

**4TH SEM./AUTO/DIP.MECH./MECH(MAIN)/ MECH(PROD) /MECH(SAND)/
MECH(IND.INT) MECHANICAL / 2023(S)**

TH-1 Theory of Machine

Full Marks: 80

Time- 3 Hrs

Answer any five Questions including Q No.1& 2
Figures in the right hand margin indicates marks

1. Answer **All** questions 2 x 10
 - a. What is degree of freedom?
 - b. Define inversion.
 - c. What is limiting friction?
 - d. What is the function of clutch?
 - e. Define coefficient of fluctuation of speed?
 - f. What are the advantages of gear drive?
 - g. What is the difference between governor and flywheel?
 - h. State different types of vibration.
 - i. What is the need of balancing in machine?
 - j. Define resonance.
2. Answer **Any Six** Questions 6 x 5
 - a. Explain different type of cam follower mechanism.
 - b. Explain sensitiveness, stability and isochronisms of a governor.
 - c. Derive the expression for torque transmitted in case of flat collar bearing assuming uniform pressure theory.
 - d. Explain the causes of vibration and Remedies.
 - e. Find the power lost in friction assuming i) UPT and ii) UWT when a vertical shaft of 100mm diameter rotating at 150 rpm rest on a flat foot step bearing, coefficient of friction is ,0.05. Shaft carries a load 15 KN.
 - f. Differentiate between static And dynamic balancing
 - g. Derive the expression for height for a centrifugal governor.
3. Explain the construction and working of a centrifugal governor with the neat sketch. 10
4. What is four bar chain mechanism? Explain its inversion. 10
5. A shaft rotating at 200 rpm drives another shaft at 300 rpm and transmits 6 KW through a belt. The belt is 100 mm wide and 10 mm thick. The distance between shafts is 4 m. The smaller pulley is 0.5 in diameter. Calculate the stress in the belt for both open and closed belt drive condition. 10
6. Drive the expression for length of belt for an open belt drive. 10
7. Explain the working of prony brake dynamometer with neat sketch. 10

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TH-2 Manufacturing Technology

Full Marks: 80

Time- 3 Hrs

Answer any five Questions including Q No.1& 2
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1. Answer **All** questions 2 x 10
 - a. State the properties of cemented carbide cutting tool.
 - b. Define rake angle.
 - c. List the operations carried out in a lathe.
 - d. How the material is removed in a shaper?
 - e. State the application area of a planer.
 - f. Write the functions of dividing heads in Milling operations.
 - g. How boring operation differs from drilling?
 - h. How do you classify the slotting machines?
 - i. Name the types of bond used in manufacturing of grinding wheel.
 - j. List out various surface finishing operations.

2. Answer **Any Six** Questions 6 x 5
 - a. Write down the desirable properties of coolants and lubricants. Give two example of cutting fluids.
 - b. Draw a neat sketch of a single point cutting tool indicating its complete geometry.
 - c. What are the differences between Capstan and Turret lathe?
 - d. Compare between planer and shaper.
 - e. With a neat sketch explain quick return mechanism of shaper machine.
 - f. Explain the term 'Grain', 'Grit', 'Structure' and 'Grade' of a grinding wheel.
 - g. Discuss hand lapping operation in brief.

3. What are the desirable properties of cutting tool materials? Describe any four with its principal characteristics and applications. 10
4. Describe various methods of taper turning carried out on a lathe. 10
5. With a neat sketch, explain the automatic table feed mechanism of a shaper machine. 10
6. Explain with example the procedures of simple and compound indexing. 10
7. With a block diagram, describe the function and working of Radial drilling machine. 10

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Th3 Fluid Mechanics

Full Marks: 80

Time- 3 Hrs

**Answer any five Questions including Q No.1& 2
Figures in the right hand margin indicates marks**

1. Answer **All** questions 2 x 10
 - a. Define meta centre and meta centric height.
 - b. Write the assumptions made in the derivation of Bernoulli's equation.
 - c. Write and explain Archimedes Principle.
 - d. Define Buoyancy and centre of Buoyancy.
 - e. Differentiate between laminar and turbulent flow.
 - f. Define notch and weir.
 - g. What is Pitot tube? Describe the use of it.
 - h. What is impact of jet?
 - i. Write the statement of Pascal's law.
 - j. Define capillarity.

