

TED (15) - 5021  
(REVISION-2015)

N21-07018

Reg.No.....

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**DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/MANGEMENT/  
COMMERCIAL PRACTICE - NOVEMBER 2021**

**DESIGN OF MACHINE ELEMENTS**

(Maximum Marks:75)

(Time: 2¼ hours)

**PART - A**

**Marks**

- I. Answer **any three** questions in one or two sentences. Each question carries 2 marks.
1. Define the efficiency of a screw jack.
  2. Give 2 examples for rigid couplings.
  3. What is meant by base circle of a cam?
  4. What is turning moment diagram?
  5. Define the circular pitch of a gear. ( 3 x 2 = 6 )

**PART - B**

- II Answer **any four** of the following questions. Each question carries 6 marks.
1. Describe about overhauling and Self-locking of screw jack.
  2. Describe about sunk key, saddle key and feather key.
  3. Describe about design of shafts based on strength and rigidity considerations.
  4. Describe about sensitiveness of a governor. What happens if the governor is too sensitive.
  5. Explain about different types of thrust bearings.
  6. Compare between gear drive and belt drive.
  7. With the help of a diagram, explain about compound belt drive. ( 4 x 6 = 24 )

**PART - C**

(Answer **any of the three units** from the following. Each full question carries 15 marks.)

**UNIT - 1**

- III a) With the help of a neat diagram, explain the nomenclature of a screw thread. (8)

- b) A shaft of 50mm diameter is transmitting 20 kW at 200rpm. A square key having 14 mm side and 80mm long is used to connect a gear with the shaft. Determine the induced shear stress and the compression stress in the key. (7)

**OR**

- IV (a) A screw jack having square threads of 60mm mean diameter and 12mm pitch is operated by a 500mm long hand lever. Coefficient of friction at the threads is 0.1 . Determine the efforts needed to be applied at the end of the lever to lift a load of 30 kN. (8)
- (b) A cylinder head of a steam engine is held by 12 bolts. The effective diameter of the cylinder is 400mm. The steam pressure is 0.85 MPa. Find the size of the bolt if the permissible stress in the bolt is 20MPa. (7)

**UNIT – II**

- V (a) Design a cast iron flange coupling to connect two shafts of 100 mm diameter. The shaft runs at 300 rpm and transmits a torque of 6 kN-m. Assume permissible shear stress for shaft, bolt and keys as 50 MPa. The permissible crushing stress for bolt and key material may be taken as 100MPa. For cast iron flange, the allowable shear stress is 8 MPa. (9)
- (b) A steel spindle transmits 1.5MW power at 200rpm. The angular deflection should not exceed  $1^\circ$  per metre of the spindle. If the modulus of rigidity for the material of the spindle is 84 GPa. Find the diameter of the spindle and shear stress induced in the spindle. (6)

**OR**

- VI (a) Design a muff coupling to connect to shafts transmitting 100 kW at 200 rpm. The permissible shearing and crushing stresses for shaft and key material are 55 MPa and 110 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) A hollow shaft of external and internal diameters 120mm and 60 mm is transmitting power at 100 rpm. Find the power transmitted by the shaft, if the shearing stress is not to exceed 40 MPa. (6)

**UNIT – III**

- VII (a) A 400mm diameter shaft running in a journal bearing carries a load of 2500 N. If the coefficient of friction between the shaft and the bearing is 0.03, determine the power loss when it runs at 1500 rpm. (5)
- (b) Draw the profile of a plate cam operating a knife edged follower from the following data:
- 1) It lifts the follower through 40 mm during 90° of cam rotation.
  - 2) The follower remains at rest for the next 30° of cam rotation
  - 3) The follower descends to the original position during the next 60° of cam rotation.
  - 4) The follower remains at rest for the remaining part of cam rotation.
- The least radius of cam is 40 mm. Assume simple harmonic motion for both upward and downward strokes and the follower passes through the axis of the cam. (10)

**OR**

- VIII (a) With a neat diagram, Explain the cam terminology (9)
- (b) Explain the difference between fly wheel and governor (6)

**UNIT – IV**

- IX (a) Find the power transmitted by a belt running over a pulley of 800mm diameter at 300 rpm. The coefficient of friction between the belt and pulley is 0.25. Angle of lap is 160° and the maximum tension in the belt is 3 kN. (8)
- (b) Two pulleys 800 mm and 400 mm diameters are connected by a belt. Central distance between the pulleys is 5 metres. Find the length of belt required for (a) open belt drive and (b) Cross belt drive. (7)

**OR**

- X (a) With neat diagrams, explain about different types of gear trains. (8)
- (b) A set of spur gears for the gearing of a machine are arranged as follows. A drives B, C drives D and E drives F. Gears B and C and gears D and E are compound gears. When  $T_A=30$ ,  $T_B=60$ ,  $T_C=20$ ,  $T_D=75$ ,  $T_E=25$  and  $T_F=70$  teeth. If gear “A” rotates in clock wise direction at 1000 rpm. Find the speed and direction of rotation of follower gear F. (7)

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