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(Revision - 2015)

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DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/ MANAGEMENT/COMMERCIAL PRACTICE, NOVEMBER – 2020

DESIGN OF MACHINE ELEMENTS

[Maximum Marks: 75] [Time: 2.15 Hours]

PART-A

(Answer ***any three*** questions in one or two sentences. Each question carries 2 marks)

I. 1. Define ultimate stress.
2. What is lead of a screw?
3. List the different stresses induced in shaft.
4. State the function of a governor.
5. Define slip in belt drive. (3 x 2 = 6)

PART-B

(Answer ***any four*** of the following questions. Each question carries ***6*** marks)

II 1. Write six advantages of threaded fastenings.
2. Differentiate between overhauling and self-locking of screws.
3. A solid shaft is to transmit a torque of 20 kN-m. If the maximum shear stress induced in the shaft is not to exceed 55 MPa, find the maximum diameter of the shaft.
4. Write the design procedure of a sleeve or muff coupling.
5. What is sensitiveness and hunting?
6. Write six comparisons between v-belt and flat belt.
7. Write six advantages of gear drive over belt, rope and chain drives. (4 x 6 = 24)

PART-C

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

UNIT – I

III (a) A cylinder has an effective diameter 300 mm, it is subjected to a maximum steam pressure of 1.5 N/mm^2. Cylinder cover is fixed by means of 16 studs. Permissible tensile stress in studs is limited to 30 MPa. Determine the size of studs. (8)

(b) A 40 mm diameter shaft is subjected to a tangential force of 20 kN around its circumference. Determine the size of the key. The allowable shear stress in key is 60 MPa. (7)

OR

IV (a) A screw jack has a double square threaded screw of mean diameter 50 mm and pitch 10 mm. The coefficient of friction between the screw and nut is 0.1, neglecting the collar friction. Calculate the torque required to be applied on the screw for lifting a load of 25kN. (8)

(b) Two screws of a pipe hanger must hold a tensile load of 9 kN. Calculate the most suitable size of screw. Take the working stress in tension is 40 MPa.. (7)

UNIT – II

V (a) Design hub and flange of a rigid flange coupling to transmit a maximum 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. Take the permissible shear stresses for shaft, bolt and key material are 50 MPa and crushing stresses for shaft, bolt and key material are 100 MPa. Shear stress for flange material is 16 MPa. (8)

(b) A hollow shaft having an inside diameter 60% of its outer diameter and has to transmit 200 kW at 800 rpm. If the shear stress is not to exceed 60MPa. Find the outside and inside diameters of the shaft. (7)

OR

VI (a) Design a sleeve or muff coupling for a shaft transmitting 40 kW at 140 rpm. The allowable shear and crushing stresses for shaft and key which are made of mild steel are 42 MPa and 84 MPa respectively. The material of the muff is cast iron with permissible shear stress of 14 MPa. Assume that the maximum torque transmitted is equal to the mean torque. (8)

(b) A mild steel shaft transmitting power is subjected to a torque of 2860 N-m. If the angle of twist is 1^0 in a length of 1498 mm and the modulus of rigidity is 79 GPa. Calculate the diameter of the shaft in mm. (7)

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 60^0 of cam rotation.

(ii) Follower to dwell for the next 45^0.

(iii) Follower to return to its original position during next 90^0.

(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. (8)

(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 coefficient of friction is 0.02. (7)

OR

VIII (a) Draw the profile of a cam to give the following motion to a roller follower.

(i) Outstroke during 60^0 of rotation.

(ii) Dwell for next 30^0 of rotation.

(iii) Return stroke for next 60^0 of rotation.

(iv) Dwell for the rest of motion.

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 10mm? (8)

(b) A flat foot step bearing 180 mm diameter supports a load of 30 kN. If the coefficient of friction is 0.04 and the speed 120 rpm. Calculate the power lost at the bearing in overcoming friction. (7)

UNIT - IV

IX (a) Two parallel shafts 5 meters apart are provided with pulleys 500 mm and 750 mm in diameter. Find the length of the belt for turning the shafts in the same direction and for turning the two shafts in the opposite direction. (8)

(b) An engine shaft running at 150 rpm is required to drive a machine shaft by a belt. The pulley on the engine shaft is 2m diameter and that of the machine shaft is 1m diameter. If the belt thickness is 6 mm. Determine the speed of the machine shaft, assume slip = 0. (7)

OR

X (a) Two pulleys of 250 mm and 500 mm diameter are connected by a flat belt. Calculate the angle of lap if the centre distance is 1.5 m., when (i) an open belt drive is used and (ii) a crossed belt drive is used. (8)

(b) A 400 mm diameter pulley is driven at 750 rpm by a flat belt with a tight side tension of 300 N and slack side tension of 45.35 N. Determine the power transmitted by the belt. (7)
