

## **MANUFACTURING TECHNOLOGY- II**

**Periods / Week: 4+1**

**Examination : 3Hrs**

**Total period : 60**

**End exams TH : 80 marks**

**I.A. : 20 marks**

### **Topic wise distribution of periods**

<b>Sl.No.</b>	<b>Topic</b>	<b>Periods</b>
<b>1</b>	<b>Tool Materials</b>	<b>04</b>
<b>2</b>	<b>Cutting Tools</b>	<b>06</b>
<b>3</b>	<b>Lathe Machine</b>	<b>08</b>
<b>4</b>	<b>Shape</b>	<b>06</b>
<b>5</b>	<b>Planning M/C</b>	<b>06</b>
<b>6</b>	<b>Milling</b>	<b>08</b>
<b>7</b>	<b>Slotter</b>	<b>06</b>
<b>8</b>	<b>Grinding</b>	<b>06</b>
<b>9</b>	<b>Drilling, Boring, Broaching</b>	<b>06</b>
<b>10</b>	<b>Surface finish, lapping</b>	<b>04</b>
	<b>Total Period</b>	<b>60</b>

### **RATIONALE:**

Engineering basically means production of goods & services for human consumption. The major function of mechanical engineering is to manufacture various products using machineries, production processes & production management techniques. Therefore, this is one of the most important subjects to be learned by a mechanical & automobile engineer.

### **COURSE CONTENTS:**

#### **1.0 Tool Materials**

- 1.1 State Composition of various tool materials
- 1.2 State physical properties & uses of such tool materials.

#### **2.0 Cutting Tools**

- 2.1 Explain cutting action of various hand tools such as Chisel, hack saw blade.
- 2.2 Explain cutting action of dies & reamer
- 2.3 Describe tool geometry of turning tool & milling cutter.
- 2.4 State purpose of providing different tool and specify the angels for different materials to be machined.
- 2.5 Define speed & feed.
- 2.6 Specify various coolants and lubricants.
- 2.7 State the purpose of using coolants & lubricants

