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

Question Paper Code: 35703

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2018

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 various phase of design process?
2. How will you classify machined design and explain it?
3. What types of stresses are induced in shafts?
4. Under what circumstances flexible couplings are used?
5. Name the possible modes of failure of riveted joints.
6. What is threaded joint?
7. What is nipping in a leaf spring?
8. What is surge in springs?
9. What is known as self-acting bearing?
10. Define the terms Radial clearance and Eccentricity ratio for hydro dynamic journal bearing.

PART - B (5 x 16 = 80 Marks)

11. (a) A cantilever beam of circular cross section is fixed at one end and subjected to completely reversed force of 10*kN* at the free end. The force is perpendicular to the axis of the beam. The distance between free and fixed ends is 100*mm*. The beam is made of steel with ultimate tensile strength of 540 *MPa*. And tensile yield strength of 320*MPa*. The construction of the cantilever is such that there is no stress concentration. The size factor, surface finish factor and reliability factor are 0.85, 0.8, and 0.868 respectively. The operating temperature is 50^0C for which the temperature factor is 1.010. If the diameter of the beam is 35*mm* determine the life of the beam. (16)

Or

(b) An unknown weights falls through 10*mm* onto a collar which is rigidly attached to the lower end of a vertical bar 3*m* long and 600 mm^2 cross section. The maximum instantaneous extension is 2*mm*. What is the corresponding stress and the value of the weight? Take $E = 200\ kN/mm^2$. (16)

12. (a) Design a rigid type of flange coupling to connect two shafts. The input shaft transmits 37.5 *kW* power at 180 *rpm* to the output shaft through the coupling. The service factor for the application is 1.5. Select suitable material for various parts of the coupling. (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 cylindrical beam of size 60 *mm* is attached to support by a complete circumferential fillet weld of 6 *mm*. Find (i) torque and (ii) bending moment that can be applied if limiting shear stress is 140 *MPa*. (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/mm2 and allowable stress in spring material as 600 MPa. (16)

Or

(b) A four-stroke single cylinder gas engine runs at a constant load and delivers 25 *kW* at 300 *rpm*. The maximum fluctuation of energy per cycle may be taken as 0.65 times the useful work per cycle. Design a suitable rim flywheel of rectangular section to limit the variation of speed during the cycle to ±2% of the mean speed. The flywheel is made of cast iron. (16)

15. (a) Load on a hydrodynamic full journal bearing is 30 *kN*. The diameter and speed of the shaft are 150 *mm* and 1200 *mm* respectively. Diametral clearance 0.2 *mm*. Sommerfield number is 0.631. L/D ratio 1:1. Calculate temperature rise of oil, quantity of the oil, and amount of heat generated. (16)

Or

(b) Load on a hydrodynamic full journal bearing is 30 *kN*. The diameter and speed of the shaft are 150 *mm* and 1200 *mm* respectively. Diametral clearance 0.2 *mm*. Sommerfield number is 0.631. L/D ratio 1:1. Calculate temperature rise of oil, quantity of the oil, and amount of heat generated. (16)

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