Code: R7310305

**R7**

B.Tech III Year I Semester (R07) Supplementary Examinations, May 2013

**DESIGN OF MACHINE MEMBERS - I**

(Mechanical Engineering)

Time: 3 hours Max Marks: 80

Answer any FIVE questions

All questions carry equal marks

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1 A machine member 0.06 m diameter and 0.5 m long is supported at one end as a cantilever. It is subjected to a bending load at free end is 3 kN and an axial load 15 kN. Determine the tensile, compressive and shear stresses.

2 (a) Derive Soderberg's equation for design of variable loads.
(b) What are the limitations of Soderberg's criterion?

3 A double riveted double cover butt joint is used for connecting plates 1.2 cm thick. The permissible stresses are 100 N/mm$^2$ in tension, 80 N/mm$^2$ in shear and 160 N/mm$^2$ in bearing. Determine the efficiency of the joint. Sketch the joint.

4 A steam engine of effective diameter 300 mm 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 350 N/mm$^2$ and endurance limit of 250 N/mm$^2$. The bolts are tightened with an initial preload of 1.5 times that of steam force. A soft copper gasket is used to make a leak proof joint. The stress-concentration factor is 2.8. Determine the size of the bolts.

5 A 63 mm diameter shaft has a key 16 × 16 mm the shaft material has yield strength of 324 N/mm$^2$. Assume shear yield strength to be half of the tensile yield strength and factor of safety is to be equal to 2. The shaft fits into a cast iron hub for which the working stress in compression is 125 MPa. Determine the length of the key in the hub to carry torque of the shaft.

6 A transmission shaft is supported by two bearings which are 1.5 m apart. A 150 mm diameter, $20^0$ involute gears is located, 360 mm to the left of the right bearing, and is driven by a gear directly behind it. A 450 mm diameter pulley is keyed to the shaft, 450 mm to the right of the left bearing, and drives a pulley with a horizontal belt directly behind it. The ratio of belt tensions is 2.5, with slack side on top. The drive transmits 45 KW at 360 rpm. Determine the shaft diameter, assuming permissible shear stress as 45 MPa.

7 A mild steel shaft has to transmit 70 KW at 240 rpm. The allowable shear stress in the shaft material is limited to 45 MPa, and the angle of twist is not exceeding $1^0$ in a length of 20 times the shaft diameter. Determine the shaft diameter, and design a cast iron flange coupling of protected type for the shaft. The shear stress in the coupling bolts is to be limited to 30 MPa.

8 (a) Explain about the spring material and their properties.
(b) Determine the diameter of wire and the number of turns of a coil spring to have a mean coil diameter of 125 mm, and a spring stiffness of 72 kN/m. The total axial load is 8 kN and the allowable shear stress is 275 MPa.

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