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Question Paper Code : 51040

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2014.

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. Specify any four factors that influence the factor of safety.
2. What are preferred numbers?
3. Why is a circumferential flange provided in flange couplings?
4. Mention the assumptions made in the design of keys.
5. What are the different types of stresses induced in bolts?
6. Transverse fillet welds are preferred to parallel fillet welds. Why?
7. What is 'Nipping in leaf springs?
8. What are the purposes for which concentric springs are used?
9. What is the limitation of Mckee's equation?
10. Why are flywheels used in presses?

PART B — (5 × 16 = 80 marks)

11. (a) A steel shaft of 60 mm diameter is subjected to a bending moment of 12 kN-m and a torque T. If the yield point of the steel in tension is 910 N/mm^2, find the maximum value of this torque without causing yielding of the shaft according to maximum distortion energy theory.

Or

(b) A circular cross section C45 steel member is subjected to an axial load that varies from -1200 N to +2700 N and to a torsional moment that varies from 0 to +600 Nm. Assume a factor of safety of 1.7 and a stress concentration factor of 1.6. Determine the required diameter of the member for indefinite life.

12. (a) An overhung shaft carries a 800 mm diameter pulley, whose centre is 240 mm from the centre of the nearest bearing. The weight of the pulley is 650 N and the angle of lap of the belt is 180°. The pulley is driven by a motor vertically below it. If the permissible tension in the belt is 2.7 kN and coefficient of friction is 0.3, determine the diameter of the shaft when internal diameter is 0.6 times the external diameter. Neglect centrifugal tension and assume permissible shear and tensile stresses as 62 N/mm^2 and 82 N/mm^2.

Or

(b) Design a protected type flange coupling for the following requirements:

Power to be transmitted = 9 kW

Speed of the shafts = 920 rpm

Select suitable materials.

13. (a) Sketch a bolted connection and indicate the various forces including initial tension. Derive the relationship to estimate the load shared by the bolt in a preloaded joint when an external load acts on the joint.

Or

(b) A plate 80mm wide and 10 mm thick is to be welded to another plate by means of single transverse and double parallel fillet welds. Determine the length of weld run in each case, if the joint is subjected to varying loads. The recommended design stress in tension is not to exceed 75N/mm^2 and in shear 55 N/mm^2 for static loading.

14. (a) Design a set of concentric springs for an aircraft engine valve to exert a maximum force of 5.5 kN for a deflection of 42 mm. Take maximum allowable stress for the spring material as 620 N/mm^2 and rigidity modulus as 0.8×10^5 N/mm^2.

Or

(b) A locomotive semi-elliptical spring of span 900 mm carries 82 kN load at its center. The spring has 3 full length leaves and 14 graduated leaves with a central band of 120 mm. All the leaves are to be stressed to 440 N/mm^2 when fully loaded. The ratio of the total spring depth to width is 2. Take E = 2×10^5 N/mm^2. Determine

(i) Width and thickness of the leaves: (7)

(ii) Initial gap that should be provided before the application of band load. (5)

(iii) Load on the band after the spring is assembled. (4)

15. (a) The radial and thrust loads acting on a bearing are 7400N and 3500N respectively. The shaft diameter is 130 mm and it rotates at 1600 rpm. The outer ring is stationary. Load is smooth, 8 hrs/day for a life of 15000 hrs.

(i) Select a deep groove ball bearing. (8)

(ii) Find the rated 90% life of selected bearing. (4)

(iii) Compute the probability of the selected bearing surviving 17,000 hours. Take b = 1.34. (4)

Or

(b) A single cylinder I.C. engine working on four stroke cycle develops 65 kW at 400 rpm. The maximum fluctuation of energy can be assumed to be 0.86 times the energy developed/cycle. If the total fluctuation of speed is not to exceed 1% and the maximum centrifugal stress in the flywheel made of cast iron is to be 5.7 MN/m^2, estimate the mean diameter and the cross-sectional area of the rim.
