

Printed Pages : 7

TME-502

(Following Paper ID and Roll No. to be filled in your Answer Book)

**PAPER ID : 4075**Roll No. 

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**B. Tech.****(SEM. V) EXAMINATION, 2007-08****MACHINE DESIGN - I***Time : 3 Hours]**[Total Marks : 100*

*Note :* Answer all questions. Use of design data book is permitted. Assume any missing data suitably.

1 Answer any **four** of the following : **5×4**

- (a) What are the different stages in the design of a machine element, explain.
- (b) Explain the BIS method of specifying cast iron and its major types.
- (c) With a suitable example, explain the significance of preferred numbers in design.
- (d) What is the importance of standardization in design, discuss with suitable examples.
- (e) Briefly discuss the weighted factor method of material selection.
- (f) Enumerate advantages and disadvantages of plastic materials over metals.

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- (a) A flat bar as shown in figure is subjected to an axial load of 50 kN. If the stress in the bar is to be limited to  $100 \text{ N/mm}^2$ , determine the thickness of the bar.

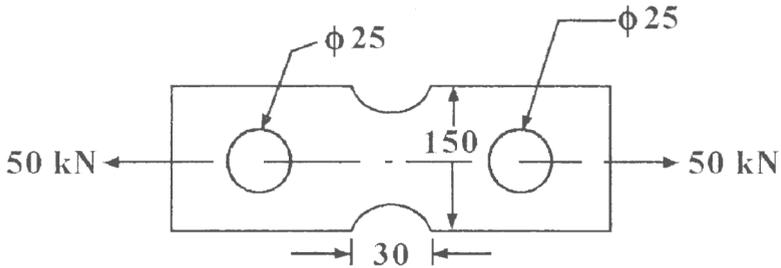


Fig. 1

- (b) A pulley is mounted on a shaft midway between two bearings. The bending moment at the pulley varies from 200 kN-mm to 600 kN-mm and a torsional moment varies from 60 kN-mm to 180 kN-mm. The shaft material has an ultimate strength of 550 MPa and yield strength of 400 MPa. If factor of safety is 1.5 and the stress concentration factors for the keyway in the pulley in bending and torsion is 1.5 and 1.2 respectively, find the shaft size for infinite life.
- (c) Figure shows a hanger with rectangular cross-section, with the proportions indicated. A force  $F$  of magnitude 10 kN acts at  $30^\circ$  to the vertical

as shown. The permissible stress in the hanger material is 60 MPa. Find the cross section of hanger.

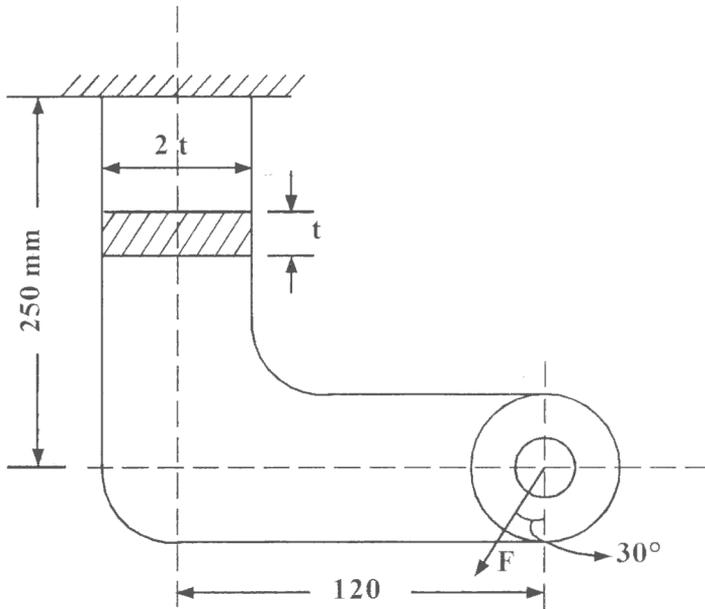


Fig. 2

3 Answer any **two** of the following : 10×2

- (a) The outline of a drill press is shown in figure. The column is secured to the bottom block by 8 bolts as shown (two bolts on each side of column on each location) of allowable tensile stress for the bolt material is 84 MPa and the external load  $P=20$  kN acting as shown in figure, find the suitable size of the bolt.

