This question paper contains 4 printed pages.

3267 *Your Roll No.* .....

B.Tech. (M) / II **J**

Paper VI— STRENGTH OF MATERIALS

(EME–206)

Time : 3 hours *Maximum Marks* : 70

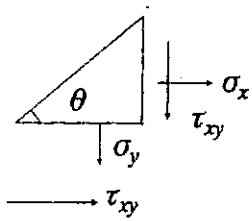
(Write your Roll No. on the top immediately on receipt of this question paper.)

Answer five questions in all, selecting at least two from Part A and two from Part B.

Assume missing data, if any.

PART A

1. Derive the equation for normal stress σ_n and shear stress τ_s when an elemental body is subjected to two mutually perpendicular stresses σ_x and σ_y shown below on an inclined plane at θ alongwith τ_{xy}.



14

2. (*a*) Determine σ_n and τ_s for the body subjected to stress conditions shown in fig.

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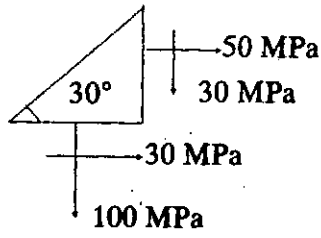
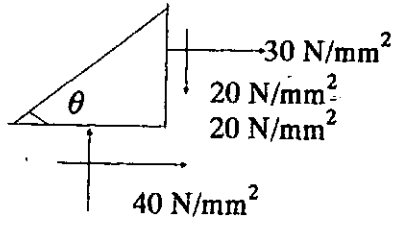


8

(*b*) Derive the equation for shearing stress on principal plane. 6

3. (*a*) Derive the expression for maximum deflection of simply supported beam subjected to uniformly distributed load. 7

(*b*) Determine principal stresses on a point on a strained material shown in fig. 7



4. (*a*) State Rankine theory and Tresca's theory of elastic failure. 6

(*b*) A material is having 100 MPa, 40 MPa and 60 MPa as principal stresses. Calculate total strain

energy, volumetric strain energy and shear strain energy. 8

PART B

5. A fixed beam is subjected to a point load at its mid span. Derive equation for (*i*) shear force, (*ii*) bending moment, (*iii*) slope and (*iv*) deflection. Draw corresponding diagrams. 14

6. An open coiled helical spring having 12 coils, 20 cm mean coil diameter is made of 2 cm diameter steel rod. The helix angle is 30°. Find the deflection and angular twist of one of the ends of the spring relative to the other end, if it is subjected to axial load of 200 N. What are the maximum bending and torsional stresses in the wire? Neglecting the direct shear and normal loads on the wire cross-section, calculate the maximum direct and shear stress on the wire.

   Take $E=200\ GN/m^2$, $G=80\ GN/m^2$. 14

7. (*a*) A thin cylinder 0·4 mm thickness, 100 cm in length and 14 cm internal diameter is subjected to internal pr of 6 MPa. The increase in volume due to this pressure is 14 cm^3. Determine Poisson's ratio and mod of rigidity.

   E=210 GPa. 8

   (*b*) Derive expression for Euler's theory for column with one end fixed and the other end free. 6

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