

# SAURASHTRA UNIVERSITY, RAJKOT

## SEMESTER V B.E. [ MECHANICAL ]

Code	Subject	Teaching Scheme				Exam Scheme		
		Lect.	Pra.	Theory	Paper Hrs.	Prac/ Oral	Term Work	Total
501	Fluid Mechanics	4	2	100	3	25	25	150
502	Energy Conversion - I	4	4	100	3	25	25	150
503	Dynamics of Machine - I	4	2	100	3	25	25	150
504	Mechanical Measurement	4	2	100	3	25	25	150
505	Manufacturing Process - II	4	2	100	3	50	50	200
	<b>TOTAL</b>	<b>20</b>	<b>12</b>	<b>500</b>	<b>-</b>	<b>150</b>	<b>150</b>	<b>800</b>

**SAURASHTRA UNIVERSITY, RAJKOT**

**B.E. SEM V ( MECHANICAL )**

**501 : FLUID MECHANICS**

TEACHING SCHEME		EXAMINATION SCHEME				
THEORY Hours	PRACTICAL Hours	THEORY Marks	PAPER Hours	PRACTICAL\ORAL Marks	TERMWORK Marks	TOTAL Marks
4	2	100	3	25	25	150

1. **HYDROPOWER STATION**

General idea about hydroelectric power plant.

2. Turbo – Machinery :-

(a) **IMPACT OF JET:** - Flat plate curved vanes fixed and moving single and series of plates, efficiency, condition for maximum efficiency, hinged plates & pipe bends. Jet propulsion on ships and its analysis.

(b) **HYDRAULIC OF TURBINES:** - Classification of turbines, impulse turbine theory, pelton wheel construction, theory and problems of reaction turbines, construction & theory francis turbines, Propeller turbine & Kaplan turbine construct theory & problems.

(c) **PERFORMANCE OF TURBINES:** - Specific speed, expression and values for different turbines, significance cavitations selection of turbines, governing of turbines.

(d) **PUMPS :-** Classification, centrifugal pumps : Main components, constructional details & working, definition of head and efficiency, closed impeller, semi closed impeller, open impeller, specific speed, priming effect of finite number of stages, limitation of suction lift, priming cavitations & its effects. Head less due to flow variation problems. Constructional details and working only of other types of positive displacement such as piston pump, plunger pump, bucket pump, and rotary pumps. Such as gear pump, screw pump, vane pump, radial piston pump.etc.

3. **COMPRESSORS :**

(a) **RECIPROCATING COMPRESSOR :-** Introduction important terms, Application of compressed air, Single stage reciprocating air compressor, Work done for operating a single stage reciprocating air compressor, neglecting clearance volume and considering clearance volume, Calculation of mass of air of compressed, Concept of volumetric efficiency, Volumetric efficiency referred to ambient condition, Factors affecting volumetric efficiency, Free air delivery, Multi stage compression, Advantages and disadvantages of multi stage compression, Two stage compressor with inter cooling , work done in two stage compressor with clearance, Optimum intermediate pressure in two stage compressor with complet intercooling, optimum intermediate pressure in two stage compressor with pressure drop between stages but inter cooling is perfect. Actual indicator diagram, Mean effective pressure & indicated power, compressor efficiencies, advantages of multistage compression.

(b) **CENTRIGUAL COMPRESSOR :-** Concept, essential parts, principal of operation, static and stagnation properties, velocity diagram and theory of operation, work done by impeller, ideal energy transfer, power input factor, isentropic efficiency, pressure co-efficient, mach number, pre-whirl, degree of reaction, surging and chocking, losses in centrifugal compressor performance, characteristics, effect of impeller shape on performance.

(c) **AXIAL FLOW COMPESSOR:-** Concept, construction, working, stage velocity triangles, work input, work done factor, isentropic efficiency, factors limiting the pressure rise, static pressure rise, stage loading and flow co-efficient, degree of reaction, lift and drop, co-efficient of lift and drag, advantages, comparison, performance characteristics.

4. **MISCELLANEOUS MACHINES :-** Machines Constructional details and uses of hydraulic press, intensifier, crane, jack, lift, accumulator, hydraulic ram. Fluid couplings and fluid torque converter, hydraulic braking system.

