

Code No: **R31035****R10****Set No. 1****III B.Tech I Semester Supplementary Examinations, October/November -2017****DESIGN OF MACHINE MEMBERS - I****(Mechanical Engineering)****Time: 3 hours****Max. Marks: 75****Answer any FIVE Questions
All Questions carry equal marks**

- 1 a) A weight of 1 kN is dropped from a height of 50 mm at the free end of a cantilever beam of effective length 300 mm. Determine the cross section of the cantilever beam of square cross – section if the allowable stress in the material of the beam is limited to 80Mpa? [5M]
- b) The stresses induced at a critical point in a machine component made of steel 45C8 ($S_{yt} = 380 \text{ N/mm}^2$) are as follows:
 $\sigma_x = 100 \text{ N/mm}^2$; $\sigma_y = 40 \text{ N/mm}^2$; $\tau_{xy} = 80 \text{ N/mm}^2$.
Calculate the factor of safety by
i) the maximum principal stress theory and ii) the maximum shear stress theory. [10M]
- 2 a) Explain the Soderberg method for combination of stresses? [5M]
- b) A circular bar of 500 mm length is supported freely at it two ends. It is acted upon by a central concentrated cyclic load having a minimum value of 20 kN and a maximum value of 50 kN. Determine the diameter of the bar by taking a factor of safety of 1.5, size effect of 0.85, surface finish factor of 0.9. The material properties of bar are given by: ultimate strength of 650 Mpa, yield strength of 500 Mpa and endurance strength of 350 Mpa. [10M]
- 3 a) What do you understand by the term riveted joint? Show the various rivet configurations during the formation riveted joint? [5M]
- b) A triple riveted lap joint with zig-zag riveting is to be designed to connect two plates of 6 mm thickness. Determine the diameter of the rivet, pitch of rivets and distance between the rows of the rivets. Indicate how the joint will fail. Also, find the efficiency of the joint. The permissible stresses are 120 MPa in tension, 100 MPa in shear and 150 MPa in crushing. [10M]
- 4 a) An eye bolt is to be used for lifting a load of 60 KN. Find the nominal diameter of the bolt, if the tensile stress is not to exceed 100 MPa. Assume coarse threads. [5M]
- b) A mild steel cover plate is to be designed for an inspection hole in the shell of a pressure vessel. The hole is 120 mm in diameter and the pressure inside the vessel is 6 N/mm^2 . Design the cover plate along with the bolts. Assume the allowable tensile stress for mild steel on 60 MPa and for bolt material as 40 Mpa? [10M]

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| 5 | a) | What is the difference between a cotter and key? Why a single taper is provide in cotter and not on both sides? Discuss the advantages and limitations of cotter joint? | [5M] |
| | b) | Two mild steel rods of 36mm diameter are to be connected by means of a cotter joint. The ends of the rod to be suitably enlarged by forging. The thickness of the cotter is 12mm. Calculate the dimensions of the joint, if the permissible stresses are 60MPa in tension, 45MPa in shear, and 90MPa in compression. | [10M] |
| 6 | a) | Derive the equation for torque acting upon a hollow shaft from the torsion equation. | [7M] |
| | b) | Determine the diameter of the hollow shaft with inside dia = 0.6 outside dia. The shaft is driven by an overhung pulley of 90cm dia. Take weight of pulley = 60kg, the belt tensions as 290 and 100kg, over hang = 25cm, angle of lap = 180°. | [8M] |
| 7 | | Design and draw a muff coupling to transmit 50Hp at 120 rpm. The shaft and key are made of the same material having allowable shear stress of 30N/mm^2 and compressive stress of 80N/mm^2 . The flange is made, as cast Iron with allowable shear stress is 15N/mm^2 . | [15M] |
| 8 | a) | Why the circular cross section is most commonly used for spring and not others? Under what circumstances the non-circular section would be recommended? | [5M] |
| | b) | A helical spring is made from a wire of 6 mm diameter and has outside diameter of 75 mm. If the permissible shear stress is 350 MPa and modulus of rigidity 84 kN/mm^2 , find the axial load which the spring can carry and the deflection per active turn? | [10M] |

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