JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATION- 2023

MTECH (SE) II SEMESTER

COURSE CODE(CREDITS): 12M1WCE211 (3) MAX. MARKS: 35

COURSE NAME: SOLID MECHANICS IN STRUCTURAL ENGINEERING

COURSE INSTRUCTORS: Dr. Tanmay Gupta MAX. TIME: 2 Hours

Note: *(a) All questions are compulsory.*

(b) Marks are indicated against each question in square brackets.

(c) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems.

Q.1 Discuss Mohr's circle for three-dimensional state of stress. **[4]**

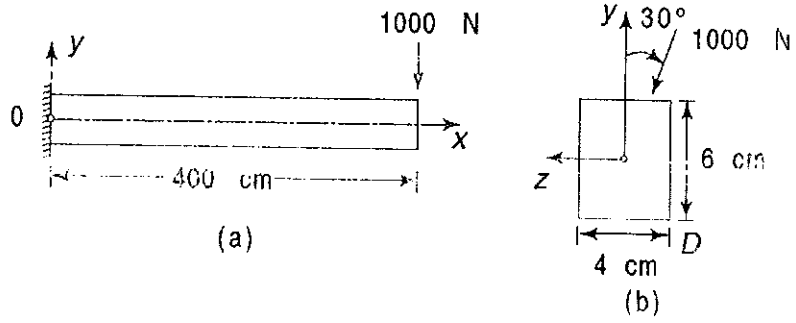
Q.2 What do you understand by stress invariants? Prove that cubic equation of stress has real roots. **[4]**

Q.3 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. E = 207 X 10^6 kPa, ν = 0.25. At r = a state of stress can be assumed as follows: **[8]**

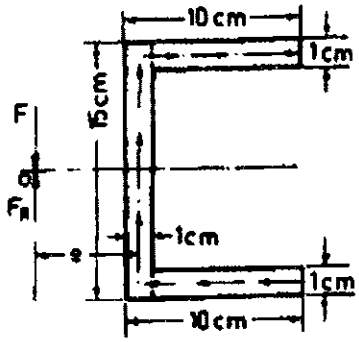
$$\sigma_r = -p, \qquad \sigma_\theta = p\frac{b^2 + a^2}{b^2 - a^2}, \qquad \sigma_z = p\frac{a^2}{b^2 - a^2}$$

Q.4 With neat diagram explain the problem of stresses in composite tubes—shrink fits? **[3]**

Q.5 A cantilever beam of rectangular section is subjected to a load of 1000 N (102 kgf) which is inclined at an angle of 30° to the vertical. What is the stress due to bending at point D near the built-in-end? **[4]**



Q.6 Why is it important to find out shear center for unsymmetrical sections? Determine the shear center for the given channel section? **[4]**



Q.7 Write the expression of stress on a fibre at a distance y from centroidal axis in a curved beam as per Winkler Bach theory. Find the value of h^2 for rectangular cross-section of width B and depth D, if the neutral axis position is given by the formula $y = -[Rh^2/(r^2+h^2)]$ **[4]**

Q.8 A cubical element is subjected to the following state of stress. $\sigma_x = 100$ MPa, $\sigma_y = -20$ MPa, $\sigma_z = -40$ Mpa, $\tau_{xy} = \tau_{yz} = \tau_{zx} = 0$. Assuming the material to be homogeneous and isotropic, determine the principal shear strains and the octahedral shear strain, if E = 2 X 10^5 MPa and Poisson's ratio = 0.25. **[4]**