

**DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/MANAGEMENT/
COMMERCIAL PRACTICE, APRIL - 2026**

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 lead in a screw thread.
2. Write the torsion equation for circular shaft.
3. Define the term hunting in a governor.
4. What is the function of a bearing?
5. Define pitch point.

(5 x 2 = 10)

PART – B

(Maximum marks: 30)

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

1. Define ultimate stress, working stress and factor of safety.
2. Explain hollow saddle key and flat saddle key.
3. A solid circular transmission shaft of 100 mm diameter is subjected to a torque of 10 kN-m. Calculate maximum shear stress produced in the shaft.
4. Why is the roller follower preferred over the knife edge follower?
5. Explain thrust bearings with neat figures.
6. Distinguish between simple gear train and compound gear train.
7. Write the advantages of chain drive over belt drive.

(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) Calculate the optimal size of screws needed for a pipe hanger to withstand a tensile load of 9 kN, considering a working stress in tension of 40 MPa, with two screws utilized. (8)
- (b) Explain general design procedure for machine elements. (7)

OR

- IV. (a) A steam engine cylinder has an effective diameter of 300mm and maximum steam pressure acting on the cylinder cover is 1.5MPa. Calculate the number of studs required to fix the cylinder cover. Assuming the permissible stress in the stud is 50 MPa. (7)
- (b) A screw jack having square threads of 50 mm mean diameter and 12.5 mm pitch is operated by a 500 mm long hand lever. The coefficient of friction at the thread is 0.1. Determine the efforts required at the mean circumference of the threads to lift the load. (8)

UNIT – II

- V. (a) Discuss with the help of sketch, the design procedure of Muff coupling. (6)
- (b) Find the diameter of a solid steel shaft to transmit 20 kW at 200 r.p.m. The ultimate shear stress for the steel may be taken as 360 MPa and a factor of safety as 8. If a hollow shaft is to be used in place of the solid shaft, find the inside and outside diameter when the ratio of inside to outside diameters is 0.5. (9)

OR

- VI. (a) Derive an expression for design of a shaft of diameter 'd' subjected to twisting moment only. (6)
- (b) Design a muff coupling for a shaft transmitting 40 kW at 350 rpm, along with designing the shaft and muff, considering permissible shear stresses of 30 MPa for the shaft and 15 MPa for the muff, and assuming the maximum torque is 25% greater than the mean torque. (9)

UNIT - III

- VII. (a) Briefly explain the classification of bearings. (6)
- (b) 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 37.5 mm 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. (9)

OR

- VIII.** (a) Compare governors and flywheels. (6)
- (b) A journal with a diameter of 60mm and a length of 90mm operates at a speed of 450 rpm. It is lubricated with oil having an absolute viscosity of 0.06 kg/m-s. Given a diametral clearance of 0.1mm, determine the safe load on the bearing ($S = 14.3 \times 10^{-6}$). (9)

UNIT – IV

- IX.** (a) Explain compound gear train with the help of a diagram. Also find its speed ratio. (7)
- (b) Two pulleys, one 450 mm diameter and the other 200 mm diameter, on parallel shafts 1.95 m apart are connected by a crossed belt. Find the length of the belt required and the angle of contact between the belt and each pulley. (8)

OR

- X.** (a) Derive an expression for the velocity ratio of flat belt drive. (8)
- (b) A toothed wheel has 108 teeth. Its module is 1.25 mm. Find the circular pitch, pitch diameter and diametral pitch (7)
