

Code No: 55019

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year I Semester Examinations, February/March - 2016

DESIGN OF MACHINE MEMBERS-I

(Mechanical Engineering)

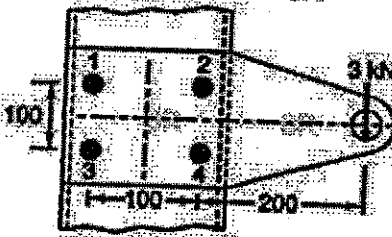
Time: 3 hours

Max. Marks: 75

Answer any five questions  
All questions carry equal marks

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- 1.a) A steel bar 2.4 m long and 30 mm square is elongated by a load of 500 kN. Find the increase in volume. Consider Young's Modulus as 200 GPa and Poisson's ratio as 0.25.
- b) Differentiate between the strain energy and the modulus of resilience.
- c) Select suitable material for the following cases, indicating the reason:
- A shaft subjected to variable torsional and bending load
  - Spring used in a spring loaded safety valve
  - Nut of a heavy duty screw jack
  - Low speed line-shaft coupling.
- 2.a) Compare the Soderberg and Goodman diagrams for variable stresses.
- b) A machine component is subjected to fluctuating stress that varies from 40 MPa to 100 MPa. The corrected endurance limit stress for machine component is 270 MPa. The ultimate and tensile strength of the material are 600 MPa and 450 MPa respectively. Find the factor of safety using Soderberg line and Goodman line. Also, find the factor of safety against static loading. [5+5+5]
- 3.a) Sketch and explain the various types of failures in Riveted Joints.
- b) A single riveted lap joint is made in 15 mm thick plates with 20 mm diameter rivets. Determine the strength of the joint, if the pitch of the rivets is 60 mm. The permissible working stresses are 120 MPa in tension, 90 MPa in shear and 160 MPa in crushing. Find the efficiency of the joint. [7+8]
4. A steel plate subjected to a force of 3 kN and fixed to a vertical channel by means of four identical bolts is shown in figure. The bolts are made of plain carbon steel 45C8 and the factor of safety is 2. Discuss the nature of the stresses induced in the bolts. Determine the diameter of the shank. All the dimensions are in mm. [15]



- 5.a) How are the keys classified? Draw neat sketches of different types of keys and state their applications.
- b) Two rod ends of a pump are joined by means of a cotter and spigot and socket at the ends. Design the joint for an axial load of 100 kN which alternately changes from tensile to compressive. The allowable stresses for the material used are 50 MPa in tension, 40 MPa in shear and 100 MPa in crushing. [7+8]
6. A 400 mm diameter pulley, A, mounted on a counter shaft midway between bearing, 1200 mm apart, transmits 50 kW at 1500 rpm to a machine below it by a flat belt drive. The power is fed to the counter shaft by another pulley, B, 300 mm in diameter and mounted at an overhung of 300 mm. The electric motor vertically below pulley B provides power to it. The belt tensions on both the pulleys are vertical and coefficient of friction is 0.3. Design the shaft if the allowable shear stress and normal stresses are 45 MPa and 70 MPa respectively. [15]
- 7.a) Sketch a muff coupling and identify its advantages and disadvantages.
- b) A universal coupling is used to connect two mild steel shafts of 75 mm diameter. Assuming that the shafts are subjected to torsion only, find the diameter of the pins if the allowable shear stress for pin is 28 MPa. [7+8]
- 8.a) What is the curvature effect in a helical spring? How does it vary with spring index?
- 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 GPa, find the axial load which the spring can carry and the deflection per active turn. [7+8]

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