JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -1 EXAMINATION- 2026

M.Tech-II Semester (SE)

COURSE CODE (CREDITS): 25M11CE211[3] MAX. MARKS: 15

COURSE NAME: Solid Mechanics in Structural Engineering

COURSE INSTRUCTOR: Dr. Tanmay Gupta MAX. TIME: 1 Hour

***Note:** (a) All questions are compulsory. (b) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems (c) Use of calculators is allowed*

Q.No	Question	CO	Marks
Q1	(a) A bar 30 mm in diameter was subjected to tensile load of 54 kN and measured extension of 300 mm gauge length was 0.112 mm and change in diameter was 0.00366 mm. Calculate Poisson's Ratio and the value of three moduli. (b) A steel bolt of length L passes through a copper tube of the same length, and the nut at the end is turned up just snug at room temp. Subsequently the nut is turned by 1/4 turn and the entire assembly is raised by temp 55^0C. Calculate the stress in bolt if L=500 mm, pitch of nut is 2mm, area of copper tube =500 sq.mm, area of steel bolt =400 sq.mm $E_s=2 * 10^5$ N/mm^2 ; $\alpha_s=12*10^{-6}/^0C$ $E_c=1 * 10^5$ N/mm^2 ; $\alpha_c= 17.5*10^{-6}/^0C$	1	5
Q2	The state of stress at a point is characterised by the components as: $\sigma = \begin{bmatrix} 12.31 & 4.20 & 0.84 \\ 4.20 & 8.96 & 5.27 \\ 0.84 & 5.27 & 4.34 \end{bmatrix}$ (a) Find the values of the principal stresses and their directions. (b) Also determine the principal shears and the associated normal stresses, by clearly drawing 3D Mohr' circle.	2	6
Q3	(a) The octahedral plane is defined as the plane whose normal makes equal angles with the three principal axes, there are technically eight such planes in a 3D space. Why do they all share the same magnitudes of normal and shear octahedral stress? Why is the octahedral shear stress a more "fair" representation of a material's failure potential than a single maximum shear stress? (b) Any stress state can be split into a Hydrostatic part and a Deviatoric part, explain the different physical effects these two components have on a material element (e.g., volume vs. shape). Why is the Deviatoric stress tensor used almost exclusively when analysing the "yielding" of metals?	1	4

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