### 3.0 Lathe Machine

#### 3.1 S.S & S.C lathe.

3.1.1 Define S.S & S.C lathe.

3.1.2 Identify the different operations of lathe & their functions.

3.1.3 Enlist the different operations on lathe.

3.1.4 State & explain turning, grooving, step turning, thread cutting, taper turning parting off.

3.1.5 State the safety precautions needed

#### 3.2 Capstan lathe

3.2.1 Explain the function of different components.

3.2.2 Define multiple tool holders.

#### 3.3 Turret Lathe

3.3.1 Explain the functions of different components.

3.4 Differentiate between capstan & turret lathe.

3.5 Explain the indexing arrangement for turret head

3.6 Draw the tooling lay out for preparation of a hexagonal bolt & bush.

3.7 State the advantages of capstan, turret lathe over S.S & S.C lathe

3.8 Explain with neat sketch the feeding mechanism

### 4.0 Shaper

4.1 List out the different parts.

4.2 Describe the functions of above parts.

4.3 Explain the automatic table feed mechanism.

4.4 Explain the construction & working of tool head.

4.5 Explain the quick return mechanism through sketch.

4.6 State the specification of a shaping machine.

### 5.0 Planing Machine

5.1 Enlist different parts.

5.2 Describe explain the function of parts.

5.3 Explain the table drives mechanism.

5.4 Explain the working of tool and tool support.

5.5 Explain the clamping of work through sketch.

### 6.0 Milling Machine

6.1 Describe various types of milling machine and operations performed by them.

6.2 Explain work holding attachment.

6.3 Describe construction & working of simple dividing head, universal dividing head.

6.4 Explain the procedure of simple indexing.

6.5 Explain the procedure of compound indexing.

6.6 Describe the different numerical indexing procedure.

6.7 Show one example from each indexing method.

## 7.0 Slotter

7.1 Enlist the different parts.

7.2 Explain the construction & working.

7.3 Specific various tools.

## 8.0 Grinding

8.1 Define grinding

8.2 Explain manufacturing of grinding wheels.

8.3 State Criteria for selecting of grinding wheels.

8.4 Explain specification of grinding wheels with example.

8.5 Explain working

8.5.1 Cylindrical Grinder

8.5.2 Surface Grinder

8.5.3 Centre less Grinder

## 9.0 Drilling

9.1 State classification of drilling machine.

9.2 Explain the working of

9.2.1 Bench drilling machine

9.2.2 Pillar drilling

9.2.3 Radial drilling machine

9.3 Boring

9.3.1 Basic Principle of Boring

9.3.2 Different between Boring and drilling.

9.4 Broaching

9.4.1 Types of Broaching (pull type, push type)

9.4.2 Advantages of Broaching.

9.4.3 Application of Broaching.

## 10.0 Surface finish, lapping

10.1 Design Surface finish

10.1.1 Define super finishing

10.2 Describe lapping & explain their specific cutting.

## RECOMMENDED BOOKS:

1. Work shop Technology by Hazra Choudhary Vol.-I
2. Work shop Technology by Hazra Choudhary Vol.-II
3. Work shop Technology Part-I & II by W.A.S Chapman

## **THEORY OF MACHINES**

Periods/Week : 4+1  
Total periods : 60

Exam : 3hr  
End exam. Th. : 80 marks  
IA : 20 marks  
Total :100 marks

### Topic wise distribution of periods

Sl.No.	Topic	Periods
01	Simple Mechanism	10
02	Friction	12
03	Power Transmission	12
04	Governors and flywheels	09
05	Balancing of machine parts	09
06	Vibration of machine parts.	08
	Total Period	60

### RATIONALE:

Mechanical and Automobile engineering is involved with design, manufacture and use of various types of machines. Each machine consists of a large number of static and moving parts or sub assemblies called mechanisms. There exist a large number of different types of mechanisms. Each of these mechanisms can generate a particular type of output motion with some other kind of input motion. Theory of machines is study of such different kinds of mechanisms. It is, therefore, necessary to study and understand functions of different type of mechanisms for design, manufacture and use of various machines.

### CONTENTS (in terms of specific objectives):

#### 1. Simple Mechanisms

1.1 Understand the subject of theory of machine.

##### 1.2 Define

1.2.1 Link.

1.2.2 Kinematic

1.2.3 Kinematic chain.

1.2.4 Mechanism.

1.2.5 Inversion.

##### 1.3 Explain.

1.3.1 Lower pair.

1.3.2 Higher pair.

1.3.3 Four bar link mechanism with their inversions..

1.3.4 Cam and followers.

#### 2 Friction

2.1 Laws of dry friction

##### 2.2 Explain

2.2.1 Friction on horizontal plane

2.2.2 Friction on inclined plane.

2.2.3 Angel of repose.

- 2.2.4 Friction between nut and screw for square threads.
- 2.3 Explain principle of single and multiple collar bearings.
- 2.4 Derive the formula for torque transmission and power for
  - 2.4.1 Flat pivot bearing.
  - 2.4.2 Conical pivot bearing.
  - 2.4.3 Flat collar bearing of single and multiple types.
- 2.5 Derive the formula for torque and power transmission for screw jack, single and multiple clutches
- 2.6 Solve numerical problems on above.
- 2.7 Explain the concept of rolling friction.
- 2.8 Describe
  - 2.8.1 Roller bearings.
  - 2.8.2 Needle roller bearings.
  - 2.8.3 Ball bearings.
- 2.9 Classify the bearings.
- 2.10 State function of bearings.
- 2.11 Explain the working of
  - 2.11.1 Simple frictional brakes.
  - 2.11.2 Absorption type of dynamometers.

