M. Sc. Mathematics Examination, 2022

(2nd Year, 2nd Semester)

Solid Mechanics – IV

Paper – DSE - 07 (B27)

Time : 2 hours Full Marks : 40

Symbols / Notations have their usual meaning.

Answer question no. **1** and ***any two*** from the rest.

1. Define yield criteria in plasticity. Show that Von Mises' yield criterion can be put in the form

$$(\sigma_1-\sigma_2)^2+(\sigma_2-\sigma_3)^2+(\sigma_3-\sigma_1)^2=2\sigma_0^2 \qquad 10$$

Or

Define Stress Space and π-plane. Give geometrical interpretation of Tresca's yield criterion in the Stress-Space. 10

2. Obtain Prandtl-Reuss Stress-Strain relations and Mises flow equations valid in the plastic range of a medium. Show that a Mises' material may be considered as a limiting case of a Prandtl-Reuss material as the shear modulus G tends to inifinity. 15

3. Show that for unrestricted plastic flow in a circular tube under internal pressure p_0 and initial radii a_0 and b_0, the pressure at any point within the tube is given by

$$p=\frac{\sigma_0}{\sqrt{3}}\log\left(1+\frac{b_0^2-a_0^2}{a^2}\right). \qquad 15$$

4. A long circular cylinder of radius b rotates with angular velocity ω about its axis. Find the least value of ω for starting of yielding. Also find the stresses in the plastic state of the cylinder. 15