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TED (10) – 4022

(REVISION — 2010)

Reg. No. ....

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FIFTH SEMESTER DIPLOMA EXAMINATION IN MECHANICAL  
ENGINEERING — MARCH, 2015

DESIGN OF MACHINE ELEMENTS

[Time : 3 hours

(Maximum marks : 100)

Marks

PART—A

(Maximum marks : 10)

I Answer the following questions in one or two sentences. Each question carries 2 marks.

1. Define factor of safety.
2. State the expression for maximum efficiency of a screw jack and name each term.
3. State the torsion equation and name each term.
4. Define pitch curve of a cam.
5. List the mode of transmission of mechanical power.

(5×2=10)

PART—B

(Maximum marks : 30)

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

1. Explain the various stresses acting on a screwed joint due to screwing up forces.
2. Two shafts are connected by means of a flanged coupling to transmit a torque of 215N-m. The flanges of the coupling are fastened by 4-bolts of the same material at a radius of 50mm. Find the size of the bolt if the allowable shear stress for the bolt material is 40MPa.
3. A hollow shaft of 160mm outside diameter and 120mm inside diameter, if the maximum allowable shear stress is 55MPa. What is the strength of the shaft ?
4. Differentiate sliding contact bearings and rolling contact bearings.
5. Differentiate flywheel and governor.
6. Discuss about creep of belt.
7. A spur gear having 30 number of teeth rotates at 200 r.p.m. What will be its circular pitch and the pitch line velocity if it has a module of 2mm.

(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) Explain different types of keys used to connect shafts and couplings. 7
- (b) Design a rectangular key for a shaft of 45mm diameter. The shearing and crushing stresses in the key are limited to 80MPa and 240 MPa. 8

OR

- IV (a) Discuss overhauling and self locking of screw jack. 7
- (b) What force will be required at a radius of 80mm to raise or lower a 11KN crossbar of a planer which is raised and lowered by two 38mm square thread single start screw having a pitch of 7mm ? The outside and inside diameter of collar are 76mm and 38mm respectively. Assume the coefficient of friction at the threads as 0.11 and at the collar as 0.13. Consider uniform pressure. 8

## UNIT—II

- V (a) "A hollow shaft has greater strength and stiffness than solid shaft of same length material and weight". Explain. 7
- (b) A factory line shaft is 4.5m long and is to transmit 75KW at 200 r.p.m. The allowable fibre stress in shear is 49MPa and the maximum allowable twist is 1 in a length of 20 diameters. Determine the required shaft diameter. Take modulus of rigidity as 84GPa. 8

OR

- VI (a) A flanged coupling has 8 equally spaced bolts on a pitch circle diameter of 120mm. The maximum torque to be transmitted is 2500N-m. If the ultimate shear stress of the bolt material is 350MPa, estimate the minimum diameter of bolts required. Take factor of safety as 5. 7
- (b) Design and sketch a cast iron flanged coupling for a shaft transmitting 15KW at 200 r.p.m. and having an allowable shear stress of 40MPa. The working stress in the bolt should not exceed 30MPa. Assume that the same material is used for shaft and key and the crushing stress in 100MPa. The maximum torque is 25% greater than the full load torque. The shear stress for cast iron is 14MPa. 8

## UNIT—III

- VII (a) Illustrate the variation of coefficient of friction with bearing characteristic number with the help of necessary line diagram. 7
- (b) Draw the profile of a plate cam operating with a knife edge follower:
- (i) Follower lifts through 40mm during  $90^\circ$  cam rotation.
  - (ii) The follower remains at rest for the next  $30^\circ$  cam rotation.
  - (iii) The follower descends for the next  $120^\circ$  of cam rotation
  - (iv) The follower remaining at rest for the remaining part of the cam rotation. The least radius of the cam is 50mm. Assume uniform acceleration and deceleration for the upward and downward strokes and the follower axis passes through the axis of the cam. 8

OR

- VIII (a) List and explain the different types of displacement diagrams of plate cam. 7
- (b) The arms of a porter governor are 250mm long and pivoted on governors spindle axis. Mass of each ball is 4kg and mass of central sleeve is 15kg. The height of governor is 200mm when the sleeve begins to rise and it reduces to 150mm for maximum speed. Determine :
- (i) Radii of rotation at minimum and maximum speed.
  - (ii) The range of speed.
  - (iii) Sleeve lift. 8

## UNIT—IV

- IX (a) Enumerate the advantages of gear drive. 7
- (b) A flat belt make contract with a 350mm diameter pulley over an angle of  $160^\circ$ . The co-efficient of friction is 0.3 and the speed of the pulley is 1200 r.p.m. If the maximum allowable tension in the belt is 550N, calculate the maximum torque and maximum power that can be transmitted by the belt. 8

OR

- X (a) Discuss simple gear train and reverted gear train. 7
- (b) A spur gear wheel of 300mm PCD and rotating at 210 r.p.m. drives a machine using 3.5kW. Neglecting friction calculate the tangential effort exerted at the teeth of the spur gear wheel. 8