Total No. of Questions : 8] *[Total No. of Printed Pages : 3*

Roll No .....

ME-5003 (CBGS)

B.E. V Semester

Examination, November 2018

Choice Based Grading System (CBGS)

Design of Machine Elements

Time : Three Hours

Maximum Marks : 70

Note: i) Attempt any five questions.

ii) All questions carry equal marks.

iii) Assume suitable data, if necessary. Use of Design Data Book is permitted.

1. a) Enumerate the steps involved in the design procedure for the machine elements. 4

   b) What is stress concentration? Draw stress concentration in tension, bending and torsion. 5

   c) Explain about the concept of factor of safety for designing a machine component used in high precision machinery and low precision machinery? 5

2. a) Discuss various types of misalignments, which normally occur between two shafts. 4

   b) A marine engine shaft and coupling are to be designed for flange coupling to transmit 2900 kW at a speed of 100 rev/min. Flanges are connected by 8 taper bolts having a permissible shear stress of 60 MPa. The material of the shaft and bolts used is same. Design the flange coupling and determine the shaft diameter. 10

3. a) Explain the theories used for designing shaft subjected to combined bending and twisting moments. 4

   b) The shaft of a rolling machine is driven by means of a motor placed horizontally. The flywheel which also acts as pulley is of 1.5 m diameter and has belt tensions 5.4 kN and 1.8 kN on tight sight and slack side, respectively. The weight of the flywheel is 15kN. Determine the shaft diameter if maximum allowable shear strength is 50 N/mm^2. The overhang of the flywheel is 250mm. 10

4. a) Differentiate between a clutch and coupling. Give a brief classification of clutches. 4

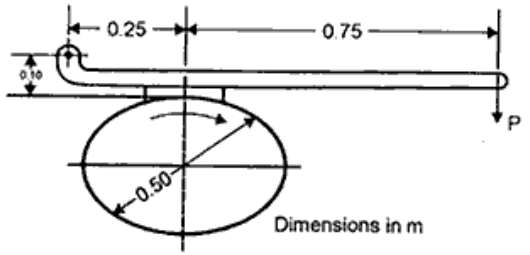
   b) Find out the diameter of cast iron pulleys and the thickness and width of a leather belt of belt speed of 20 m/s to transmit 129.5 kW power from a shaft that is directly connected to a steam engine running at 32.6 rad/s, to a centrifugal pump with a speed ratio of 1:3.6. Consider slip of 2% and service factor of 1.2. 10

5. a) What is belt slip and creep? Clearly make a difference between the two. 4

   b) Design a roller chain drive to transmit power from a 15 kW motor to a reciprocating pump. The pump is to operate continuously 24 hr per day. The speed of the motor is 570rev/min and that of the pump is 200rev/min. Decide upon the number of teeth on each sprocket. Find the pitch and width of the chain. 10

6. a) What is the drawback of a single shoe brake? How do you overcome this? 4

b) The block brake shown in figure is to balance a torsional moment of 575 Nm on the drum shaft. Assuming the co-efficient of friction between brakes shoe and drum to be 0.25. Determine the operating force 'P' required. 10



7. a) Why is dynamic load not a problem in worm wheel gears? 4

b) Determine the main dimensions of a cone clutch. It is to be faced with leather and is to transmit 30kW at 750 rev/min from an electric motor to an air compressor. Also find the axial force that must be produced by the spring. 10

8. a) Define contact ratio. What are its limits? 4

b) It is required to design a pair of spur gears with 20° full-depth involute teeth consisting of a 20-teeth pinion meshing with a 50 teeth gear. The pinion shaft is connected to a 22.5 kW, 1450 rpm electric motor. The starting torque of the motor can be taken as 150% of the rated torque. The material for the pinion is plain carbon steel Fe 410 (S_{ut} = 410 N/mm^2), while the gear is made of grey cast iron FG 200 (S_{ut} = 200 N/mm^2). The factor of safety is 1.5. Design the gears based on the Lewis equation and using velocity factor to account for the dynamic load. 10

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