JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -2 EXAMINATION- 2025

MTECH (SE) II SEMESTER

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

COURSE NAME: SOLID MECHANICS IN STRUCTURAL ENGINEERING

COURSE INSTRUCTORS: Dr. Tanmay Gupta MAX. TIME: 1 Hour 30 Min

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

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

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Q.1 A solid circular shaft is subjected to a bending moment of 3kNm and a torque of 1kNm. The shaft is to be made in carbon steel for which (yield stress) σ_y = 480MPa and (max shearing stress) τ_y = 265MPa. If in the beginning plastic deformation is to be avoided, calculate the shaft diameter using: (a) Maximum Principal Stress Theory (b) Maximum Shearing Stress Theory (c) Distortion Energy Theory **[6]**

Q.2 The homogeneous three-dimensional state of stress for a metal part undergoing plastic deformation is defined as $\sigma_x = 10$, $\sigma_y = 20$, $\sigma_z = -10$. $\tau_{xy} = 5$, $\tau_{yz} = \tau_{zx} = 0$ (all in MPa). Using Von-Mises yield criterion find the value of estimated shear yield stress in MPa, also show Mohr Circle for the same. **[7]**

Q.3 A member made of isotropic bronze (E = 82.6 GPa and $\nu = 0.35$) is subjected to a state of plane strain ($\varepsilon_{zz} = \varepsilon_{zx} = \varepsilon_{zy} = 0$). Determine σ_{zz}, ε_{xx}, ε_{yy}, and $y_{xy} = 2\varepsilon_{xy}$, if $\sigma_{xx} = 90$ MPa, $\sigma_{yy} = -50$ MPa, and $\sigma_{xy} = -70$ MPa. **[4]**

Q.4 With help of neat diagram prove that cubical dilation $\Delta = \varepsilon_{xx} + \varepsilon_{yy} + \varepsilon_{zz}$ **[4]**

Q.5 State the conditions under which the following is a possible system of strains: **[4]**

$$\varepsilon_{xx} = a + b(x^2 + y^2)\ x^4 + y^4, \qquad \gamma_{yz} = 0$$
$$\varepsilon_{yy} = \alpha + \beta\,(x^2 + y^2) + x^4 + y^4, \qquad \gamma_{zx} = 0$$
$$\gamma_{xy} = A + Bxy\,(x^2 + y^2 - c^2), \qquad \varepsilon_{zz} = 0$$