2. Answer **Any Six** Questions 6 x 5
 - a. Derive the formula of force exerted by a fluid jet on a stationary flat plate placed normal to the jet.
 - b. Define Absolute pressure, gauge pressure, vacuum pressure and atmospheric pressure. Write the relation between them.
 - c. What is Newton's Law of viscosity? Write the relation between Dynamic viscosity and kinematic viscosity.
 - d. The diameter of the pipe at section 1 & 2 are 10cm and 30cm respectively. The velocity at section 1 is 5 m/s. calculate
 - (a) the velocity at section 2
 - (b) discharge through the pipe

- e. What are the different losses of energy in pipes? Write the expression for the head loss due to friction using
 - (a) Darcy's formula
 - (b) Chezy's formula
- f. Define pressure and pressure head.
Calculate the pressure due to a column of 0.4 m of
 - (i) water
 - (ii) an oil of specific gravity 0.9
- g. Define density, Specific weight, specific gravity of a fluid. Write the relation between them.

3 A horizontal venturimeter with inlet diameter 30cm and throat 15cm respectively is used to measure the flow of water. The reading of differential manometer connected to inlet and throat is 10 cm of mercury. Determine the rate of flow. Take $C_d = 0.98$. 10

4 A rectangular plane surface is 2.5 m wide and 4m deep. It lies in vertical plane in water. Determine the total pressure and position of the centre of pressure on the plane surface when its upper edge is horizontal and (a) coincides with water surface (b) 2m below the free water surface 10

5 The right limb of a simple U-tube manometer containing mercury is open to atmosphere while the left limb is connected to a pipe in which oil of specific gravity 0.8 is flowing. The center of pipe is 11cm below the level of mercury in the right limb. Find the pressure of fluid in the pipe of difference of Hg level in the two limbs is 21cm. 10

6 Define orifice. What are the different types of orifices. Write in detail about the flow through an orifice. 10

7 Write short notes on 2 x 5
 (a) Surface tension
 (b) HGL & TEL

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TH-4 Thermal Engineering -II

Full Marks: 80

Time- 3 Hrs

Answer any five Questions including Q No.1& 2
Figures in the right hand margin indicates marks

1. Answer **All** questions 2 x 10
 - a. Define specific fuel consumption?
 - b. Define wet steam and dry saturated steam?
 - c. Explain Newton's law of cooling?
 - d. Define FAD?
 - e. Write the mountings of boiler?
 - f. What is thermal conductivity and state its SI unit?
 - g. Define brake thermal efficiency?
 - h. Define mechanical efficiency of air compressor?
 - i. What are the various modes of heat transfer?
 - j. Differentiate between gas and vapour?

2. Answer **Any Six** Questions 6 x 5
 - a. Briefly explain different powers developed in IC engine?
 - b. Explain the construction of single acting reciprocating air compressor?
 - c. Differentiate between fire tube and water tube boiler?
 - d. Derive the efficiency of Rankine cycle?
 - e. Briefly explain the working of Cochran boiler?
 - f. State and explain Fourier's law of heat conduction?
 - g. A power plant is supplied with dry saturated steam at a pressure of 16 bar and exhaust at 0.3 bar.using the steam table find the efficiency of Carnot cycle?

- 3 A two stroke diesel engine develops a brake power of 420KW.the engine consumes 195kg/h of fuel and air fuel ratio is 22:1.calorific value of fuel is 42000KJ/Kg. If 76 KW power is required to overcome the frictional losses, calculate
1.mechanical efficiency
2.air consumption
3.brake thermal efficiency 10
- 4 Derive the expression of work input for a single acting air compressor without clearance volume? 10
- 5 The steam power plant operates on Rankine cycle has a boiler and condenser pressure of 60 bar and 0.1 bar respectively.steam coming out of the boiler is dry and saturated. Calculate thermal efficiency of the plant? 10
- 6 Explain different boiler draughts? 10
- 7 Write short notes. 4 x 2.5
(a)air fuel ratio
(b)dryness fraction
(c)Kirchhoff's law
(d)Volumetric efficiency