### 3.0 Power Transmission

- 3.1 Explain the concept of
  - 3.1.1 Power Transmission
  - 3.1.2 Type of drives
    - 3.1.2.1 Belt drive.
    - 3.1.2.2 Gear drive.
- 3.2 Derive the formula for
  - 3.2.1 Velocity ratio
  - 3.2.2 Length of belt of
    - 3.2.2.1 Open belt drive
    - 3.2.2.2 Cross belt drive
  - 3.2.3 Ratio of tensions.
  - 3.2.4 Centrifugal tensions.
  - 3.2.5 Initial tensions.
  - 3.2.6 Power transmitted by belt.
  - 3.2.7 Width of belt required.
- 3.3 Explain the use of
  - 3.3.1 Idle pulleys.
  - 3.3.2 Jockey pulley.
  - 3.3.3 V\_belts and V\_belts pulleys.
  - 3.3.4 Fast and loose pulleys.
- 3.4 Explain the concept of crowning of pulleys.
- 3.5 Gear Drivers.
- 3.6 Classify gears.

- 3.7 Define velocity ratio for.
  - 3.7.1 Simple gear train.
  - 3.7.2 Compound gear train.
  - 3.7.3 Epicyclic gear train.
- 3.8 Solve numerical problems on
  - 3.8.1 Circular pitch.
  - 3.8.2 Diametral pitch.
  - 3.8.3 Module.
- 3.9 Explain the working principle of
  - 3.9.1 Simple gear train.
  - 3.9.2 Compound gear train.
  - 3.9.3 Reverted gear train.
  - 3.9.4 Epicyclic gear train.
- 4. Governors and Flywheels
  - 4.1 State the function of governors.
  - 4.2 Classify governors.
  - 4.3 Describe working of (no mathematical treatment).
    - 4.3.1 Watt governor.
    - 4.3.2 Porter governor.
    - 4.3.3 Proel governor.
    - 4.3.4 Hartnell governor
  - 4.4 Define
    - 4.4.1 Sensitivity.
    - 4.4.2 Stability.
    - 4.4.3 Isochronism.
  - 4.5 Explain function of a flywheel.
  - 4.6 Define and write the formula.
    - 4.6.1 Fluctuation of energy.
    - 4.6.2 Coefficient of fluctuation of speed.
    - 4.6.3 Find out required weight of flywheel.
- 5 Balancing of Machine Parts
  - 5.1 Explain the concept of balancing.
  - 5.2 Explain static belonging of rotating parts.
  - 5.3 Explain the principle of balancing of reciprocating masses.
  - 5.4 State the causes and effect of unbalance.
  - 5.5 Different between static and dynamic balancing.
- 6 Vibration in Machine Parts.
  - 6.1 Introduction to vibration.
  - 6.2 Classify vibrations.
  - 6.3 Explain the basic concept of.
    - 6.3.1 Natural Vibration.

- 6.3.2 Forced Vibration.
- 6.3.3 Damped Vibration.
- 6.3.4 Torsional Vibration.
- 6.3.5 Longitudinal Vibration.
- 6.4 Define with respect to vibration.
  - 6.4.1 Cycle.
  - 6.4.2 Amplitude.
  - 6.4.3 Time period.
- 6.5 State the causes of Vibration.
- 6.6 State the points for remedies of vibration.

**RECOMMENDED BOOKS:**

1. The Theory of Machines by Thomas Bevan, CBS Publishers & Distributors.
2. Theory of Machine by Saha Jadavani.
3. Theory of Machine by R.S.Khurmi.
4. Theory of Machines by Abdulla Shariff. Dhanpat Rai & Sons.

## Hydraulic Machines and Fluid power

Periods / Week : 4+1

Examination : 3Hrs

Total period : 60

End exams TH: 80 marks

I.A. : 20 marks

### Topic wise distribution of periods

Sl.No.	Topic	Periods
1	Turbines	12
2	Centrifugal Pump	12
3	Reciprocating Pump	08
4	Pneumatic system	14
5	Hydraulic Control system	14
	<b>Total Period</b>	<b>60</b>

### RATIONALE:

Use of fluids can be realized by a group of machine called Hydraulic machines.  
Use of Pneumatic and hydraulic control system in Automation.

