

DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/  
MANAGEMENT/COMMERCIAL PRACTICE — OCTOBER, 2017

DESIGN OF MACHINE ELEMENTS

[Time : 3 hours

(Maximum marks : 100)

PART — A

(Maximum marks : 10)

Marks

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

1. Define factor of safety.
2. State the purpose of couplings.
3. Explain the term "Hunting of governors".
4. State the ratio of belt tensions.
5. Define the module of a gear.

(5×2 = 10)

PART — B

(Maximum marks : 30)

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

1. Describe the self locking and overhauling conditions of screw jack.
2. Explain the bolts of uniform strength.
3. State the torsion equation and explain each term.
4. With a free hand sketch indicate the proportions of the parts of a muff coupling.
5. Compare the functions of Flywheel and governor.
6. A journal bearing whose diameter is 200 mm is subjected to a load of 50 kN, and the shaft makes 100 RPM. Find the work lost in friction, if the coefficient of friction is 0.02.
7. Mention the advantages and disadvantages of gear drive over the belt drive.

(5×6 = 30)

## PART — C

(Maximum marks : 60)

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

## UNIT — I

- III (a) A cylinder cover of a steam engine is secured by 12 studs. The cylinder is 0.3m diameter and has a steam pressure of  $1.2 \text{ N/mm}^2$ . Calculate the diameter of the studs, assuming the permissible stress to be  $30 \text{ N/mm}^2$ . 8

- (b) With the help of sketches explain different types of Keys. 7

Or

- IV (a) 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. Coefficient of friction at the thread is 0.1.

(i) Find the Efficiency of screw jack.

(ii) Check Whether it is self locking or overhauling.

- (iii) Determine the force needed to be applied at the end of the lever to lift the load of 20kN. 8

- (b) With the help of a sketch explain the important terms used in screw threads. 7

## UNIT — II

- V (a) A solid shaft is transmitting 1 MW power at 300 RPM. The Maximum allowable shear stress of shaft material is  $60 \text{ N/mm}^2$ . Maximum torque on shaft exceed the mean torque by 25%. Determine the diameter of solid shaft. The solid shaft is replaced by a hollow shaft of same material and same length. It's  $d/D$  ratio is 0.5. Calculate the percentage of material save. 8

- (b) Draw the rigid flange coupling and indicate the proportions of the parts in terms of diameter of the shaft. 7

Or

- VI (a) Design a Cast iron flange coupling to connect two shafts in order to transmit 7.5 kW at 720 RPM. The following permissible stresses may be assumed: Permissible shear stress for shaft, bolt and key material =  $33 \text{ N/mm}^2$ , Permissible crushing stress for key material =  $60 \text{ N/mm}^2$ , Permissible shear stress for Cast iron =  $15 \text{ N/mm}^2$ . 8

- (b) A solid shaft is transmitting 1 MW at 240 RPM. Determine the diameter of the shaft, if the maximum torque transmitted exceeds the mean torque by 20%. Take the maximum allowable shear stress as 60 MPa. 7

## UNIT — III

- VII (a) Draw the cam profile to give the following motion to a roller follower:

(i) Outward stroke during first  $60^\circ$  of cam rotation.(ii) Dwell for next  $15^\circ$  of cam rotation(iii) Return stroke during  $60^\circ$  of cam rotation.

(iv) Dwell for remaining part of cam rotation.

The stroke of the follower is 25 mm, the diameter of the roller is 20 mm, the minimum radius of cam is 40 mm. The line of stroke of follower passes through the centre of cam axis. The outward and return stroke takes place with uniform acceleration and retardation.

- (b) With a sketch explain the working of a simple Watt governor. 8

Or

- VIII (a) A foot step bearing supports a shaft of 120 mm diameter, running at 120RPM. The shaft is bored with a shallow hole of 40 mm at the end. If the bearing pressure is  $0.75 \text{ N/mm}^2$  and coefficient of friction is 0.015. Find : 8

(i) Load to be supported (ii) Power lost in friction (iii) Heat generated

- (b) Explain Turning Moment diagram (Crank - effort diagram). 7

## UNIT — IV

- IX (a) Find the power transmitted by a belt running over a pulley of 600 mm diameter at 200 RPM. The coefficient of friction between the belt and pulley is 0.25, angle of lap  $160^\circ$  and maximum tension in the belt is 2.5 kN. 8

- (b) With a sketch explain the Epicyclic gear train. 7

Or

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

- (b) List out the advantages and disadvantages of chain drive. 7