REFERENCE BOOKS :-

Hydraulic machine

Fluid Mechanics

Fluid Mechanics and Fluid power engineering

Hydraulic and Hyd.M/C

Hydraulic Machine

Hydraulic & Hydraulic Machines

Gas Turbines

Thermal Engineering

Dr. Jagdishlal

R.K.Bansal

Dr. D.S.Kumar

R.C.Patel & A.D. Pandya.

Dr. Vasandani

Dr. D.R.Malhotra

Khajuria & Dubey

P.I.Balleaney

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**B.E. SEM V ( MECHANICAL )**

**502 : ENERGY CONVERSION - I**

TEACHING SCHEME		EXAMINATION SCHEME				
THEORY	PRACTICAL	THEORY	PAPER	PRACTICAL\ORAL	TERMWORK	TOTAL
Hours	Hours	Marks	Hours	Marks	Marks	Marks
4	4	100	3	25	25	150

**[A] THEORY :**

**1. THERMODYNAMIC CYCLES :-**

Carnot cycle, limitations, rankine cycle, modified rankine cycle, introduction of super heat, reheat, regeneration, open and closed type feed water heating, super critical pressure cycle, co-generation.

**2. HIGH PRESSURE BOILERS :**

La- mont boiler, leoffler boiler, benson boiler, vortex boiler, Schmidt Hartmann boiler, super critical pressure boiler, testing of boilers.

**3. BOILER ACCESSORIES AND DRAUGHT :-**

Economiser of various types, super heater of various types, Air preheaters, Natural and artificial draughts, calculation of chimney height.

**4. FUEL AND ASH HANDLING :**

Coal handing system, coal delivery unloading, preparation transfer, conveyors, mechanical equipment. Ash handling, Hydraulic and gravity systems, pneumatic suction system, Pulverised coal, Cyclone and electro magnetic precipitators.

**5. FUEL BURNERS AND BOILER FURNACES :**

Constructional details of various types of oil burners, pulverised fuel burners, cyclone burners, long frame burners, turbulent burners tangential burners, gas burners, furnace walls, furnace bottom and refuse removal, insulation, dust collectors, stokers, stokers firing, pulverized fuel firing.

**6. CONDENSERS AND COOLING TOWERS :**

Jet and surface condensers, air leakages, vacuum efficiency, condenser water cooling system, open and closed system, water cooling method such as a spray pond, natural draft cooling towers, mechanical draft cooling towers, air cooled system for Dry-type cooling system, performance of condensers and cooling towers, condensate pumps. water, cooling towers.

**7. FEED WATER TREATMENT:**

Water analysis, scaling corrosion, Embrittlement, Foaming and priming methods of feed water treatment, evaporators, Deaeration, cold line soda process, hot line soda softening process, Ion exchange process, Demineralising, Blowdown - feed water heater, surface heater.

**8. BOILER HOUSE CONTROLS :**

Stream flow measurement, measurement of stream temperature and its control, combustion control for maintaining pressure and temperature, measurement of draught, fuel flow measurements. Gas analysis, CO<sub>2</sub> recorders, Measurement alarms, Feed water control.

**9. NUCLEAR POWER :**

Introduction, nuclear energy release from nuclear reaction, fission, fission chain reaction, nuclear fuels, nuclear reactors, moderators shield, reflectors, control rods, coolant, pressurized water reactors, breeder reactor, liquid metal cooled reactor, principle of control and operation. safety measures, economics of nuclear power development in india.

**REFERENCE BOOKS :**

- Power Plant Engineering Domkundwar
- Power Plant Engineering Keshwani
- Power Plant Engineering Morse F. T.
- Power Plant Engineering Voppat
- Power Plant Engineering Gaffort
- Power Plant Engineering Verma
- Power Plant Engineering EL-Wakil
- Turbomachines DR. S.M.Yahya
- Steam Turbines Yadev
- Power Plant Engineering Rajput

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**503 : DYNAMICS OF MACHINE - I**

TEACHING SCHEME		EXAMINATION SCHEME				
THEORY Hours	PRACTICAL Hours	THEORY Marks	PAPER Hours	PRACTICAL\ORAL Marks	TERMWORK Marks	TOTAL Marks
4	* 2	100	3	25	25	150

