

[Total No. of Questions - 9] [Total No. of Printed Pages - 3]

Dec.-22-0187

ME-504 (Machine Design-I, ME, AE)

B.Tech. 5th (CBCS)

Time : 3 Hours

Max. Marks : 60

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

**Note :** Attempt five Questions taking one question from each unit.  
Question no. 9 is compulsory.  
Note: Use of Design data book may be allowed.

### UNIT - I

- (a) Distinguish between design synthesis and design analysis. (4)
- (b) What do you understand by Creep? Explain this phenomena with the help of required diagram. (6)
- (a) What are the design consideration of forging? (4)
- (b) Explain tolerance in design consideration with neat sketch. Describe BIS system of Tolerance. (6)

### UNIT - II

- (a) Define transmission shaft and explain its types. Write its application. (4)
- (b) It is required to design a square key for fixing a pulley on the shaft, which is 50 mm in diameter. The pulley transmits 10 kW power at 200 rpm to the shaft. The key is made of steel 45C8 ( $S_{yt} = S_{yc} = 380 \text{ N/mm}^2$ ) and the factor of safety is 3. Determine the dimensions of the key. Assume ( $S_{sy} = 0.577S_{yt}$ ). (6)
- (a) Explain about design of splines. Write its application. (4)

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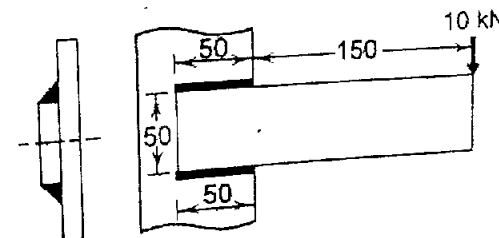
- (b) A hollow circular shaft of outer and inner diameters of  $d_o$  and  $d_i$  respectively is subjected to a bending moment of  $M_b$  and a torsional moment of  $M_t$ . Prove that according to the maximum shear stress theory.

$$\frac{0.5 S_{yt}}{(fs)} = \frac{16}{\pi d_o^3 (1 - C^4)} \sqrt{(M_b)^2 + (M_t)^2}$$

where,  $C = d_i / d_o$  (6)

### UNIT - III

- (a) Explain all types of rivet heads with neat sketches used in riveting. (4)
- (b) A double-riveted double-strap butt joint is used to connect two plates; each of 12 mm thickness, by means of 16 mm diameter rivets having a pitch of 48 mm. The rivets and plates are made of steel. The permissible stresses in tension, shear and compression are 80, 60 and 120 N/mm<sup>2</sup> respectively. Determine the efficiency of the joint. (6)
- (a) What is reinforcement in weld? What are its advantages and disadvantages? (4)
- (b) A welded connection of steel plates, as shown in Fig. is subjected to an eccentric force of 10 kN. Determine the throat dimension of the welds, if the permissible shear stress is limited to 95 N/mm<sup>2</sup>. Assume static conditions. (6)



[P.T.O.]

## UNIT - IV

7. (a) Differentiate between design of key and cotters. (4)
- (b) Shaft, 40 mm in diameter, is transmitting 35 kW power at 300 rpm by means of Kennedy keys of  $10 \times 10$  mm cross-section. The keys are made of steel 45C8 ( $S_{yt} = S_{yc} = 380$  N/mm<sup>2</sup>) and the factor of safety is 3. Determine the required length of the keys. (6)
8. It is required to design a knuckle joint to connect two circular rods subjected to an axial tensile force of 50 kN. The rods are co-axial and a small amount of angular movement between their axes is permissible. Design the joint and specify the dimensions of its components. Select suitable materials for the parts. (10)

**Compulsory**

9. (a) What is a static load?
- (b) What is fracture mechanics?
- (c) What is standardization?
- (d) Write the situations where creep is a serious problem.
- (e) What are the disadvantages of the cold working process?
- (f) What types of stresses are induced in shafts?
- (g) What is saddle key?
- (h) What do you understand by efficiency of riveted joints?
- (i) What is caulking? What is its objective?
- (j) State maximum shear stress theory of failure.

(10×2=20)