Master level/ M. Sc. (Structural Engineering)/ 1st Semester Full Marks: 60

Time: 3 hours Pass Marks: 30

Subject: Advanced Mechanics of Solids (STR513/MSTR503)

- *Attempt all the questions.*
- *Figures in the margin indicate full marks.*
- *Assume suitable values, with a stipulation, if necessary.*
- *Candidates are required to answer the questions in their own words as far as possible.*

1. Derive the Cauchy's equation for components of traction on an Arbitrary plane along the all orthogonal direction. [6]

2. Write down the generalized Hook's Law for a linear elastic isotropic material. The following stresses are applied on the cubical element, σ_x=650 Mpa, σ_y=350 Mpa, σ_z= -110 Mpa $\tau_{xy}= \tau_{yz} = \tau_{zx}$=0. Determine the Principle shear strain and octahedral shear strain. Assume the material is isotropic and homogeneous. Take E = 2 × 10^5 Mpa and ϑ = 0.99. [2+4]

3. Derive Airy's stress function in a plane problem in Cartesian coordinates. Determine the Principal strain and their direction at A (0, -9,2) of the given body, the displacement field of which is given by the equations: u= [(5x + 0.9y²)i +(y² + 0.9z)j + (0.7z² +9x)k]× 10^{-2}. [2+4]

4. Explain the Axisymmetric problem with suitable examples of Axisymmetric bodies. A thick-walled steel cylinder with radii a = 5 cm and b = 10 cm is subjected to an internal pressure P. The yield stress in tension for the material is 350 MPa. Using a factor of safety of 1.5, determine the maximum working pressure P according to the major theories of failure = 207x10^6 KPa, υ = 0.25. [2+6]

5. Explain the assumptions in the Winkler Bach Theory. The Dimension of 100KN crane hook are as shown in figure on right. Determine the stresses at the inside and outside fibers of the hook on horizontal diameter passing through the centre of curvature. [2+7]
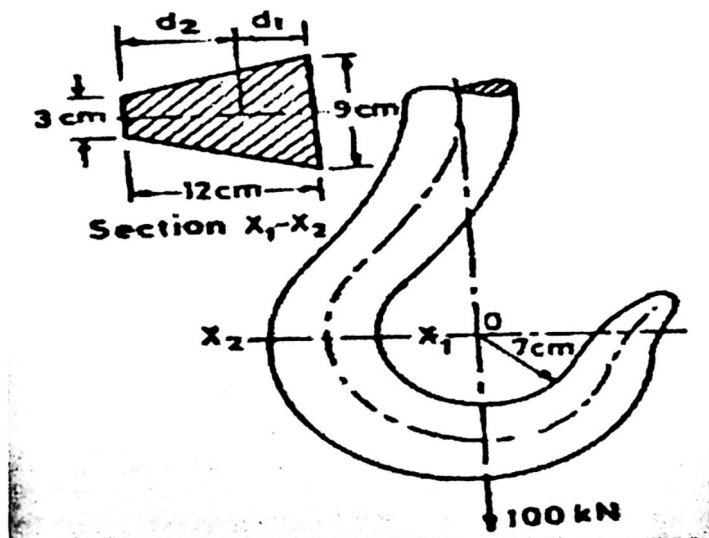
6. Explain Elastic–plastic problem of beam and Analysis of infinite beam concentrated load at centre of following elastic foundation of beam. [3+7]
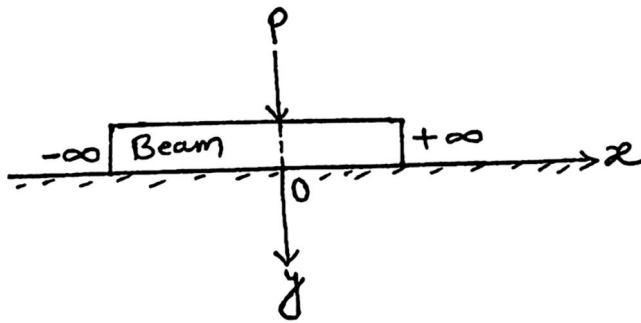
7. Derive Polar stress components and Equilibrium equation of the polar coordinates system. [7]

8. What do you mean by warping function? Briefly Assumptions, Derive the Torsion equation for General Prismatic Solids Bars. [1+7]

The End