JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -2 EXAMINATIONS-2022

M.Tech-I Semester (Structural Engineering)

COURSE CODE (CREDITS): 12M1WCE211 (3) MAX. MARKS: 25

COURSE NAME: SOLID MECHANICS IN STRUCTURAL ENGINEERING

COURSE INSTRUCTOR: Arnav Anuj Kasar MAX. TIME: 1 Hour 30 Min

Note: *All questions are compulsory. Marks are indicated against each question in square brackets.*

Q1. The state of stress characterized by τ_{ij} is given below. Resolve the given state into a hydrostatic state and a pure shear state. Determine the normal stresses on an octahedral plane.

$$\tau_{ij} = \begin{bmatrix} 10 & 4 & 6 \\ 4 & 2 & 8 \\ 6 & 8 & 6 \end{bmatrix}$$ [2 Marks]

Q2. The state of stress at a point is such that $\sigma_x = \sigma_y = \sigma_z = \tau_{xy} = \tau_{yz} = \tau_{zx} = 10$. Determine the principal stresses and their directions. [5 Marks]

Q3. Determine the principal stresses and their associated directions for the following state of stress along the standard Cartesian coordinate system.

$$\tau_{ij} = \begin{bmatrix} 1 & 2 & 1 \\ 2 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$$ [5 Marks]

Q4. Show that the shear stresses are complementary. Use usual nomenclature. [5 Marks]

Q5. What are the fundamental laws of stresses at a point of a three dimensional body in state of static equilibrium? Discuss briefly. [3 Marks]

Q6. A cylindrical boiler, 180 cm in diameter, is made of plates 1.8 cm thick, and is subjected to an internal pressure 1400 kPa (figure below). Determine the maximum shearing stress in the plate at point P and the plane on which it acts. [5 Marks]