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(REVISION — 2015)

Reg. No. .....

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DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/ MANAGEMENT/COMMERCIAL PRACTICE — APRIL, 2018

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. What is root of a thread ?
2. What are the basic functions of key ?
3. What is meant by strength of a shaft ?
4. Define radial and thrust bearings ?
5. What is creep 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 assumptions made for the design of cylinder cover bolts ?
2. A generator weighing 20 kN is to be provided with an eye bolt in the housing for lifting purposes. Find the size of bolts if it is made of C- 40 steel. If the ultimate tensile strength of C- 40 steel is 600 MPa and the factor of safety is 6 ?
3. Compare the strength of a hollow shaft and solid shaft having same material, length and weight.
4. Differentiate between thrust bearing and journal bearing.
5. What is sensitiveness and hunting ?
6. Write six comparisons between v-belt and flat belt drive.
7. Write six advantages of chain drive over belt drive. (5 × 6 = 30)

Marks

PART — C

(Maximum marks : 60)

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

UNIT — I

III (a) Find the force to be applied at the end of one metre long handle of a screw jack so that a load of 7 kN is lifted with constant velocity. The screw is square threaded having a pith of 16 mm and root diameter 50 mm. The coefficient of friction between the screw and nut is 0.16. 9

(b) An eye bolt carries a tensile load of 18 kN. Find the size of the bolt, if the tensile stress is not to exceed 100 MPa. 6

OR

IV (a) The effective diameter of a cylinder is 0.5m and the highest pressure of steam acting on the cylinder head is 1.2 MPa. Allowable stress in tension of bolt material is 35 MPa. If the cylinder head is held by 10 bolts, find the size of the bolts. 9

(b) Two shafts are connected by means of a flange coupling to transmit torque of 210 N-m. The flange of the coupling are fastened by four bolts of the same material at a radius of 50 mm. Find the size of the bolts, if the allowable shear stress for the bolt material is 40 MPa. 6

UNIT — II

V (a) Design a muff coupling to connect two shafts transmitting 90 kW at 180 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) Explain different types of couplings. 6

OR

VI (a) Design the flange, bolt and key for a cast iron flange coupling to connect two shafts of 100 mm diameter. The shaft runs at 250 rpm and transmits a torque of 5 kN-m. Assume permissible shear stress for shaft, bolt and key as 50 MPa. The permissible crushing stress for bolt and key material may be taken as 100 MPa. For cast iron flange, the allowable shear stress is 8 MPa. 9

(b) Derive the equation for the torque transmitted by a hollow shaft. 6

Marks

UNIT — III

VII (a) Draw the profile of a cam operating a knife edged follower from the following data.

(i) Follower to move outwards through 40 mm during 60° of cam rotation.

(ii) Follower to dwell for the next 45°.

(iii) Follower to return to its original position during next 90°.

(iv) Follower to dwell for the rest of the cam rotation.

The displacement of the follower is to take place with simple harmonic motion during both the outward and return stroke. The least radius of the cam is 50 mm. 9

(b) The load on journal bearing due to the turbine shaft of 300 mm diameter is 150 kN. The shaft rotates at 1800 rpm. Determine (i) Length of bearing if allowable bearing pressure is 1.6 MPa and (ii) Amount of heat to be removed by the lubricant, if coefficient of friction is 0.011. 6

OR

VIII (a) Construct a cam profile using the following data.

Outstroke during 60° of rotation.

Dwell for next 30° of rotation.

Return stroke for next 60° of rotation

Dwell for the rest of motion

Stroke of follower is 20 mm. Minimum radius of cam is 50 mm. Axis of knife edged follower is offset by 20 mm from the axis of cam. The follower moves with uniform velocity during both outward and return stroke. 9

(b) A Journal bearing having a diameter of 65 mm is subjected to a load of 5 kN at a speed of 200 rpm. If the length to diameter ratio is 3 and coefficient of friction is 0.02. Find the bearing pressure and heat generated. 6

UNIT — IV

IX (a) Two pulleys 600 mm and 400 mm diameters are connected by a belt. Central distance between the pulleys is 6 metres. Find the length of belt required for (i) Open belt drive and (ii) Cross belt drive. 9

(b) List and sketch different types of flat belt drive. 6

OR

X (a) A flat belt makes contact with a 350 mm diameter pulley over an angle of 160°. The coefficient of friction is 0.3 and the speed of the pulley is 1200 rpm. If the maximum allowable tension in the belt is 550 N. Calculate the maximum torque and maximum power that can be transmitted by the belt. 9

(b) Write six advantages of gear drive. 6