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DIPLOMA EXAMINATION IN ENGINEERING/ TECHNOLOGY /MANAGEMENT/ COMMERCIAL PRACTICE, APRIL-2021

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). What is Factor of Safety?
(2). What are the different types of power screws?
(3). What are the properties needed for selecting a shaft material?
(4). Define Dwell in CAM
(5). What are the materials used for making gears? (3 x 2 = 6)

PART – B

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

II. (1). What are the factors considered while designing a machine element?
(2). A MS bolt has a joint with a metallic part through a steel washer. The initial tension due to tightening of the bolt is 65 KN. The external load is 20KN. If the ratio of elasticity MS bolt to sleeve washer is 0.01. find the resultant load
(3). Derive the expression for designing of shaft subjected to torsion
(4). Draw the figure of Flange coupling and mark the main parts
(5). Mention 3 advantages and disadvantages of Rolling contact bearing
(6). What are the classifications of Governors?
(7). Determine the power transmitted by belt (4 x 6= 24)

PART – C

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

UNIT –I

III. (a). A cylinder cover of a steam engine is secured by 6 studs, the cylinder is 0.3m diameter and has a steam pressure of 1.2N/mm^2 gauge. Calculate the diameter of the studs assuming the permissible stress intensity to be 30N/mm^2 (8)

(b). A load of 3000N is to be raised by a screw jack with a screw of 75mm mean diameter and a pitch of 12mm. Find the efficiency of the screw jack, if the coefficient of friction between the screw and the nut is 0.075 (7)

OR

IV. (a). Write the procedural steps in designing a machine element and explain (8)

(b). Two machine elements are fastened together tightly by means of a 30mm tap bolt Compute the stress developed in the bolt due to initial tightening, if the force tending to separate the elements is negligible. Assume pitch of 2mm (7)

UNIT-II

V. (a). A solid shaft is transmitting 1 MW at 300rpm. Determine the diameter of the shaft if the maximum torque transmitting exceeds the mean torque by 30%. Take the maximum allowable shear stress as 60N/mm^2. Also compute the outside and inside diameters of the hollow shaft if it is used for the same purpose. What will be the percentage of material saving if the solid shaft is replaced by hollow shaft? Take diameter ratio, K=0.5 (8)

(b). Compare the weight, strength and stiffness of a hollow shaft of the same external diameter as that of solid shaft. The inside diameter being 60% of external diameter. Both have the same material and length (7)

OR

VI. (a). The permissible shearing and crushing stresses for the shaft and key material are 50N/mm^2 and 100N/mm^2 respectively. The material of muff is Cast Iron with a permissible shear stress of 15N/mm^2. Assume that the ratio of maximum torque to mean torque is 1:1. Design a muff coupling to connect two shafts transmitting 100KW at 200rpm. (9)

(b). A flange coupling uses 8 equally spaced bolts on a pitch circle diameter of 120mm. The maximum torque to be transmitted is 2500Nm. If the ultimate shear stress of the bolt material is 350N/mm^2. Estimate the minimum diameter of bolts required, if factor of safety is 4 (6)

UNIT-III

VII. (a). A flat collar bearing has internal and external diameter of 60mm and 100mm respectively

and the coefficient of friction is 0.05. Assuming the pressure is uniform at 0.15N/mm^2. Calculate the power lost in friction at a speed of 5 Rev/sec. (8)

(b). A journal bearing 60mm in diameter and 90mm long runs at 450rpm. The oil used for hydrodynamic lubrication has absolute viscosity of 0.06kg/ms. If the diametrical clearance is 0.2mm, find the safe load on the bearing (7)

OR

VIII. (a). Draw the profile of a CAM to give the following motion to a reciprocating follower with a flat face contact. Outstroke for 120^0 of rotation, Dwell for next 30^0, Return stroke for next 120^0, Dwell for the remaining. The stroke of the follower is 30mm and the minimum radius of cam is 25mm. The follower moves with uniform velocity for both strokes. The axis of the follower passes through the axis of the cam shaft. (8)

(b). In a porter governor two balls of weight 30N each are joined by 4 equal links of length 300mm each. A dead weight of 320N is used on the sleeve at the center. If the radius of rotation is 240mm, find the equilibrium speed. (7)

UNIT-IV

IX. (a). An induction motor drives the main shaft by means of a flat belt. The diameter of the pulley of the motor shaft and main shaft are 450mm and 750mm respectively. Another pulley of 500mm, diameter mounted on the main shaft drives a 700mm pulley which is keyed to counter shaft. If there is 2% slip on each drive, determine the speed of counter shaft. Neglect the thickness of belt and assume motor runs at 1400rpm. (8)

(b). Find the power transmitted by a belt running over a pulley of 750mm at 200rpm. The coefficient of friction between the belt and the pulley is 0.25, angle of lap 160 and the maximum tension in the belt is 2.5kN. (7)

OR

X. (a). Design a reverted gear train of 4 gears to give a speed reduction of 15. All gears are to be of same pitch. No gear is less than 15 teeth (8)

(b). Two parallel shafts about 600mm apart are connected by spur wheels. One shaft is to run at 120rpm and other at 360rpm. Design the wheel if the diametrical pitch of the teeth is to be 0.2. (7)

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