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TME-303 191 Printed Pages : 5

Paper Code & Roll No. to be filled in your Answer Book

Roll No. | | | | | | | | | | |

Odd Semester Examination-2016

B.Tech. (Semester-III)

SOLID MECHANICS

[Time : 3 Hours] [Maximum Marks :100]

Note : Attempt **all** questions. All question carry **equal** marks. Assume missing data suitably.

1. Attempt **any four:** [5×4=20]

(a) A bar 0.3m long is 50mm square in section for 120 mm of its length, 25mm diameter for 80mm and of 40 mm diameter for the remaining length. If a tensile force of 100KN is applied to the bar, calculate the maximum and minimum stresses produced in it and total elongation. Take E= 200 GN/m² and assume uniform distribution of load over the cross sections.

(b) Derive the equilibrium equation with diagram in 2 dimensions.

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(c) Explain the stress due to impact load.

(d) Explain the maximum principal strain theory.

(e) Explain the castigliano's theorm.

(f) Describe the compatibility relations.

2. Attempt **any four:** [5×4=20]

(a) Explain the stress and strain invariants.

(b) A piece of steel plate is subjected to perpendicular stresses 6MN/m² (tensile) and 4 MN/m² (compressive). Calculate normal and tangential stresses and magnitude and direction of resultant stress on the interface whose normal makes an angle of 30^0 with the axis of second stress.

(c) Draw the shear force and bending moment diagram of a simply supported beam of length l having point load on the midpoint and udl over the entire span.

(d) What do you mean by pure bending? Whatare the assumptions made in theory of simple bending?

(e) A solid circular shaft transmits 75 kw power at 200 rpm. Calculate shaft diameter, if the twist in shaft is not to exceed 1° in 2 meters length of shaft and

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shear stress is limited to 50 MN/m². Take G= 100 GN/m².

(f) State the Cauchy stress tensor and derive it.

3. Attempt **any two:** [10×2=20]

(a) A steel bar 120mm in diameter is completely encased in an aluminium tube of 180mm outer diameter and 120mm inner diameter so as to make a composition beam. The composite beam is subjected to a bending moment of 15 KNm. Determine the maximum stress due to bending in each material. Take $E_s = 3E_{al}$.

(b) A hollow rectangular masonry pier is 1.2m×0.8m, overall, the wall thickness being 0.15m, a vertical load of 100KN is transmitted in the vertical plane bisecting 1.2m side at an eccentricity of 0.1m from the geometric axis of the section. Calculate the maximum and minimum stress intensities in the section.

(c) What do you mean by neutral axis? Derive an expression for the bending of a beam.

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4. Attempt **any two:** [10×2=20]

(a) A horizontal beam AB of length 8m is simply supported at A and B. It carries UDL of 3 KN/m over the entire span and a clockwise moment of 12 KNm is applied in the plane of beam at a point C, 5m from A. Draw the shear force and bending moment diagrams and determine position and magnitude of maximum bending moment.

(b) The intensity of loading in a simply supported beam of 8m span varies gradually from 2KN/m at one end to 6KN/m at the other end. Draw the shear force and bending moment diagrams.

(c) A rectangular block of material is subjected to a tensile stress of 100 MN/m² on one plane and a tensile stress of 50 MN/m² on plane right angles, together with shear stresses of 60 MN/m² on the same planes. Find : (i) magnitude of principal stresses (ii) Directions of principal planes (iii) magnitude of greatest shear stress.

5. Attempt **any two:** [10×2=20]

(a) A cantilever beam with a span of 3 meter long is loaded with a uniformly distributed load 15KN/m

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over a length of 2 meter from fixed end. Determine slope and deflection at the free end of cantilever using moment area method. Take $E = 2.1 \times 10^8$ KN/ m^2 and $I = 0.000095 m^4$.

(b) Derive the relation between slope, deflection and radius of curvature.

(c) A cantilever beam 3m long carries two point loads, 60 KN each at distances of 0.75n and 1.75m respectively from the fixed end. Determine deflection at free end. Take $E = 200 GN/m^2$ and $I = 12689400\ Cm^4$.

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