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9. In a single block brake, the drum diameter is 300 mm and the contact angle is  $90^\circ$ , the coefficient of friction for the brake lining and drum is 0.30, if the operating force is 400 N, applied at the end of the lever 400 mm long, determine the torque transmitted by the brake. The distance of the fulcrum from the centre of the brake drum is 200 mm and assume that the force of friction passes through the fulcrum. 20

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B. Tech. 5th Semester (ME) F. Scheme Examination,  
December-2017

MECHANICAL MACHINE DESIGN-I

Paper-ME-303-F

*Time allowed : 4 hours]*

*[Maximum marks : 100*

*Note : Attempt any five questions in total, at least one question from each section. Question no. 1 is compulsory. Each question carries equal marks (20 marks). Use of PSG design data book is permitted.*

1. Discuss the following : 5×4
- (a) Reverse engineering and Redesign
  - (b) Design of keys
  - (c) Bolt preloading
  - (d) Self energizing condition of brakes.

Section -A

2. (a) Describe the factors to be considered in design for technical and environmental feasibility. 10
- (b) Discuss the classification of engineering materials in detail. 10

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3. (a) Discuss about interchangeability and selection of fits and tolerances for design of machine elements. 10
- (b) Why is it not possible to determine elastic limit in a single tensile test? What is cold shortness? 10

**Section –B**

- 4 (a) A piston rod of a steam engine is connected to crosshead by a cotter joint. Design the joint if the piston diameter is 300mm and maximum steam pressure is 1.2 MPa. The design stresses for all the parts are  $\sigma_d = 60 \text{ N/mm}^2$ ,  $\sigma_{dc} = 90 \text{ N/mm}^2$ , and  $\tau_d = 35 \text{ N/mm}^2$ . 10
- (b) What are the methods of increasing the fatigue strength of bolted joint? How will you designate ISO metric thread? 10
5. (a) A turn-buckle is used to tighten a wire-rope, right hand and left hand single start square threads are employed. The outside diameter of the screw is 38 mm and pitch is 8.5 mm. if the coefficient of friction between screw and nut is 0.15, determine the torque on the turn-buckle for a tightening load of 8,000 N. 10

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- (b) What are the different stresses developed in the welded joint? Explain with figure. 10

**Section –C**

6. (a) Describe rigid and flexible coupling with sketch. 10
- (b) The diameters of the driving and driven pulleys are 900 mm and 1200 mm respectively and the centre distance is 3 meters. The output of the driven shaft is 110 kW. Take  $v = 21 \text{ m/s}$ ,  $\mu = 0.3$ ,  $\sigma_d = 3 \text{ MPa}$ ,  $s = 1.5\%$ ; friction loss at each shaft is 5%. Design the belt. 10
7. (a) What is meant by simplex and duplex roller chains? What are the types of failure in roller chain? 10
- (b) What is the role of flywheel in presses? Derive the expression for bending stress in flywheel. Also discuss various stresses in flywheel arms. 10

**Section –D**

8. A clutch has a single pair of mating surface 300 mm outer diameter and 225 mm inner diameter,  $\mu = 0.25$ ,  $p_{\max} = 825 \text{ kPa}$ . Find the torsional capacity for both uniform pressure and uniform wear theory. Justify the different values of T.

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