Reg. No. : | | | | | | | | | | |

Question Paper Code: 31753

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2017

Fifth Semester

Mechanical Engineering

01UME503 – DESIGN OF MACHINE ELEMENTS

(Approved Design Data book is permitted)

(Regulation 2013)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 2 = 20 Marks)

1. What are the steps in machine design process?
2. How will you classify machined design and explain it?
3. What types of stresses are induced in shafts?
4. What do you understand by torsional rigidity and lateral rigidity?
5. State three conditions where tap bolts are used.
6. What is threaded joint?
7. What is nipping in a leaf spring?
8. What is the main function of a flywheel in an engine?
9. What are journal bearings? Give a classification of these bearings?
10. List the important physical characteristics of a good bearing material.

PART - B (5 x 16 = 80 Marks)

11. (a) The load on a bolt consists of an axial pull of 10kN together with a transverse shear force of 5Kn. Find the diameter of bolt required according to 1.Maximum principal stress theory; 2. Maximum shear stress theory; 3. Maximum principal strain theory; 4. Maximum strain energy theory and 5. Maximum distortion energy theory. (16)

Or

(b) A bar of circular cross section is subjected to alternating tensile forces varying from a minimum of 200KN to a maximum of 500KN. It is to be manufactured of material with an ultimate tensile strength of 900Mpa and an endurance limit of 700Mpa. Determine the diameter of bar using safety factors of 3.5 related to ultimate tensile strength and 4 related to endurance limit and stress concentration factor of 1.65 for a fatigue load. Use Goodman straight line as basis for design. (16)

12. (a) Two 400 mm diameter pulleys are keyed to a simply supported shaft 500 mm apart. Each pulley is 100 mm from its support and has horizontal belts, tension ratio being 2.5. If the shear stress is to be limited to 80 MPa while transmitting 45 kW at 900 r.p.m., find the shaft diameter if it is to be used for the input-output belts being on the same or opposite sides. (16)

Or

(b) Design a cast iron protective flange coupling to connect two shafts in order to transmit 7.5 kW at 720 r.p.m. The following permissible stresses may be used: Permissible shear stress for shaft, bolt and key material = 33 MPa Permissible crushing stress for bolt and key material = 60 MPa Permissible shear stress for the cast iron = 15 MPa. (16)

13. (a) Design a cotter joint to connect two mild steel rods for a pull of 30 kN. The maximum permissible stresses are 55 MPa in tension ; 40 MPa in shear and 70 MPa in crushing. Draw a neat sketch of the joint designed. (16)

Or

(b) A triple riveted butt joint with equal double cover plates (zig-zag riveting) is used for the longitudinal joint of a Lancashire boiler of 2.5 m internal diameter. The working steam pressure is 1.12 N/mm2 and the efficiency of the joint is 85 per cent. Calculate the plate thickness for mild steel of 460 MPa ultimate tensile strength. Assume ratio of tensile to shear stresses as 7/6 and factor of safety 4. The resistance of the rivets in double shear is to be taken as 1.875 times that of single shear. Design a suitable circumferential joint also. (16)

14. (a) Design a leaf spring for the following specifications : Total load = 140 kN ; Number of springs supporting the load = 4 ; Maximum number of leaves = 10; Span of the spring = 1000 mm ; Permissible deflection = 80 mm. Take Young's modulus, E = 200 kN/mm^2 and allowable stress in spring material as 600 MPa. (16)

Or

(b) Design a cast iron flywheel for a four stroke cycle engine to develop 110 kW at 150 r.p.m. The work done in the power stroke is 1.3 times the average work done during the whole cycle. Take the mean diameter of the flywheel as 3 metres. The total fluctuation of speed is limited to 5 per cent of the mean speed. The material density is 7250 kg / m^3. The permissible shear stress for the shaft material is 40 MPa and flexural stress for the arms of the flywheel is 20 MPa. (16)

15. (a) A single row deep groove ball bearing operating at 2000 r.p.m. 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. (16)

Or

(b) Design a journal bearing for a centrifugal pump running at 1440 r.p.m. The diameter of the journal is 100 mm and load on each bearing is 20 kN. The factor *ZN/p* may be taken as 28 for centrifugal pump bearings. The bearing is running at 75°C temperature and the atmosphere temperature is 30°C. The energy dissipation coefficient is 875 W/m^2/°C. Take diametral clearance as 0.1 mm. (16)

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