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

Question Paper Code : 91654

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

Fifth Semester

Mechanical Engineering

ME 2303/ME 53/10122 ME 504 — DESIGN OF MACHINE ELEMENTS/ MACHINE DESIGN

(Common to Fifth Semester, Automobile Engineering and Mechanical and Automation Engineering, Fourth Semester – Manufacturing Engineering, Industrial Engineering and Management and Industrial Engineering)

(Regulation 2008/2010)

(Common to PTME 2303/PTME 3214/10122 ME 504 — Design of Machine Elements/ Machine Design for B.E. (Part-Time) Fourth/Fifth Semester Mechanical Engineering – Regulation 2009/2010)

Time : Three hours Maximum : 100 marks

(Approved Data Book as permitted)

Any missing data can suitably be assumed.

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Determine the force required to punch a hole of 20mm diameter in a 5mm thick plate with ultimate shear strength of 250 MPa?

2. List at least two methods to improve the fatigue strength.

3. Shaft A has diameter which is double the diameter of shaft B of same material and transmit 80 kW if both shafts rotate at same speed, what is the power transmitted by shaft B.

4. Discuss forces on keys.

5. Why are ACME treads preferred over square thread for power screw?

6. What are the disadvantages of welding?

7. Define (a) Coefficient of fluctuation of speed (b) Coefficient of fluctuation of energy.

8. Distinguish between close coiled and open coiled springs.

9. In hydrodynamic bearing, what are factors which influence the formation of wedge fluid film?

10. Define static Capacity of Bearing.

PART B — (5 × 16 = 80 marks)

11. (a) An unknown weights falls through 10mm onto a collar which is rigidly attached to the lower end of a vertical bar 3 m long and 600 mm² cross section. The maximum instantaneous extension is 2mm. What is the corresponding stress and the value of the weight? Take E = 200 kN/mm².

Or

(b) A shaft of diameter 'd' is subjected to a torque varying between 900 Nm to 1800 Nm. Assuming a factor of safety 2 and a stress concentration factor of 1.2, find the diameter of the shaft. Take σ_u = 650 N/mm², σ_y = 480 N/mm², Size factor B = 0.85 and surface finish factor C = 0.5.

12. (a) In an axial flow rotary compressor, the shaft is subjected to maximum twisting moment and maximum bending moment of 1500 Nm and 3000 Nm respectively. Neglecting the axial load, determine the diameter, if the permissible shear stress is 50 N/mm². Assume minor shocks. If the shaft is hollow one with K = di/do = 0.4., what will be material saving in hollow shaft which is subjected to same loading and material as a solid shaft.

Or

(b) Design a cast iron flange coupling for a mild steel shaft transmitting 90 kW at 250 rpm, the allowable shear stress in the shaft is 40 MPa and the angle of twist is not to exceed 1° in a length of 20 meters. The allowable shear stress in the coupling bolt is 30 MPa. Take G = 84 kN/mm².

13. (a) A steel bolt of M16x2 is 300mm long carries an impact load of 5000 Nm. If the threads stop adjacent to the Nut and E = 2.1 × 10⁵ MPa

(i) Find the stress in the root area

(ii) Find the stress if the shank area is reduced to root area.

Or

(b) A cylindrical beam of size 60 mm is attached to support by a complete circumferential fillet weld of 6mm. find (i) torque and (ii) bending moment that can be applied if limiting shear stress is 140 MPa.

14. (a) Design a closed coiled helical spring subjected a tensile load of magnitude varying from 2500 N to 3000 N and the axial deflection of spring for this range of load is 6.5 mm. Design the spring, taking the spring index as 6 and safe shear stress for material equal to 465 MPa.

Or

(b) Design a CI flywheel for a four stroke engine developing 150 kW at 200 rpm. Calculate the mean diameter of the flywheel if the hoop stress is not to exceed 4 MPa. Total fluctuation of speed is to be 4% of the mean speed. Work done during the power stroke may be assumed to be 1.5 times the average work done during the cycle. Density of CI is 7200 kg/m^3.

15. (a) A 50 mm diameter journal bearing rotates at 1500 rpm, L/D = 1, radial clearance is 0.05 mm, minimum film thickness = 0.01 mm. Calculate the maximum radial load that the journal bearing can carry and still operate under hydrodynamic condition. For this load, calculate power lost in friction and increase in the oil temperature. Assume Hg = H_d. Absolute viscosity = 20x10^3 Pas, Sp. Gravity of oil 0.8, Sp. Heat of oil 2.1 kJ/kg°C.

Or

(b) Find the rated load of a deep groove ball bearing for the following load cycle.

S.L. NO.	RADIAL LOAD (N)	AXIAL LOAD (N)	% OF TIME
1	3000	1000	15
2	3500	1000	20
3	3500	10	30
4	500	2000	35

Also find the 90% life of ball bearing if bearing used is 6207 with dynamic capacity 19620 N.

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