

Total No. of Questions—12]

[Total No. of Printed Pages—8

**[3862]-137**

**S.E. (Production/Production S/W) (II Sem.) EXAMINATION, 2010**

**DESIGN OF MACHINE ELEMENTS**

**(2008 COURSE)**

**Time : Three Hours**

**Maximum Marks : 100**

**N.B. :—** (i) Answer *three* questions from Section I and *three* questions from Section II.

(ii) Answers to the two Sections should be written in separate answer-books.

(iii) Neat diagrams must be drawn wherever necessary.

(iv) Figures to the right indicate full marks.

(v) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

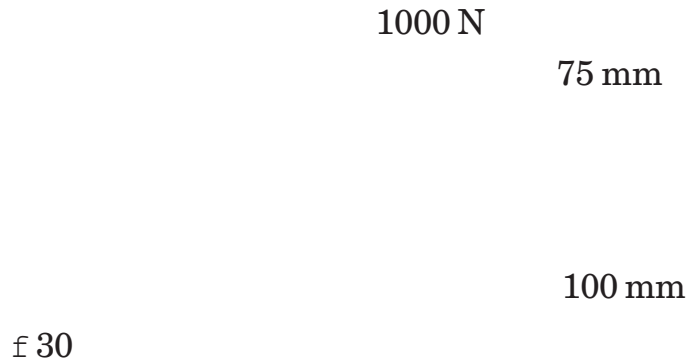
(vi) Assume suitable data, if necessary.

**SECTION I**

1. (a) What are the different design methods ? Also compare these methods. [6]

P.T.O.

- (b) A link of “S” shape made of 30 mm diameter as shown in Fig. 1. Determine the maximum tensile stress and shear stress in the link. [12]



1000 N  
Fig. 1

*Or*

2. (a) What is design synthesis and design analysis ? [6]
- (b) A bell crank lever is to be designed to raise load of 5 kN at the short end. The arm lengths are 150 mm and 500 mm. The permissible stresses for lever and pin material in shear and tension are  $60 \text{ N/mm}^2$  and  $90 \text{ N/mm}^2$  respectively. The bearing pressure on the pin is to be limited  $12 \text{ N/mm}^2$ . Assume the lever cross-section as  $t \times 4t$ . [12]

3. (a) Compare the weights of equal length of hollow shaft and solid shaft to transmit a given torque for the same maximum shear stress. The material for both the shafts is same and inside diameter is  $\frac{2}{3}$ rd of outside diameter for hollow shaft. [6]
- (b) A standard splined connection of  $8 \times 52 \times 60$  mm is used for the gear and shaft assembly of gearbox, 20 kW power at 300 r.p.m. is transmitted by the splines. The normal pressure on splines is limited to  $6.5 \text{ N/mm}^2$ . Coefficient of friction is 0.06. Calculate the length of hub of the gear and force required. [10]

*Or*

4. (a) Write a short note on protected type flange coupling. [6]
- (b) Along with a neat sketch state the design procedure for rigid type flange coupling. [10]

5. (a) Derive the expression for the torque requirement for tightening of bolt. [6]

(b) A bracket shown in fig. is fixed to the support by means of three bolts. The dimensions given in Fig. 2 are in mm.

The bolts are made of plain carbon steel 45C8. ( $S_{yt} = 380$  N/mm<sup>2</sup>) factor of safety is 2.5, assume  $d = d_c/0.84$ . [10]

