[Total No. of Questions - 9] [Total No. of Printed Pages - 4] (2064)

14695

B. Tech 6th Semester Examination

Machine Design-II (ME)

ME-6002

Time : 3 Hours **Max. Marks : 100**

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 : (i) Attempt five questions in all, selecting one question each from Sections A, B, C & D of the paper and Section E is compulsory.

(ii) All questions carry equal marks.

(iii) Use of Non-Programmable calculator is allowed.

(iv) Use of only PSG Design Data book is permitted. Any missing data may be suitably assumed.

SECTION - A

1. (a) Describe the design procedure of a machine. Illustrate your answer with suitable example. (8)

(b) The link shown in fig. 1 is subjected to a completely reversed load of 80 kN. Determine the minimum factor of safety. The material has an endurance limit of 180 N/mm^2. Assume: (i) Theoretical stress concentration factor at 60 mm diameter hole as 5 and that at 40 mm diameter hole as 3, (ii) Notch sensitivity = 0.8, (iii) Surface finish factor = 0.85, (iv) Size factor = 0.9. Is this factor of safety is sufficient? If not what changes would you suggest in the link? (12)

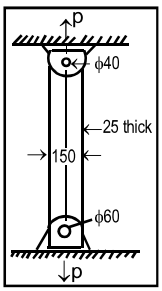

Fig. 1

2. (a) Explain the stress concentration factor and suggest some methods of relieving stress concentration. (8)

   (b) A hot rolled steel shaft is subjected to a torsional moment that varies from 330 N-m clockwise to 110 N-m counterclockwise and an applied bending moment at a critical section varies from 440 N-m to -220 N-m. The shaft is of uniform cross-section and no keyway is present at the critical section. Determine the required shaft diameter. The material has an ultimate strength of 550 MN/m^2 and yield strength of 410 MN/m^2. Take the endurance limit as half the ultimate strength, factor of safety of 2, size factor of 0.85 and a surface finish factor of 0.62. (12)

SECTION - B

3. (a) Explain soderberg criterion for shaft design. (8)

   (b) A machinery shaft supported on bearings 2.4 m apart is to transmit 187.5 kW at 200 rev/min. It is subjected to bending load of 5000 N located at a distance of 0.66 m from one bearing. Safe stress in shear is 42 MPa and in bending 84 MPa. (i) Determine the shaft diameter for steady loading, (ii) Determine the shaft diameter if the transverse load is steady and the torsional load is suddenly applied. (12)

4. (a) Explain in detail surging phenomenon of springs. (8)

   (b) A safety valve 50 mm in diameter is to blow off at a pressure of 1 N/mm^2. It is held in seat by helical spring. The maximum lift of the valve is 10 mm. Design a suitable compression spring index 5 and providing an initial compression of 35 mm. Assume suitable material for the purpose and find energy stored in the spring. (12)

SECTION - C

5. (a) What are the factors which decide the static capacity of ball bearings? In what respect the dynamic capacity differs from the static capacity of a ball bearing? (8)

(b) A pivot bearing supports a shaft of 150 mm diameter which is counter-bored at the end with a hole diameter of 50 mm. If the bearing pressure is limited to 0.8 N/mm^2 and the speed is 100 r.p.m.; find: (i) The load to be supported; (ii) The power lost in friction; and (iii) The heat generated at the bearing. Assume coefficient of friction=0.015. (12)

6. (a) Explain the importance of lubrication of ball and roller bearings. Illustrate few methods of carrying out proper lubrication for specific applications. (8)

(b) A full journal bearing has a journal of 50 mm diameter and runs concentrically inside a 75 mm long bearing with a radial clearance of 0.025 mm. If the journal speed is 1500 rpm and the viscosity of the lubricant is 40 mPa.sec at 35°C, calculate the following at this temperature: a) The value of the tangential drag force on the journal, b) The value of the viscous shear stress, and c) Power loss in viscous friction. (12)

SECTION - D

7. (a) Bring out the logical development of the Lewis equation for the strength of the gear teeth. What is the significance of the form factor? (8)

(b) A pair of helical gears is to transmit 15 kW. The teeth are 20° stub in diametral plane and have a helix angle of 45°. The pinion runs at 1000 r.p.m. and has 80 mm pitch diameter. The gear has 320 mm pitch diameter. If the gears are made of cast steel having allowable static strength of 100 MPa; determine a suitable module and face width from static strength considerations and check the gears for wear, given σ_{es}=618 MPa. (12)

8. (a) Define the following terms used in worm gearing: (i) Lead; (ii) Lead angle; (iii) Normal Pitch; and (iv) Helix angle. (8)

   (b) A triple threaded worm has teeth of 6 mm module and pitch circle diameter of 50 mm. If the worm gear has 30 teeth of $14^{1/2^{\circ}}$ and the coefficient of friction of the worm gearing is 0.05, find (i) the lead angle of the worm, (ii) velocity ratio, (iii) centre distance, and (iv) efficiency of the worm gearing. (12)

SECTION - E (Compulsory Question)

9. Write short answers of the following:

   (a) What are the factors that affect endurance limit of machine parts?

   (b) How will you design shaft on the basis of torsional rigidity?

   (c) Explain hydrodynamic lubrication.

   (d) Explain variable stress criteria.

   (e) In what respect ball and roller bearings are preferred over journal bearing?

   (f) What types of stresses are induced in shafts?

   (g) Explain the phenomenon of nipping.

   (h) How are dynamic loading and wear taken care of while designing gear?

   (i) What is the difference between S-N curves for ferrous and non-ferrous components?

   (j) What are the various forces acting on worm and worm gears? (2×10=20)