

TED (15) – 5021

(REVISION — 2015)

Reg. No.

Signature

DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/
MANAGEMENT/COMMERCIAL PRACTICE — APRIL, 2019

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 lead of a thread.
2. Define efficiency of a screw jack.
3. Write any two applications of coupling.
4. What is the function of a flywheel ?
5. What is slip in belt drive ?

(5 × 2 = 10)

PART — B

(Maximum marks : 30)

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

1. What are the advantages of threaded joints ?
2. Two screws for a pipe hanger must hold a tensile load of 10 kN. Calculate the most suitable size of screw. Take the working stress in tension is 45 MPa.
3. Derive an expression for the torque transmitted by a solid shaft.
4. Write the classification of followers.
5. Write six differences between flywheel and governor.
6. Explain velocity ratio of belt drive.
7. What are the advantages of gear 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 turn buckle is used to tighten a wire rope. The threads are single right and left hand and square in section. The outside diameter of the screw is 40 mm and the pitch is 8.5 mm. The coefficient of friction between the screws and nuts is 0.15. What torque on the turn buckle is necessary, if the rope is to be tightened to a tension of 8 kN ? 9
- (b) A 40 mm diameter shaft is subjected to a tangential force of 20 kN around its circumference. Determine the size of key. The allowable shear stresses in key is 60 MPa. 6

OR

- IV (a) In a steam engine maximum steam pressure is 1.2 MPa absolute and the back pressure is 0.015 MPa absolute. The cylinder diameter is 300 mm. Determine the diameter of the screwed end of the piston rod when the allowable stress is 45 MPa in tension. 9
- (b) A rectangular sunk key is used to connect a pulley to a 40 mm diameter shaft. The standard cross section of the key is 12 mm \times 8 mm and 65 mm long is required to transmit 750 N-m torque. The key and the shaft are made of same material. Determine whether the length is sufficient, if the permissible shear stress and crushing stresses are limited to 60 MPa and 150 MPa respectively ? 6

UNIT — II

- V (a) Design a muff coupling to connect two shafts transmitting 100 kW at 200 rpm. The permissible shearing and crushing stresses for shaft and key material are 50 MPa and 100 MPa respectively. The material of muff is cast iron with permissible shear stress of 15 MPa. Assume that the maximum torque transmitted is equal to the mean torque. 9
- (b) Derive the equation for the torque transmitted by a hollow shaft. 6

OR

- VI (a) Design shaft, hub and key for a flange coupling to transmit a torque of 250 N-m between two co-axial shafts. The shaft is made up of alloy steel, flanges out of cast iron and bolts out of steel. Four bolts are used to couple the flanges. The shafts are keyed to the flange hub. Take the permissible shear stress for shaft, bolt and key material as 50 MPa, crushing stresses for shaft, bolt and key material as 100 MPa and shear stress for flange material as 16 MPa. 9
- (b) What are the requirements of good couplings ? 6

UNIT — III

- VII (a) Draw the profile of a cam operating a knife edged follower from the following data.
- (i) it lifts the follower through 40 mm during 90° of cam rotation.
 - (ii) The follower remains at rest for the next 30° rotation of cam.
 - (iii) The follower descends to the original position during the next 120° of cam rotation.
 - (iv) The follower remains at rest for the remaining part of cam rotation.
- The least radius of cam is 50 mm. Assume uniform acceleration and retardation for both upward and downward strokes and the follower axis passes through the axis of the cam. 9
- (b) An axial thrust of 50 kN is carried by a plain collar type thrust bearing, having inner and outer diameters of 250 mm and 400 mm respectively. Assuming the coefficient of friction between the thrust surfaces is 0.02. Calculate the power lost in friction at a speed of 120 rpm. 6

OR

- VIII (a) Draw the profile of a cam to give the following motion to a roller follower.
- (i) Out stroke during 60° of cam rotation.
 - (ii) Dwell to the next 30° of cam rotation.
 - (iii) Return stroke during next 60° of cam rotation and
 - (iv) Dwell for the remaining part of cam rotation.
- The stroke of the follower is 20 mm and the minimum radius of the cam is 50 mm. The follower is radial and moves with simple harmonic motion. The radius of the roller is 15 mm and the follower axis passes through the axis of the cam. 9
- (b) A journal bearing whose diameter is 200 mm is subjected to a load of 50 kN and the shaft makes 100 rpm. Find the heat generated, if the coefficient of friction is 0.02. 6

UNIT — IV

- IX (a) Two pulleys 450 mm diameter and 200 mm diameter are on parallel shafts, 1.95m apart and are connected by a cross belt. Find the length of belt required and the angle of contact between belt and each pulley. What power can be transmitted by the belt when larger pulley rotates at 200 rpm, if the maximum permissible tension in belt is 1 kN and the coefficient friction between belt and pulley is 0.25 ? 9
- (b) Draw and mark the gear nomenclature. 6

OR

- X (a) A 300 mm diameter pulley running at 200 rpm is connected by belt to another pulley at a distance of 3 m. The second pulley has to rotate at 120 rpm. If the belt is 5 mm thick and slip between belt and pulley is 3% at each stage. Determine the diameter of the second pulley. Also find the length of belt if the drive is an open belt drive. 9
- (b) Write six disadvantages of chain drive. 6