Cut section model of Hydraulic Ram
16. Cut section model of Hydraulic Jet and Air lift pump.
17. Tilting Flame

MATS UNIVERSITY
SEMESTER –IV
BRANCH – MECHANICAL
SUBJECT - DYNAMICS OF MACHINES LAB
CODE - BE418

EXPERIMENTS TO BE PERFORMED

1. To find out the oscillations of simple pendulum with universal vibration apparatus.
2. To find out the oscillations of Compound pendulum with universal vibration apparatus.
3. To find out the radius of gyration of bi-filler suspension with universal vibration apparatus.
4. To find out undamped torsional vibrations of single rotor system with universal vibration apparatus..
5. To find out the frequency of damped torsional vibration of single rotor system with universal vibration vibration apparatus.
6. To measure the frequency of torsional vibrations of single rotor system with universal vibration apparatus.
7. To measure the frequency of torsional vibrations of double rotor system with universal vibration apparatus.
8. To find out free vibration of helical coiled spring with universal vibration apparatus.
9. To study forced damped vibration of a spring mass system and simple supported beam with universal vibration apparatus.
- 10.To find out the Gyroscopic couple and prove the Gyroscopic law with Gyroscope apparatus.
- 11.To find out the Power and effort of Proel, Porter & Hartnell Governor with Governor Apparatus.
- 12.To find out the critical speed for different diameters of shaft by whirling of shaft apparatus.
- 13.To verify the static and dynamic balancing for different planes and masses by balancing apparatus.

LIST OF EQUIPMENTS/MACHINES REQUIRED

1. Universal Vibration Apparatus
2. Whirling Of Shaft Apparatus.
3. Balancing Apparatus (Both Static & Dynamic)
4. Epicyclic Gear Train And Holding Torque Apparatus
5. Gyroscope apparatus
6. Governor apparatus with differential attachments

MATS UNIVERSITY
SEMESTER –IV
BRANCH – MECHANICAL
SUBJECT - MACHINE DRAWING LAB
CODE - BE419

LIMITS, FITS AND TOLERANCES

Process tolerance, Machining symbol, Indication of machining symbol, Indication of surface roughness characteristics, Symbol for direction of lay indication of machine allowance, Position of specification of surface roughness, indication of dimensional tolerances elements of inter changeable system, Tolerance, Fundamental tolerance, Calculation of limit size, method of specifying dimensions, with tolerances on the drawing, Fits, Limits and fit system, Selection of fit, limit and tolerance, Geometrical tolerance, form tolerance, form tolerance, Position tolerance, indication of Geometrical tolerance

PRODUCTION DRAWING

Introduction, Need, Scope production drawing procedure, Production drawing for

- (1) Cotter joint
- (2) Nut and bolt
- (3) Spur gear
- (4) Flywheel
- (5) Belt pulley

DETAIL AND ASSEMBLY DRAWING (PRODUCTION DRAWING)

- (A) Detailed drawing
- (B) Assembly drawing
 - (1) Introduction
 - (2) Working drawing classification
 - (3) Procedure of detail and assembly drawing
 - (4) Assembly and detail of:
 - (i) Coupling : Universal and Oldhams coupling
 - (ii) Bearing : Simple bushed, ball and roller, foot step bearing and plumer block
 - (iii) Lathe part ; tail stock/tool post
 - (iv) Machine vice and pipe vice
 - (v) I.C. engine parts : Piston and connecting rod/Crank shaft
 - (vi) Valves : Non return/stop valve
 - (5) Blue print reading

Text Books:

1. Machine Drawing, by N.D.Bhatt, Charotal Publishing House.
2. Machine Drawing, by Machine Drawing, by P.S. Gill- S.K. Katariya & sons
3. Engineering Drawing, by A.C.Parkinson, Wheeler Publishing.

Reference:

1. Machine Drawing by K.L Narayan, P. Kannaiah and K. Venkata Reddy, New Age.