1. **Linkages :-**  
Compound pendulum: Dynamically equivalent system, Biflar Triflar, Suspensions, Determination of moment of inertia of irregular bodies.
2. **Static and dynamic force analysis in machines :**  
Static and dynamic force analysis of simple mechanisms D Alembert;s principle graphical and analytical methods. Shaking force and shaking moments analysis, Inertia forces of I.C. Engines, Graphical and analytical method.
3. **Dynamics of rigid body :-**  
Gyroscopic and its effect, Gyroscopic acceleration, Gyroscopic couple, Reaction couple, Air screw, Gyroscopic effect on naval ship and stabilization of naval ship, automotive vehicle: two and four wheeler.
4. **Control force analysis :-**  
Governors: dead weight type and spring controlled, governors of centrifugal type, sensitiveness: stability: hunting of governor, condition for stable , isochronous and stable governor, effort and power of governor, controlling force curve.
5. **Theory of gears :-**  
Law of gearing, conjugate tooth profile, involute cycloidal and circular tooth profile, interference, minimum number of teeth, arc of contact, contact, ratio, geometry of helical, bevel, worm and spiral gear, force analysis and efficiency of all,
6. **Introduction to synthesis of mechanism :-**  
Introduction to synthesis of mechanism, synthesis of four bar chain for given instant value of angular velocities and acceleration, analysis of four bar chain mechanism, Freudenstein , equation , Precision points for function generation angle relation ship for function generation, graphical synthesis of four bar mechanism and slider crank mechanism, synthesis of two and three position of links , vector methods.

**REFERENCE BOOKS :**

Theory of Machines	J.M. Sheth & H.M.Jadvani
Mechanical Vibration	Grover
Theory of Machine	P.I.Ballaney
Mechanical Vibration	G.K.Groover
Mechanical Vibration	Sharma
Theory of Machines	Jagdishlal
Mechanical Vibration	Thomson
Theory of Machine	J.M.Shah & Jadvani
Theory of Machine	S.S.Ratan
Mechanism & Machine Theory	Rao and Duhkipati
Mechanical vibration	Seto
Theory & Practice of Mechanical Vibration	Rao & Gupta

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**504 : MECHANICAL MEASUREMENTS**

TEACHING SCHEME		EXAMINATION SCHEME				
THEORY Hours	PRACTICAL Hours	THEORY Marks	PAPER Hours	PRACTICAL\ORAL Marks	TERMWORK Marks	TOTAL Marks
4	2	100	3	25	25	150

**[A] THEORY :**

- **General** : Generalized measurement system, Fundamental methods of measurement, Calibration, Concept of transducers, Types of transducers and their uses.
- **Metrology**  
Metrological measurement, length standards, Limit fits and tolerance, Length measuring machine, depth gauge, plain ring gauge, plain plug gauge, snap gauge, Adjustable type gap gauge, combined limit gauge, position gauge, Centoua gauge, cylindrical gauge, Angle gauge blocks, micrometers, tool room micro scope, Dial indicator, sine bar, comperators, surface roughness measurement, Gear measurement, Screw thread measurement, IS for plug and ring gauges.
- **Motion measurement:**  
Displacement, speed, velocities, acceleration, power and frequency measurement.
- **FORCE MEASUREMENT :-**  
Measurement of force, torque, Mass, Weight and force measuring methods, torque measurement, Absorption and transmission dynamometer.
- **PRESSURE MEASUREMENT:-**  
Measurement of pressure, Bourdon tubes, Bellows and diaphragm type pressure gauges, Ring balance gauge, manometers, Simple - V - Tube, Inclined tube, vaccum gauges, such as meleod gage, Thermal Conductivity gauge, Ionization gauge, Measurement of high pressures Bulk modulus pressure gauge, Testing of pressure gauge - Dead weight pressure gauge tester.
- **FLOW MEASUREMENT :**  
Measurement of flow , Orific plate, Nozzles, Venturimeter, Rotameter, displacement meter, Velocity methods, Velocity probes, such as impact tube, pitot tube, hot wire anemometer, non contact type flow measuring devices.
- **TEMPERATURE MEASUREMENT :**  
Concept of temperature, Temperature standards, Calibration of temperature measuring devices, Radiation pyrometer, optical pyrometer, Resistance thermometer, Thermo couplesm Thermo couples wires, Installation of thermo couple. Thermo electric pyrometer, Thermistor.

