B 2337

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2007.

Fifth Semester

Mechanical Engineering

ME 331 — DESIGN OF MACHINE ELEMENTS

Time : Three hours
Maximum : 100 marks

Answer ALL questions.

(Use of approved design data book is permitted)

PART A — (10 × 2 = 20 marks)

1. What is an 18-8 steel? Mention at least two application of it.

2. What do you mean by factor of safety? List some factors to be considered for the determination of factor of safety.

3. Which type of fit will you recommend for the following :

    (a) Gear box shaft bearing

    (b) Spigot and location fit

    (c) IC engine main bearing

    (d) Keyed shaft.

4. Define preferred numbers. State its application.

5. Which type of thread would you suggest for the following?

    (a) Lead screw for a lathe

    (b) Fastening of a bracket to a wall

    (c) Screw jack.

6. What do you mean by efficiency of a riveted joint? The efficiency of a riveted joint is always less than 100% give your comment.

7. Sketch different types of keys and mention their specific uses.

8. Why is piston end of a connecting rod kept smaller than the crank pin end?

9. Define the term surge in spring. How it can be avoided?

10. What is nipping in a leaf spring?

PART B — (5 × 16 = 80 marks)

11. (a) (i) Explain in short the stress concentration factor and methods of relieving stress concentration. (6)

    (ii) A steel rod of yield strength 350 N/mm² and an endurance limit of 265 N/mm² is subjected to an axial load which varies from –300 kN minimum to 700 kN maximum and has a stress concentration factor 1.8. Assume factor of safety 2. Calculate the diameter of the steel rod. (10)

Or

(b) (i) A commercial cold rolled C 30 steel rotating shaft is to be designed to transmit variable torque ranging from 1 kNm to 2 kNm. Considering loading of shaft with minor shocks, specify the diameter of the shaft. (8)

    (ii) A 50 mm diameter shaft is loaded in pure tension at a shearing stress of 70 N/mm². Find the factor of safety by various theories. The material of the shaft is 37 Mn2. Yield strength 440 N/mm². (8)

12. (a) A journal of nominal or basic size of 75 mm runs in a bearing with close running fit. Find the limits of shaft and bearing. What is the maximum and minimum clearance?

Or

(b) A rope pulley of diameter 3.6 m has 15 grooves of 45° angle. The angle of lap is 170° and the coefficient of friction between the ropes and the groove sides is 0.28. Allowing a maximum possible tension in the ropes as 960 N and the mass per metre length of the rope as 1.5 kg, determine the speed of the pulley and the maximum power transmitted.

13. (a) Design a cotter joint to transmit an axial force of 120 kN. Material to be used is C40. A factor of safety of 2 may be taken at yield point.

Or

(b) A bracket is welded to the vertical plate by means of two fillet welds as shown in Fig. 1. Determine the size of the welds, if the permissible shear stress is limited to 70 N/mm².

Fig·1
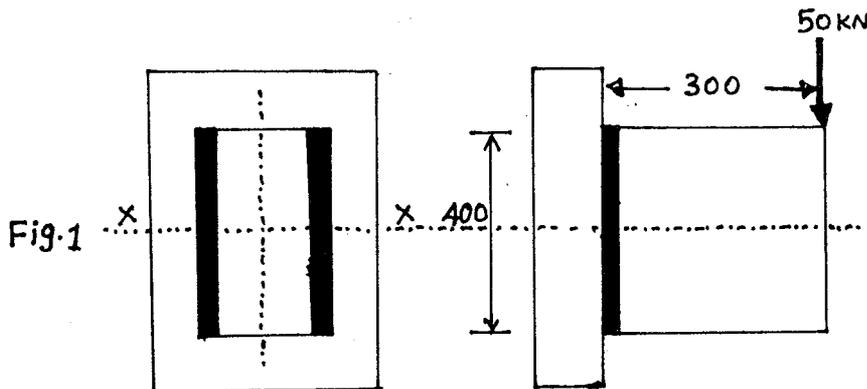
NOTE : DIMENSIONS ARE IN 'mm'

14. (a) In an axial flow rotary compressor, the shaft is subjected to a maximum twisting moment of 1500 Nm and a maximum bending moment of 3000 Nm. Neglecting the axial load on the shaft determine the diameter of the shaft, if the allowable shear stress if 50 N/mm². If the shaft is to be a hollow one with $d_i/d_0 = 0.4$, what will be the material saving in the hollow shaft. It is subjected to the same loading and of the same material as the solid shaft. Compare the torsional stiffness of the two shafts.

Or

b) Design a cast iron flywheel for a four-stroke IC engine developing 50 k[W] at 150 rpm with 75 explosions per minute. The total fluctuation of spee[d] is limited to 0.5% of the mean on either side. The work done during th[e] working stroke is 1.4 times the work done during the cycle. Assume tha[t] the flywheel stores 16/15 times the energy stored by the rim and the ri[m] section having width four times the depth so that the hoop stress doe[s] not exceed 4 N/mm².

15. (a) Design a helical compression spring for a maximum load of 1500 N for a[] deflection of 30 mm using the value of spring index as 5. Assume[] maximum permissible shear stress for spring wire as 420 N/mm² and[] modulus of rigidity 84 kN/mm².

Or

(b) A semi-elliptical spring 1500 mm long carries a total load of 12 kN. The[] spring is to have 10 leaves, two being full length leaves. The deflection is[] to be 60 mm. Design the spring.

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