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Question Paper Code: 35073

B.E. / B.Tech. DEGREE EXAMINATION, NOV 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. State Rankine's theory.
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. 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) An unknown weights falls through 10mm onto a collar which is rigidly attached to the lower end of a vertical bar 3m long and 600 mm² cross section. The maximum instantaneous extension is 2mm. What is the corresponding stress and the value of the weight? Take $E = 200 \text{ kN/mm}^2$. (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, $E = 200 \text{ kN/mm}^2$ 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 $\pm 2\%$ of the mean speed. The flywheel is made of cast iron. (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) 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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