T 8251

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2006.

Fifth Semester

Mechanical Engineering

ME 1302 — DESIGN OF MACHINE ELEMENTS

(Common to B.E (Part–Time) R 2005 Fourth Semester)

(Regulation 2004)

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 are the various phase of design process?

2. State St. Venant theory of failure.

3. Differentiate between keys and splines.

4. What is the advantage of Gear coupling?

5. How is a bolt designated? Give examples.

6. When will the edge preparation need?

7. State any two functions of springs.

8. What is lever?

9. What is a Journal bearing? List any two application.

10. What is the function of the flywheel?

PART B — (5 × 16 = 80 marks)

11. (a) (i) Determine the thickness of a 120 mm wide uniform plate for safe continuous operation if the plate is to be subjected to a tensile load that has a maximum value of 250 kN and a minimum value of 100 kN. The properties of the plate material are as follows. Endurance limit stress is 225 MPa and Yield point stress is 300 MPa. The factor of safety based on yield point may be taken as 1.5.   (10)

(ii)   What is factor of safety? List the factors to be considered while deciding the factor of safety.   (6)

Or

(b) (i)   A hollow shaft of 40 mm outer diameter and 25 mm inner diameter is subjected to a twisting moment of 120 N-m, simultaneously, it is subjected to an axial thrust of 10 kN and a bending moment of 80 N-m. Calculate the maximum compressive and shear stresses.

(12)

(ii)   Define the terms "equivalent torque and equivalent moment".   (4)

12. (a)   A Shaft is to transmit 50 kW at 1200 rpm. It is also subjected to a bending moment of 275 N-m. Allowable shear stress is 60 N/mm². The shaft is not to twist more than 2^0 in a length of 2 m. Design the shaft.

Take $G = 80 \times 10^3$ N/mm².

Or

(b)   A rigid type of coupling is used to connect two shafts transmitting 15 kW at 200 rpm. The shaft keys and bolts are made of C45 steel and the coupling is cast iron. Design the coupling.

13. (a)   The cylinder head of a steam engine with 250 mm bore is fastened by eight stud bolts made of 30C8 steel. Maximum pressure inside the cylinder is 1 MPa. Determine the bolt size and approximate tightening torque. Take 20% overload. Assume $\sigma_y = 300$ MPa for bolt material.

Or

(b)   A circular shaft, 60 mm in diameter is welded to a support by means of a fillet weld as shown in Fig. Determine the size of weld, if the permissible shear stress in the weld is limited to 85 MPa.
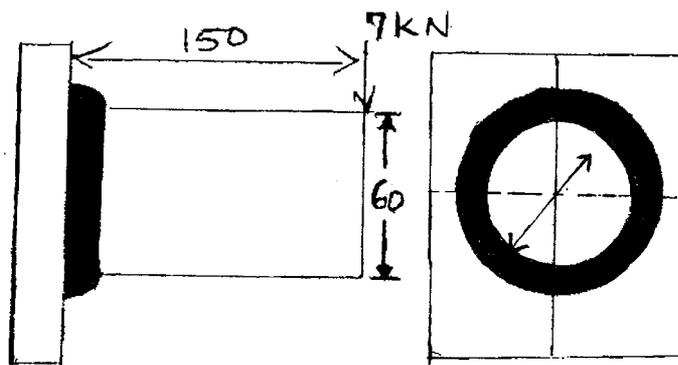

Fig. Q. 13 (b)

14. (a) A helical valve spring is to be designed for an operating load range of 90 N to 135 N. The deflection of the spring for this load range is 7.5 mm. Assuming a spring index of 10, a permissible shear stress of 80 N/mm^2 for the material and modulus of rigidity of 0.8×10^5 N/mm^2. Determine the dimensions of the spring. Sketch the spring with dimensions indicated.

Or

(b) A locomotive spring has an overall length of 1.1 m and sustained a load of 75 kN at its centre. The spring has 3 full length leaves and 15 graduated leaves with a central band of 100 mm wide. All leaves are to be stresses to 420 N/mm^2. When fully loaded the ratio of the spring depth to width is to be approximately 2. Take $E = 2.1 \times 10^5$ N/mm^2.

(i) Determine width and thickness of the leaves.

(ii) Determine the initial space that should be provided between the full length and graduated leaves before the band load is applied.

(iii) What load is exerted on the band after the spring is assembled?

15. (a) Following data is given for a 360° hydrodynamic bearing.

Journal diameter = 100 mm, Radial clearance = 0.12 mm, Radial load = 50 kN, Bearing length = 100 mm, Journal speed = 1440 rpm and viscosity of lubricant = 16 CP. Calculate

(i) Minimum film thickness

(ii) Co–efficient of friction and

(iii) Power lost in friction.

Or

(b) A multi cylinder engine is to run at a constant load at a speed of 500 rpm on drawing the crank effort diagram to seeks of 1 cm = 2500 Nm and 1 cm = 600, the area above and below the mean torque line were measured and found to be in order +1.60, –1.72, +1.68, –1.91, +1.97 and –1.62. If the speed is to be kept with in limits of ±1% of the mean speed, design the suitable type of flywheel.

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