### COURSE CONTENTS:

#### 1.0 Turbines.

- 1.1 Design & Classify water turbine.
- 1.2 Describe Construction & working of wheels
  - 1.2.1 Draw velocity triangular for a single bucket.
  - 1.2.2 Estimate work done & efficiencies for wheels
  - 1.2.3 Solve numerical problem on above
- 1.3 Describe Construction & working of Francis turbine
  - 1.3.1 Draw velocity triangular for Francis turbine
  - 1.3.2 Estimate work done & efficiencies for Francis is turbine
  - 1.3.3 Solve numerical problems on above
  - 1.3.4 Draw velocity triangle for in word & outward flow reaction turbines.
  - 1.3.5 Solve numerical problems on above.
- 1.4 Describe Construction & working of Kaplan turbines
- 1.5 Describe governing of hydraulic turbine
- 1.6 Explain the working of Surge tanks & draft tubes
- 1.7 State the criteria for selection of hydraulic turbine s
- 1.8 Solve numerical problems quantity of water, head, power & efficiency

#### 2.0 Centrifugal pump

- 2.1 Define & classify pumps
  - 2.1.1 Centrifugal pumps
- 2.2 Describe construction & working of pump.
- 2.3 Draw velocity triangle for single vane of impeller
- 2.4 Compute the work done for same.

- 2.4.1 Define various heads of pumps.
- 2.4.2 Define manometer efficiency
- 2.4.3 Solve numerical problems on above.
- 2.5 Define manometer speed.
  - 2.5.1 Derive the working of multistage pumps.
  - 2.5.2 Derive the expression for minimum speed.
- 2.6 Explain the working of multistage pumps.
- 2.7 Explain priming of pumps with various priming procedure used.
- 2.8 State the method of prevention of air intake for pumps.
- 3.0 Reciprocating pumps.
  - 3.1 Describe construction & working of single acting reciprocating pump.
    - 3.1.1 Describe construction & working of double acting reciprocating pump.
  - 3.2 Define slip.
    - 3.2.1 State positive & negative slip.
    - 3.2.2 Establish relation between slip & coefficient of discharge
  - 3.3 Derive the formula for HP required to device.
    - 3.3.1 Single acting reciprocating pump.
    - 3.3.2 Double acting reciprocating pump.
  - 3.4 Solve numerical problems on above.
- 4.0 Parameter systems.
  - 4.1 Pressure Control valves.
  - 4.2 Pressure relief valves
  - 4.3 Pressure regulator valves.
    - 4.3.1 Directional control valves.
    - 4.3.2 3/2 DCV, 4/2 DCV, 4/3 DCV, 5/2 DCV.
  - 4.4 Flow control values, throttle values, shuttle values, quick exhaust values
  - 4.5 Parameter circuits
    - 4.5.1 Direct control of single acting Cylinder.
    - 4.5.2 Operation of above acting Cylinder.
    - 4.5.3 Operation of double acting Cylinder with metering in control.
    - 4.5.4 Operation of double actions cylinder with metering out control.
  - 4.6 Use of shuttle value in pneumatic circuits.
  - 4.7 Use of quick exhaust valve in pneumatic circuits.
  - 4.8 Automatic operation of double acting cylinder
  - 4.9 Merits & demerits of pneumatic system application.
- 5.0 Hydraulic Control Systems.
  - 5.1 Hydraulic system – merits & demerits.
    - 5.1.1 Service properties of hydraulic fluids.
  - 5.2 Hydraulic accumulator

- 5.2.1 Weighted or gravity type accumulator spring loaded type gas filled bladder accumulators.
- 5.3 Pressure intensifier
- 5.4 Fluid power pumps.
  - 5.4.1 External & internal pumps, vane pump radial piston pumps.
- 5.5 ISO symbols for hydraulic components
  - 5.5.1 Hydraulic circuit using sequencing valve.
  - 5.5.2 Hydraulic circuit using counter balance valve.
  - 5.5.3 Hydraulic circuit for shaping machine
- 5.6 Table moment in surface grinding machine & millings machine
- 5.7 Compression of hydraulic & parameter systems.

