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Question Paper Code : 41040

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2013.

Fifth Semester

Mechanical Engineering

080120025 — DESIGN OF MACHINE ELEMENTS

(Common to Automobile Engineering)

(Regulation 2008)

Time : Three hours

Maximum : 100 marks

Use of approved Design data Book is permitted.

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is the effect of stress concentration on ductile materials?
2. Define endurance limit?
3. What are the advantages of hollow shaft over solid shaft?
4. Why is maximum shear stress theory used for shafts?
5. What are the different types of stresses to which a bolt is subjected?
6. How bonded joints are different from welded joints?
7. List the advantages of helical springs.
8. Why levers are usually tapered?
9. Give two applications of hydrostatic bearing.
10. Name the materials used for making fly wheels.

PART B — (5 × 16 = 80 marks)

11. (a) A bolt is subjected to a tensile load of 25 kN and to a shear load of 10 kN. Suggest a suitable size of a bolt according to various theories of failure. Take allowable yield stress is 300 N/mm^2 . Poisson's ratio is 0.25.

Or

- (b) A machine component is subjected to a flexural stress which fluctuates between $+300 \text{ MN/m}^2$ and -150 MN/m^2 . Determine the value of minimum ultimate strength according to (i) Gerber equation (ii) Goodman equation and iii) Soderberg equation. Take the value of yield strength as 0.55 UTS and endurance strength as 0.50 UTS. Take factor of safety as 2.
12. (a) In an axial flow compressor the shaft is subjected to a maximum torque of 1.5 MN-mm and a maximum bending moment of 0.35 MN-mm. The shear stress is limited to 50 N/mm^2 . Assuming factor of safety of 1.5 in bending and shock factor in twisting as 2. Design the diameter of shaft.

Or

- (b) Design a muff coupling for a shaft which transmits 55 kW at 120 rpm. The permissible shear stress values are for shaft = 60 N/mm^2 , muff = 10 N/mm^2 and key 40 N/mm^2 respectively. The permissible bending stress value for key is 100 N/mm^2 . Also make a sketch of the muff coupling.
13. (a) The cylinder head of a steam engine is subjected to a steam pressure of 0.7 N/mm^2 . It is held in position by means of 12 bolts. A soft copper gasket is used to make the joint leak-proof. The effective diameter of cylinder is 300 mm. Find the size of the bolts so that the stress in the bolts is not to exceed 100 MPa.

Or

- (b) A plate of 200 mm width is welded to a vertical plate by fillet welding on three sides to form a cantilever with an overlap of 150 mm and overhang of 400 mm and a vertical downward load of 35 kN is applied at free end for a weld stress of 75 N/mm^2 . Determine the size of the weld.

14. (a) Design a closed coiled helical compression spring for a load range varying from 2.25 kN to 2.75 kN and corresponding axial deflection of 6 mm. Spring index is 5. Permissible shear stress is 400 N/mm² and modulus of rigidity is 80 kN/mm².

Or

- (b) A hand lever for brake is 0.8m long from the centre of gravity of the spindle to the point of application of the pull of 300 N. The effective overhang from the nearest bearing is 100 mm. If the permissible stress in tensile, shear and crushing is not to exceed 66 N/mm², design the spindle, key and lever. Assume the arm of the lever to be rectangular having width twice of its thickness.
15. (a) A single row deep groove ball bearing operating at 2000 rpm is acted by a 10 kN radial load and 8 kN thrust load. The bearing is subjected to a light shock load and the outer ring is rotating. Determine the rating life of the bearing.

Or

- (b) Design a 6 arm rim type C. I flywheel for four stroke engine developing 45 kw at 1400 rpm. Total fluctuation of speed is 2.5% of main speed. Work done during power stroke is 30% more than average work during a cycle.
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