JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATION- 2025

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

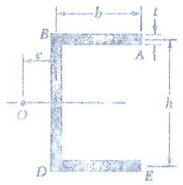
Note: (a) All questions are compulsory.

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

Q.1 Principal stresses are often used in failure criteria like Tresca and Von Mises. Explain why principal stresses, rather than individual stress components, are fundamental to predicting material failure. How does the physical interpretation of principal stresses differ between ductile and brittle materials? [3]

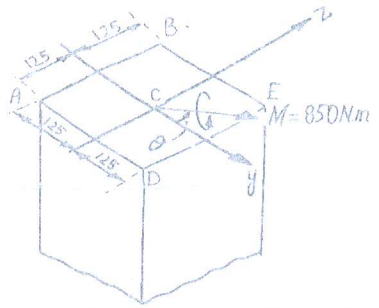
Q.2 (a) Determine the location for the shear center of the channel section with b = 100 mm., h = 150 mm and t = 4 mm. [3]

(b) Also Determine the shear stress distribution for Shear Force V = 11 kN acting at a distance of 40mm from center - line of Web BD towards O. [4]



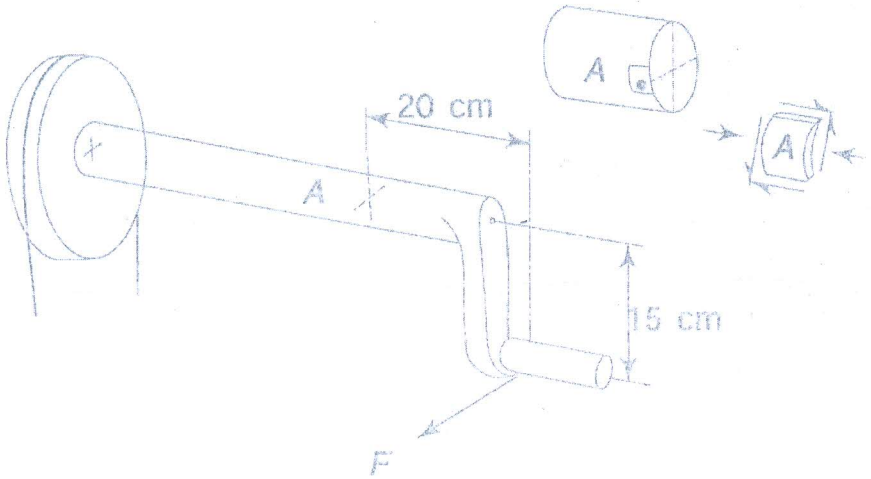
Q.3 (a) Explain Unsymmetrical bending in beams with the help of a neat diagram. [3]

(b) Determine the stress at each corner and sketch the stress distribution for θ = 45° and θ = 30°. [5]



Q.4 Explain the concept of an ideally plastic solid with reference to its stress–strain behavior. How does it differ from a linearly elastic material? Illustrate your answer with a neat sketch of the idealized stress–strain diagram for all 5 types. [5]

Q.5 A force F is necessary to rotate the shaft shown in Figure below at uniform speed. The crank shaft is made of ductile steel with σ_{yt} = 150 MPa and σ_{yc} = 330 MPa. If the diameter of the shaft is 10 cm, determine the allowable force F according to Mohr's theory of failure. Let the factor of safety be 2. Consider a point on the surface of the shaft where the stress due to bending is maximum. [8]



Q.6 Two points P and Q in the undeformed body have coordinates (0, 0, 1) and (2, 0, -1) respectively. Assuming that the displacement field $u = (x^2 + y)i + (3 + z)j + (x^2 + 2y)k$ has been imposed on the body, what is the distance between points P and Q after deformation? [4]