**REFERENCE BOOKS :**

- Mechanical Measurement and central D. S. Kumar
- Measurement Systems Doebelin
- Industrial Measurement R. K. Jain
- Engineering Metrology R. K. Jain
- Mechanical measurement Backwith & Back
- Dimensional Metrology Khare & Vajpayee
- Engineering Metrology Humar
- IS 919 Recommendation for limits & fits for engineering
- Metrology for engineers Galyer & shotbolt(ELBS)
- Engineering Metrology K.J.Hume

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**505 : MANUFACTURING PROCESS - II**

TEACHING SCHEME		EXAMINATION SCHEME				
THEORY	PRACTICAL	THEORY	PAPER	PRACTICAL\ORAL	TERMWORK	TOTAL
Hours	Hours	Marks	Hours	Marks	Marks	Marks
4	2	100	3	50	25	175

1. **Basic Machine Tools :**  
Machine tool classification, working and auxiliary motions in machine tools, primary cutting motions in machine tools.
2. **Metal cutting Lathes :**  
Engine lathes construction arrangement and principal units of engine lathes, type and size range of engine lathes, operations carried on engine lathe, attachment extending the processing capacities of engine lathes, description of other types of lathes, plain turning lathes, forcing lathes, multiple tool lathes, simple purpose lathes, turret and capstan lathes, automatic & semi automatic lathes.
3. **Drilling Machine :**  
Purpose and field of application of drilling machines upright drill processes, radial drills.
4. **Boring Machines :-**  
Purpose and field of applications, Horizontal boring machines, precession boring machines.
5. **Milling Machines :**  
Purpose and types of milling machines, general purpose milling machines, different types of milling operations, milling cutters, attachments extending the processing capabilities of general purpose milling machines, types of indexing
6. **Planers Shapers and Slotters :**  
Type of planning machines, planning operations, type of slotting machine, slotting operations, types of shaping machines, shaper mechanism, work holding devices, shaper operations, shaper tools.
7. **Metal Sawing and Broaching Machines :-**  
Classification : Attachments extending the processing capacities of each sawing and broaching machines, metal sawing- classification, reciprocating sawing machines, circular sawing machines, band sawing machines. Types of broaching machines, advantage and limitations of broaching.
8. **Grinding machines And Abrasives :**  
Classification of grinding machines, cylindrical grinders, internal grinders, surface grinders, tool and cutter grinders, surface finishing. Abrasives, manufacturer of grinding wheels, honing lapping super finishing, specification of grinding machine.
9. **Introduction to NC/CNC/DNC/for machine tools, part programming for CNC turning lathe.**
10. **Erection Alignment testes and acceptances charts for machine tools.**

**Advanced Manufacturing Processes :-**

11. **Casting :-**  
Metal mould casting processes, pressure die casting, centrifugal casting, investment casting (lost wax method), continuous casting, Co<sub>2</sub> moulding.
12. **Fabrication :-**  
Thermit welding, electro gas, Electro Slag, friction automit hydrogen, Ultrasonic welding, electron beam & laser beam welding processes, Explosive bonding.
13. **Machining :-**  
Principles of operation, tools, equipments, working and applications of Non-conventional machining process such as : EDM, ECM, USM, EBM, LBM, Plasma cutting machining.

**TERM WORK :-**

1. Practice on tool grinding.
2. Preparation of job involving operations on lathe, drills, shapers, milling and grinding machines.
3. Demonstration of one job on gear cutting milling machine.
4. Demonstration of one job on NC/CNC machine.
5. Demonstration of machine tool testing & acceptance chart.
6. Demonstration of non conventional machining processes.
7. Demonstration of Advanced casting & fabrication techniques.

Student will prepare report on the topic covered under theory & during tutorial.  
Practical examination will be based on viva on term work and preparation of jobs.

**REFERENCE BOOKS :**

- |   |                                    |
|---|------------------------------------|
| • Work shop Technology Vol. – II  | Hajra Choudhary                    |
| • Work shop Technology Vol. – II  | Chapman                            |
| • Principles of Manufacturing   | Chembel                            |
| • Engg. Manufacturing Process   | Lindbers                           |
| • New Technology  | Bhattacharya                       |
| • Welding Technology  | Gupta                              |
| • Numerical contain & computer<br>added manufacturing                   | R.P. Rao, N.K. Tewari & T.K.Kundra |
| • Manufacturing Technology  | P.N.Rao                            |
| • Principle of Metal Casting  | Hemeloper & Rosenthal              |
| Automation production systems and<br>computer Integrated Manufacturing. | BY:- Grover M.P.                   |