**RECOMMENDED BOOKS:**

1. A Text Book of Hydraulics, Fluid mex: R.S.Khurmi.
2. A Text Book of Hydraulics: R.K. Rajput.
3. Fundamental of pneumatic control engineering-FESTO
4. Hydraulics and Pneumatics Control: K. Shanmuga Sundaram

## Thermal Engg. - II

Periods / Week : 4+1

Examination : 3Hrs

Total period : 60

End exams TH : 80 marks

I.A. : 20 marks

### Topic wise distribution of periods

Sl.No.	Topic	Periods
1	Properties & Process of Vapour	10
2	Steam generator	08
3	Steam power cycle	08
4	Steam nozzle	08
5	Steam turbine	12
6	Condenser	06
7	Gas turbine & Jet Propulsion	08
	Total Period	60

### COURSE CONTENTS:

#### 1.0 Properties and process of vapours.

- 1.1 Difference between gas and vapour
- 1.2 Formation of steam
- 1.3 Representation in P-V and T-S diagram
- 1.4 Definition and properties of steam
  - 1.4.1 Steam table, Mollier diagram
  - 1.4.2 Non flow and flow process of vapour
  - 1.4.3 P-V, T-S and H-S diagram
  - 1.4.4 Determine the changes in properties
- 1.5 Heat and work transfer.
- 1.6 Steam Calorimeter

#### 2.0 Steam Generator

- 2.1 Classification and types of boiler.
  - 2.1.1 Fire tube and water tube boiler
  - 2.1.2 Straight tube and bend tube boiler
  - 2.1.3 Description and working of common boiler.
- 2.2 Boiler accessories and mountings.
  - 2.2.1 Function and description.
- 2.3 Fuel burning equipment
- 2.4 Draught
  - 2.4.1 Forced
  - 2.4.2 Induced
  - 2.4.3 Balanced
- 2.5 Modern high pressure and high capacity boiler
  - 2.5.1 Circulation in boiler, risers
  - 2.5.2 Performance of boiler

- 2.5.3 Equivalent evaporation, boiler efficiency & power (Simple problems)
- 3.0 Steam power cycle
  - 3.1 Carnot cycle with gas
  - 3.2 Carnot cycle with vapour
  - 3.3 Derive work, and efficiency of above two cycles.
  - 3.4 Rankin cycle
    - 3.4.1 Representation in P-V, t-s and h-s diagram
    - 3.4.2 Derive work and efficiency
    - 3.4.3 Effect of various end conditions in ranking cycle
    - 3.4.4 Reheat cycle and regenerative cycle
- 4.0 Steam nozzles
  - 4.1 Steam nozzles
  - 4.2 Continuity equation, steady-flow energy equation.
    - 4.2.1 Convergent and convergent divergent nozzle.
    - 4.2.2 Critical pressure ratio, effect of friction
  - 4.3 Nozzle efficiencies, velocity of steam leaving nozzle.
- 5.0 Steam turbine
  - 5.1 Principle of working
    - 5.1.1 Classification Impulse, reaction, impulse reaction, velocity compound, pressure velocity compounding turbines
    - 5.1.2 Velocity diagram for single stage impulse turbine.
  - 5.2 Tangential thrust, axial thrust, blade work.
    - 5.2.1 Blade efficiency, stage efficiency, governing of turbine, losses in turbines.
- 6.0 Condenser
  - 6.1 Function of Condenser
    - 6.1.1 Classification of jet and surface condenser
    - 6.1.2 Description of surface condenser
    - 6.1.3 Daltons law of partial pressure and its application.
  - 6.2 Cooling water requirement.
  - 6.3 Cooling towers and spray ponds, purpose, types & description
- 7.0 Gas turbine & Jet Propulsion.
  - 7.1 Advantages of gas turbine over steam turbine & I.C. engine.
  - 7.2 Constant pr. gas turbine
  - 7.3 Constant vol. gas turbine
  - 7.4 Closed cycle & open cycle gas turbine
  - 7.5 Working principle of Jet engine and Rocket engine.
  - 7.6 Fuel used in jet engine.

