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B.E./B.Tech SEMESTER ARREAR EXAMINATIONS, APRIL/MAY 2012

MECHANICAL ENGINEERING

5TH SEMESTER – (R-2008)

ME 9305 – DESIGN OF MACHINE ELEMENTS

34

Time : 3 Hrs

Max.marks: 100

NOTE:

- (i) PSG design data book is allowed
- (ii) Assume any missing dimensions suitably and logically.

Answer all Questions

PART – A (10 x 2 = 20)

1. Define fit and enlist its types
2. What do you mean by principal stresses and principal planes?
3. Define Jackshaft.
4. What are splines? Where they are used?
5. What are the varieties of steel wires available for the majority of the applications?
6. Define quill bearings
7. Define hydrostatic lubrication.
8. What is spring surge and how it can be avoided?
9. How a size of the screw thread is designated?
10. Write any two disadvantages of welding joint.

PART – B (5 x 16 = 80)

11. (i) A Journal bearing 75 mm long supports a load of 7.3 kN on a 50 mm diameter journal turning at 750 rev/min. The diametral clearance is 0.07 mm. What should be the viscosity of the oil if the operating temperature of the bearing surface is to be limited to 75°C when in still air at 20°C? Use the McKee and Lasche equations and assume the heat generated equals the heat dissipated. (10 marks)

(ii) Compare sliding contact bearings with rolling contact bearings (6 marks)

12.(a) A cantilever beam of I section supports an electric motor weighing 1000 N at a distance of 400 mm from the fixed end. If the allowable strength of the beam material is 100 N/mm^2 , determine the section of the beam. The proportions of I section are $B = 4t$ and $H = 6t$ where t is thickness of the flange as well as that of web. (16 marks)

(OR)

12.(b) A C clamp as shown in fig 12(b) carries a load of 25 kN. The cross section of the clamp at section X-X is rectangular having a width equal to twice the thickness. Assuming that the clamp is made of steel having allowable strength of 100 N/mm^2 , find its dimensions. Also determine the stresses at sections Y-Y and Z-Z. (16 marks)

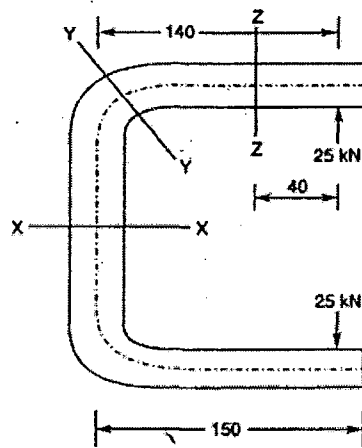


FIG 12(b)

13.(a) The layout of an intermediate shaft of a gear box supporting two spur gears B and C is shown in fig 13(a). The shaft is mounted on two bearings A and D. The pitch circle diameters of gears B and C are 900 and 600 mm respectively. The material of the shaft is steel FeE 580 ($S_{ut}=770$ and $S_{yt}=580 \text{ N/mm}^2$). The factors K_b and K_t of ASME code are 1.5 and 2 respectively. Determine the shaft diameter using the ASME code. Assume That the gears are connected to the shaft by means of keys. (16 marks)

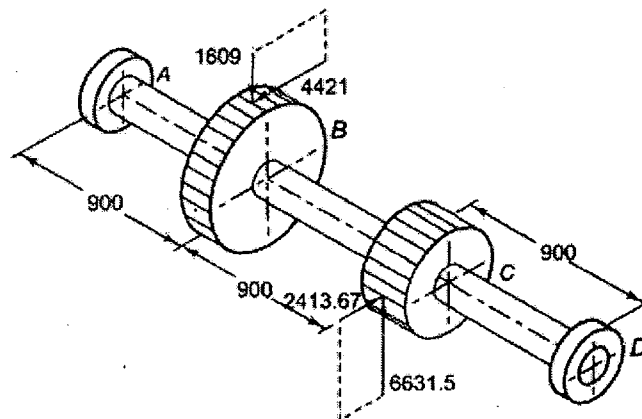


FIG 13(a)

(OR)

13.(b)(i) What is a key? Sketch the all common types of keys. (6 marks)

(ii) A shaft is required to transmit 16 kW at 500 rpm. Select a suitable key of rectangular cross section, if the hub length is 60 mm. Take allowable shear and crushing stresses for material used as 72 MPa and 140 MPa respectively. (10 marks)

14(a) (i) A cylinder head of a steam engine is held in position by M20 bolts. The effective diameter of the cylinder is 300 mm and steam pressure is 1.5 N/mm². Assuming that the bolts are not stressed initially, find the number of bolts required, if the tensile stress in the bolt is not to exceed 50 N/mm². (8 marks)

(ii) State the advantages and disadvantages of adhesive bonding in detail. (8 marks)

(OR)

14(b) For the bracket shown in fig 14(b), if the various terms are $a = 80$ mm, $b = 50$ mm, $e' = 100$ and $F = 25$ kN. Calculate the size of the weld if the load is static. (16 marks)

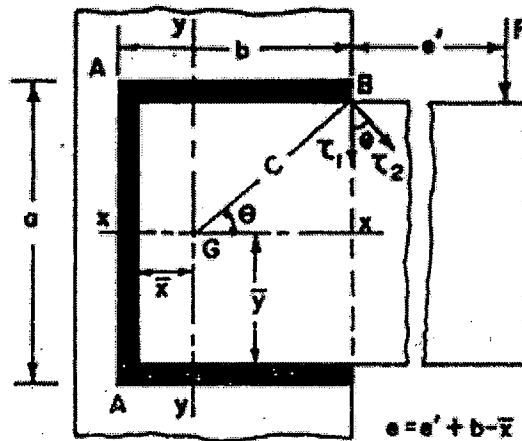


FIG 14(b)

15(a) Design a helical compression spring to sustain an axial load of 3 kN. The deflection is 60 mm. Spring index is 6. The shear stress not to exceed 300 MPa. Rigidity modulus for spring material is 81 GPa. (16 marks)

(OR)

15(b) A truck spring has a overall length of 1.2 m and sustain a load of 60 kN. The spring has 3 full length and 15 graduated leaves. All the leaves are stressed to 360 MPa when fully loaded. The ratio of the total depth to width is 2. Take $E = 206$ GPa. Determine the width and thickness of leaves, the camber and load exerted on the band. (16 marks)