

**DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/MANAGEMENT/
COMMERCIAL PRACTICE, APRIL - 2025**

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 the term working stress.
2. What is meant by lead of a screw?
3. What is meant by the strength of a shaft?
4. What is bearing in machine elements?
5. Define Pitch circle in gears.

(5 x 2 = 10)

PART – B

Maximum marks: 30

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

1. Differentiate overhauling and self-locking screws.
2. A Solid shaft is rotating at 200 r.p.m is to transmit 20 kW. The allowable shear stress of the shaft material is 42MPa. Determine the diameter of the shaft.
3. List the requirements of a good shaft coupling.
4. Explain the classification of bearings.
5. Compare flywheels and governors.
6. Explain the types of belts with diagrams.
7. Explain epicyclic gear train with a neat sketch.

(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) An eye bolt is to be used for lifting a load of 60 kN. Find the nominal diameter of the bolt, if the tensile stress is not to exceed 100MPa. (7)

(b) Explain any four types of sunk keys with neat sketches. (8)

OR

- IV. (a) A rectangular sunk key 14 mm wide, 10mm thick and 70mm long is required to transmit 1200Nm torque from a 50mm diameter solid shaft. Determine whether the length is sufficient, if the permissible shear stress and crushing stresses are limited to 56 N/mm^2 and 168 N/mm^2 . (7)
- (b) A Load of 2500 N is to be raised by a screw jack with a screw of 75 mm mean diameter and pitch of 12mm. Find the efficiency of the screw jack, if the coefficient of friction between the screw and the nut is 0.075. (8)

UNIT – II

- V. (a) A solid shaft transmits 560kW power at 300 rpm. The maximum shear stress of the material is 60 N/mm^2 . Find the suitable diameter of the shaft. (7)
- (b) Explain the procedure to design the muff coupling. (8)

OR

- VI. (a) A flange coupling uses 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 bolt material is 350 N/mm^2 , Estimate the minimum diameter of the bolts required. Consider a factor of safety of 5. (7)
- (b) A Solid shaft made of steel is subjected to a bending moment of 3000 Nm and a torque of 10000 Nm. The shaft material has an ultimate tensile stress of 700 N/mm^2 and ultimate shear stress of 500 N/mm^2 . Considering the factor of safety of 6, determine the diameter of the shaft. (8)

UNIT - III

- VII. (a) A flat foot step bearing 300mm supports a load of 25kN. If the coefficient of friction is 0.05 and the speed is 150 rpm, calculate the power lost at the bearing. (7)
- (b) Draw the profile of a cam operating a knife edged follower from following data:
- (i) Lifts the follower through 40mm during 60 degrees with Simple harmonic motion.
 - (ii) Follower remains at rest for the next 45 degrees of rotation of the cam.
 - (iii) Follower then descends to its original position during 90 degrees rotation of the cam with simple harmonic motion.
 - (iv) Follower remains at rest for the remaining part of revolution.
- The least radius of the cam is 50mm. (8)

OR

VIII. (a) Explain the working of a porter governor with a neat diagram. (7)

(b) Explain

(i) Maximum Fluctuation of speed

(ii) Maximum fluctuation of energy

(iii) Coefficient of Fluctuation of speed and

(iv) Coefficient of fluctuation of energy for a flywheel. (8)

UNIT – IV

IX. (a) Compare belt drive and chain drive. (7)

(b) A belt drive is designed to transmit 7.5 Kw at a belt speed of 12 m/s. The ratio of belt tensions is 2.25. Determine the angle of contact and belt tensions if coefficient of friction is 0.3. (8)

OR

X. (a) List the advantages and disadvantages of chain drive. (7)

(b) Two parallel shafts about 600mm apart are to be connected by spur wheels. One shaft is to run at 120rpm and the other at 360 rpm. Design the wheels, if the diametral pitch of the teeth is to be 0.25mm. (8)