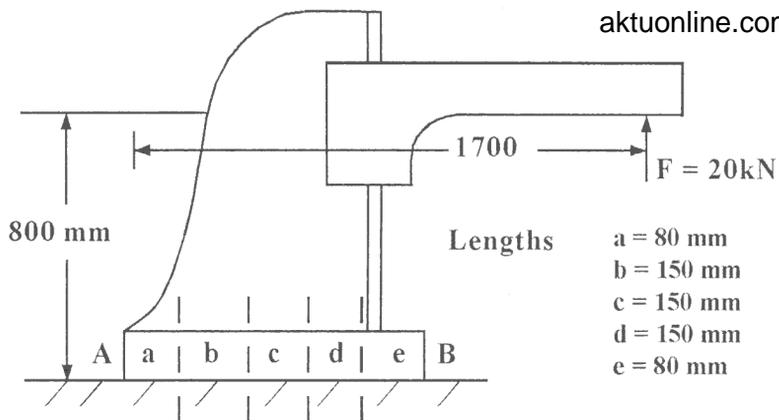


Fig. 3

- (b) A shaft is required to transmit 15 kW at 200 rpm. It is supported on two bearings 600 mm apart and two gears are keyed to it. A 18 teeth,  $14\frac{1}{2}^\circ$  involute, 5 mm module pinion is located at 120 mm to the right of right bearing and delivers power to a gear directly below the shaft. A 72 tooth,  $14\frac{1}{2}^\circ$  involute, 5 mm module gear is located at 150 mm to the right of the left bearing and receive power from a gear, directly above it. Determine the shaft diameter if permissible normal stress is 80 MPa.
- (c) Design a cast iron protected type flange coupling to connect two shafts of 36 mm diameter, transmitting 15 kN at 720 rpm. The overload capacity is 1.25 times the average torque. The bolts and key area made of c20 steel and the flanges are made of cast iron.



4 Answer any **two** of the following :

10×2

(a) A helical spring is made from a wire of 6 mm diameter and has outside diameter of 75 mm. If the permissible shear stress is  $350 \text{ N/mm}^2$  and modulus of rigidity is  $84 \text{ kN/mm}^2$ , find the axial load which the spring can carry and deflection per active turn;

(1) neglecting the effect of curvature, and

(2) considering the effect of curvature.

(b) A semi elliptical laminated vehicle spring is to be designed to carry a load of 3 kN and consists of two full length leaves and five graduate leaves of width 65 mm. The spring is to be 1100 mm in length and attached to the axle by two U bolts 80 mm apart. These bolts hold the central position of the spring so rigidly that they may be considered equivalent to a band having a width equal to the distance between the bolts. If allowable stress is 350 Mpa and modulus of electricity is 210 GPa, determine :

(i) thickness of leaves

(ii) deflection of spring

(iii) length of leaves.

- (c) A power screw having double start square thread of 32 mm nominal diameter and 5 mm pitch, is acted upon by an axial load of 12 kN. The inner and outer diameters of the screw collar surface are 20 mm and 50 mm respectively. The coefficient of thread friction and collar friction may be assumed as 0.15 and 0.20 respectively. The screw rotates at 24 rpm. Assume uniform wear condition. Permissible thread bearing pressure is 6 N/mm<sup>2</sup>. Allowable shear stress in nut and screw is 30 MPa. Determine,
- (i) torque required to rotate screw,
  - (ii) stress induced in the screw and
  - (iii) height of nut.

5 Answer any **four** of following :

5×4

- (a) What is design by evolution ? Discuss with example of an appropriate product.
- (b) Differentiate between old and new design approaches.
- (c) Discuss in brief the importance of product life cycle in product development.

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(d) Discuss various stages in morphology of design.

(e) What are various components of need analysis ? discuss.

(f) What is brain storming ? What is its significance in new product development ?