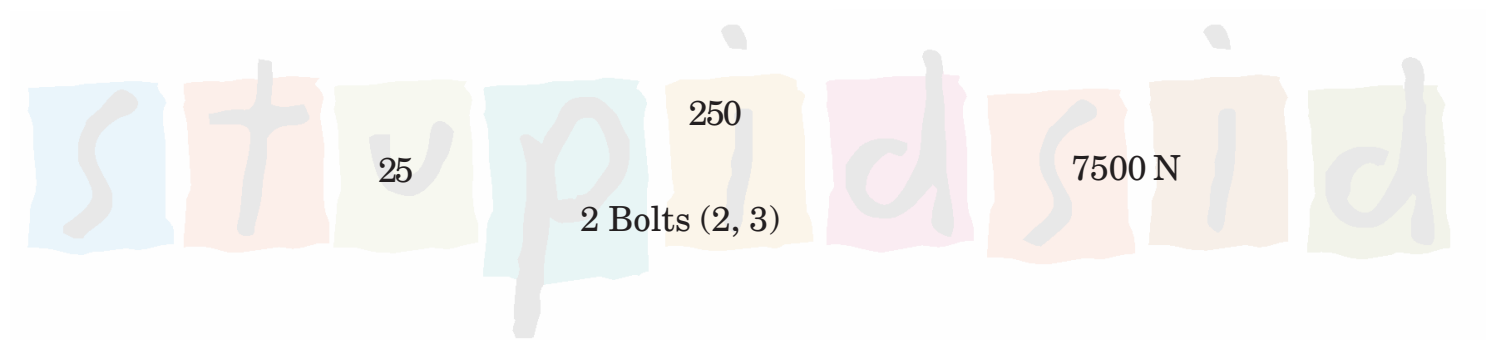


Fig. 2

*Or*

6. (a) A Fig. 3 shows the welded joints subjected to an eccentric load of 25 kN. The welding is on only one side. Permissible shear stress is 55 MPa. Determine the weld size. [10]

25 kN  
100 100

150

Fig. 3

- (b) Write a short note on welded joints subjected to torsional load. [6]

## SECTION II

7. (a) Explain various types of screw threads along with applications. [6]
- (b) The following data is given for a screw jack :
- (1) Nominal diameter of the shaft of screw : 40 mm

- (2) Pitch of square threads : 7 mm
- (3) Coefficient of thread friction : 0.15
- (4) Coefficient of collar friction : 0.1
- (5) Effective mean diameter of collar : 70 mm.

The operator can comfortably exert a force of 150 N at radius of 1.2 m to raise the load. Assuming single start threads, calculate the maximum load can be lifted, the efficiency of the screw and the overall efficiency. [10]

*Or*

8. A power screw having double start square threads of 25 mm nominal diameter and 5 mm pitch is acted upon by an axial load of 10 kN. The collar outer and inner are 50 mm and 20 mm respectively. The coefficient of friction of thread and collar friction is 0.22 and 0.15 respectively. The screw rotates at 12 r.p.m. Assuming uniform wear condition at the collar and allowable bearing pressure of  $5.5 \text{ N/mm}^2$ , find the torque required to rotate the screw and stresses in the screw and height of nut. [16]

9. (a) Write a short note on Wahl stress factor. [4]
- (b) Design a helical compression spring for a maximum load of 1200 N for deflection of 25 mm using the value of spring index as 5. Assume maximum permissible shear stress for spring material as  $400 \text{ N/mm}^2$ , Modulus of rigidity can be assumed as  $85 \text{ GN/m}^2$ . [12]

*Or*

10. A valve spring of I.C. Engine is designed as the following details :

- (1) Spring load 80 N when the valve is closed.
- (2) Spring load 105 N when valve is open.
- (3) Inside guide bush diameter 25 mm.
- (4) Outside recesses diameter 35 mm.
- (5) Valve lift 5 mm.
- (6) Permissible shear stress 350 MPa.
- (7) Modulus of Rigidity 80 GPa.

Assume the spring ends are square ground determine wire diameter, spring index, total number of coils, solid length and free length. [16]

11. (a) Explain along with suitable example role of Ergonomics in Design Engg. [6]
- (b) Write a short note on Morgan's color Code. [6]
- (c) Explain the aesthetics design principles. [6]

*Or*

12. (a) Write a short note on design for manufacturing (DFM). [6]
- (b) What are the guidelines followed in design of the parts for the following processes :
- (1) Casting
  - (2) Forging
  - (3) Welding
  - (4) Powder metallurgy. [12]