

**DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/MANAGEMENT/
COMMERCIAL PRACTICE, APRIL- 2023**

DESIGN OF MACHINE ELEMENTS

[Maximum marks: 100]

(Time: 3 Hours)

PART – A

Maximum marks : 10

I (Answer *all* the questions in one or two sentences. Each question carries 2 marks)

1. Define factor of safety.
2. What do you mean by pitch of a screw thread?
3. Recall the torsion equation for circular shaft.
4. Define sensitiveness of a governor.
5. List the four types of gear train system.

(5 x 2 = 10)

PART – B

Maximum marks : 30

II (Answer any *five* of the following questions. Each question carries 6 marks)

1. Explain bolts of uniform strength.
2. Draw the muff coupling and mark the necessary dimensions in terms of diameter of the shaft.
3. Explain thrust bearings with neat figures.
4. Write six differences between flywheel and governor.
5. Write six disadvantages of chain drive.
6. Draw the spur gear nomenclature and mark the important terms.
7. Identify initial stresses due to screwing up forces induced in screwed fastening when subjected to static loading and also give formula to find initial load in a bolt for fluid tight joint.

(5 x 6 = 30)

PART – C

Maximum marks : 60

(Answer one full question from each unit. Each full question carries 15 marks)

UNIT –I

III. (a) Explain general design procedure for machine elements.

(7)

- (b) A cylinder head is connected to the cylinder flange by means of 12 bolts. The inner diameter of the cylinder is 300mm and steam pressure 1.4N/mm^2 gauge. Assuming that the bolts are not stressed initially and the permissible stress in the bolt is not to exceed 50Mpa. Calculate the size of the bolts held in position. (8)

OR

- IV. (a) A screw jack having square threads of 50mm mean diameter and 12.5mm pitch is operated by a 500mm long hand lever. Coefficient of friction at the threads is 0.1. Determine the effort needed to be applied at the end of the lever to lift a load of 20kN. (8)
- (b) Explain the two functions of key and list the types of sunk keys. Write the main advantage of sunk key over saddle key. (7)

UNIT-II

- V. (a) Find the diameter of a solid steel shaft to transmit 20kW at 200 rpm. The ultimate shear stress for steel shaft may be taken as 360 Mpa and factor of safety 8. If a hollow shaft is to be used in place of a solid shaft, find the inside and outside diameter when the ratio of inside to outside diameter is 0.5. (8)
- (b) Write the requirements of couplings and list the three examples for rigid couplings. (7)

OR

- VI.(a) A flange coupling has 8 equally spaced bolts on a pitch circle diameter of 120mm. The maximum torque to be transmitted is 2500Nm. If the ultimate shear stress of the material is 350Mpa, estimate the minimum diameter of bolts required. Take factor of safety as 5. (8)
- (b) Find the power transmitted by a shaft of 60mm diameter at a speed of 100rpm, if the permissible shear stress is 50MPa. (7)

UNIT-III

- VII.(a) Design a cam for operating the exhaust valve of an oil engine. It is required to give equal uniform acceleration and retardation during opening and closing of the valve each of which corresponds to 60° of cam rotation. The valve must remain in the fully open position for 20° of cam rotation. The lift of the valve is 37.5mm and the least radius of the cam is 40mm. the follower is provided with a roller of radius 20mm and its line of stroke passes through the axis of the cam. (8)
- (b) Illustrate the principle of working of simple watt governor with the help of a diagram. (7)

OR

- VIII(a) The load on the journal bearing is 150kN due to turbine shaft of 300mm diameter running at 1800 rpm. Determine the following (i) Length of the bearing if allowable bearing pressure is 1.6MPa and (ii) Amount of heat to be removed by the lubricant per minute if bearing temperature is 60⁰C and the viscosity of oil at 60⁰C is 0.02kg/m-s and bearing clearance is 0.25mm. Assume leakage factor as 0.002. (8)
- (b) Explain the terms coefficient of fluctuation of speed and coefficient of fluctuation of energy of a flywheel. (7)

UNIT-IV

- IX. (a) Find the power transmitted by a belt running over a pulley of 600mm diameter at 200rpm. The coefficient of friction between the belt and the pulley is 0.25, angle of lap 160⁰ and the maximum tension in the belt is 2.5kN. (8)
- (b) Write any seven advantages of gear drive. (7)

OR

- X.(a) Two parallel shafts 600mm apart are connected by spur gearing. If the gear rotate at 150rpm and 600 rpm respectively. Determine the number of teeth required on each wheel, assuming the module of gears as 6mm. (8)
- (b) Explain compound gear train with the help of a diagram. Also find its speed ratio. (7)