**RECOMMENDED BOOKS:**

1. Thermal Engineering. A.S.Sarao
2. Engineering Thermodynamics by P.K.Nag
3. Thermal Engg. By A.R.Basu
4. Thermal Engg. By P.L.Balany.

**Mechanical Engg. Drawing**

**Periods / Week :6**

**Total period : 90**

**Examination : 4Hrs**

**End exams : 100 marks**

**Ses : 50 marks**

**Course Contents:**

- 1.0 Draw different types of
  - 1.1 Bolts, nuts, threads.
  - 1.2 Screw, Rivets
  - 1.3 Joints
    - 1.3.1 Cotter joint
    - 1.3.2 Knuckle joint
- 2.0 Flange coupling (protected type)
- 3.0 Rigid pedestal bearing
- 4.0 Flat belt pulley
- 5.0 Engine connecting rod
- 6.0 Boiler Safety valve (spring loaded)
- 7.0 Hydraulic non return valve
- 8.0 Eccentric Sheaves
- 9.0 Screw Jack

**RECOMMENDED BOOKS:**

- 1. Machine Drawing by R.K.Dhawan
- 2. Machine Drawing by N.D.Bhatt
- 3. Machine Drawing by T.Jones.

**MEL - II**

**Periods / Week :05**

**Total period : 75**

**Examination : 4Hrs**

**End exams : 50 marks**

**Ses : 25 marks**

**Total 75**

1. Material testing Lab:-
  - 1.1 Determine Young's Modulus by UTM.
  - 1.2 Determine compressive stress of wooden block / concrete block by compression testing machine.
  - 1.3 Determine the hard ness number by Rockwell / Vickers hardness testing machine.
  - 1.4 Determine the resistance of material to the impact load by Izoid / Charpy test.
  
2. Thermal Engineering Lab
  - 2.1 Model studies of Boiler (Accessories, mounting)
  - 2.2 Performance testing of diesel engine.
  - 2.3 Determine the B.H.P, I.H.P BSFC of a multi cylinder engine by Morse test
  - 2.4 Determine the over all efficiency mechanical efficiency, at air compressor.
  
3. Hydraulic m/c Lab
  - 3.1 Performance test of reciprocating or centrifugal pump and draw the characteristics curve
  - 3.2 Performance test of Impulse turbine
  - 3.3 Performance test of Reaction turbine (Kaplan / Francis)

## WORKSHOP PRACTICE- III

Period/ week : 06

Exam: 4 hrs

Total period : 90

End exam 50 marks

Sessional 25 marks

Total 75 marks

### 1.0 Advanced machining practice

#### 1.1 Job practice involving

1.1.1 Drilling

1.1.2 Boring

1.1.3 Internal V-thread cutting

#### 1.2 Operation of Capstan and turret lathe

### 2.0 Machine shop

2.1 Making V- block in shaping machine

2.2 Machining horizontal and vertical surface on planing machines

2.3 Making a key way on slotting machine

2.4 Different types of surfacing and gear cutting on milling machines

### 3.0 Foundry practice

3.1 Use of foundry tools and equipments

3.2 Preparation of moulding sand

3.3 Making of simple moulds

3.4 Making cores using different types of pattern

3.5 Study of cupola and tilting furnace

3.6 One job on ferrous/non ferrous casting

### 4.0 Advanced Welding Practice

Practice on MIG/TIG welding (Joining two non – ferrous parts)