Roll No. | | | | | | | | | | | | Total No. of Pages : 02

Total No. of Questions : 09

B.Tech.(Mechanical Engg.) (2011 Onwards)
B.Tech.(Marine Engg.) (2013 Onwards) (Sem.–3)

STRENGTH OF MATERIALS- I

Subject Code : BTME-301
Paper ID : [A1138]

Time : 3 Hrs. Max. Marks : 60

INSTRUCTION TO CANDIDATES :

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.**
3. **SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.**

SECTION-A

Q.1 Write briefly :

i) What is Factor of safety?

ii) How stress concentrations affect the work life of a material?

iii) How fatigue strength of a shaft can be improved?

iv) A load of 400 N has to be raised at the end of a steel wire. If the stress in the wire must not exceed 80 MPa, what will be the minimum diameter required?

v) What is modulus of toughness?

vi) Define the moment of Inertia of an area about an axis lying in the plane of the area.

vii) What is the radius of gyration of an area and what is the practical use of it?

viii) Write the relationship between modulus of rigidity and Young's modulus.

ix) What is principle stress and principle plane?

x) Write Maximum strain energy theory.

SECTION-B

Q.2 A hollow steel cylinder of 300 mm length, 150 mm inside diameter and 3 mm uniform wall thickness is filled with concrete and compressed between two rigid parallel plates at the ends by a load 600 kN. Find the compressive stress in each material and the total shortening of the cylinder if the Young's modulus of steel = 2×10^5 N/mm^2 and Young's modulus of concrete = 2×10^4 N/mm^2.

Q.3 Two principal stresses at a point in a bar are 200 N/mm^2 (tensile) and 100 N/mm^2 (compressive). Determine the resultant stress in the magnitude and direction on a plane inclined at 60° to the axis of the major principal stress. Also determine the maximum intensity of the shear stress.

Q.4 A 4 meter long cantilever beam carries a gradually varied load, zero intensity at the free end to 1000 N/m at the fixed end. Draw the shear force and bending moment diagram for the beam.

Q.5 A cantilever beam of length 3 m carries a uniformly distributed load over the entire length. If the slope at the free end is 0.0177 rad. Find the deflection at the free end.

Q. 6 Two shafts of the same material and the same lengths are subjected to the same torque. If the first shaft is a solid circular section, and the second shaft is a hollow circular section, whose internal diameter is 2/3 of the outside diameter and the maximum shear stress developed in each shaft is the same, compare the weights of the two shafts.

SECTION-C

Q.7 A load of 300 kN is applied on a short concrete column of 250 mm × 250 mm. The column is reinforced by the steel bars of total area 5600 m^2. If the modulus of elasticity for the steel is 15 times that of the concrete, find the stresses in concrete and steel. If the stress in the concrete should not exceed 4 N/mm^2, find the area of the steel required so that the column may support a load of 600 kN.

Q.8 A hollow steel shaft of 240 mm external diameter and 160 mm internal diameter is to be replaced by a solid alloy shaft. If both the shafts should have the same polar modulus, find the diameter of the later and the ratio of the tensional rigidities. Modulus of rigidity (C) for steel = 2.4 × C for alloy seel. If alternatively, the two shafts should have the same torsional rigidity, find the ratio of their polar moduli.

Q.9 A simply supported beam of span 6 meter has cross section 100 mm × 250 mm. If the permissible stress is 8 MPa, find the maximum intensity of the uniformly distributed load it can carry, and the maximum concentrated load W applied at 2 meter from one end it can carry.