Code: 13A03505 **R13**

B.Tech III Year I Semester (R13) Regular & Supplementary Examinations November/December 2016

DESIGN OF MACHINE MEMBERS – I

(Mechanical Engineering)

Use of Design data books is permitted in the examination hall

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) Define ductility.
(b) What happens to a shaft subjected to bending and torsion?
(c) When does a fatigue failure begin?
(d) What are the technological methods to improve fatigue strength?
(e) What are the possible modes of failure of a riveted joint?
(f) It is advisable to use lower allowable stress values for smaller diameter bolts?
(g) When do you use a knuckle joint?
(h) What is the effect of permissible angle of twist on a gear mounted on a shaft?
(i) List the advantages of splined system with number of parallel keys.
(j) When do you use a shaft coupling?

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2 What are the theories of failure under static load? Explain.

OR

3 Draw the stress-strain diagram for mild steel. Explain.

UNIT – II

4 (a) Write down Goodman's equation for combination stresses.
(b) Mention the methods of reducing stress concentration.

OR

5 Write down Soderberg's equation and state its applications to different type of loadings.

UNIT – III

6 A steam engine cylinder of 300 mm effective diameter is subjected to a steam pressure of 1.5 N/mm^2. The cylinder head is connected by means of 8 bolts having yield strength of 320 MPa, and endurance limit of 240 MPa. The bolts are tightened with an initial preload of 1.5 times that of steam load. A soft copper gasket is used to make the joint leak proof. Assuming a fatigue stress concentration factor of 1.4 and factor of safety of 2. Determine the size of the bolts required.

OR

7 Two plates of 15 mm thick are connected by a double riveted lap joint with zig-zag riveting. Assuming σ_t= 80 MPa, σ_c =120 MPa and σ = 60 MPa for both the rivets and plates. Determine the efficiency of the joint.

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UNIT – IV

8 (a) What is a cotter and when a cotter joint is used?

(b) Mention the possible modes of failure of cotter in a cotter joint.

OR

9 A shaft is supported on two bearings placed 0.6 m apart. The shaft supports a 0.5 m diameter pulley located at 0.25 m to the right of the left hand bearing and the belt drives a pulley located directly below the shaft. Another pulley of 0.4 m diameter is located 0.125 m to the right hand bearing and the belt is driven by a pulley located horizontally to the right. The coefficient of friction for the belt drive is 0.3 and the angle of contact may be taken as 180^0. The maximum tension in the belt on the smaller (0.4m diameter) pulley is 3.6 kN. Assuming permissible shear stress for the shaft material as 42 MPa, determine the shaft diameter.

UNIT – V

10 A propeller shaft is made up by joining together number of solid shafts. The joint is made by forging the ends of the shaft in the form of a flange and bolting the flanges together by means of 8 bolts. If the shaft transmits 60 kW at 120 rpm, determine the size of the shaft, the diameter and thickness of the flange and the diameter and pitch circle diameter of the bolts. Permissible stresses are T = 35 MPa and σ_c = 45 MPa.

OR

11 (a) What is a key? Classify the keys

(b) A shaft and key are made of the same material and the key width is $1/3^{rd}$ of the shaft diameter.
(i) Considering shear only, determine the minimum length of the key in terms of the shaft diameter.
(ii) Determine thickness of the key, to make the key equally strong in shear and crushing; taking the shear strength of the key material as 40% of its crushing strength.

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