Registration No : | | | | | | | | | | |

Total Number of Pages : 02 **B.Tech.**

PCME4307

6th Semester Back Examination 2017-18
ADVANCED MECHANICS OF SOLIDS
BRANCH : MECH
Time : 3 Hours
Max Marks : 70
Q.CODE : C424

Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right hand margin indicate marks.

Q1 **Answer the following questions :** **(2 x 10)**

a) State and briefly explain the theorem of Virtual Work
b) Distinguish between thin cylinder and thick cylinder.
c) How do you find the deflection in unsymmetrical bending?
d) Define Shear Centre and why it is important?
e) How do you locate the neutral axis in bending of curved beams with large initial curvature?
f) Write the Winkler-Bach formula with explanation of the terms used
g) What do you mean by Stress Concentration Factor? What is its importance?
h) State the Maxwell's theorem of reciprocal relations.
i) Write down the Equations of equilibrium in 3-dimensional elasticity problems explaining the terms used.
j) Define FRP composites

Q2 What do you mean by Modulus of Resilience? A Cantilever beam of length L= 2 m supports a uniformly distributed load of intensity w = 4 kN/m and a concentrated load P = 6 kN at its free end. Using Castigliano's theorem, determine the deflection of the beam at the free end. EI = 5 MN.m^2. **(10)**

Q3 Define strain energy. Two steel shafts each of length l and outside diameter d are subjected to uniform torsion. The first shaft is solid while the second one is hollow with inside diameter d/2. What is the ratio of the strain energies that they can absorb without exceeding a maximum allowable shear stress τ_w ? **(10)**

Q4 A thick walled pipe of 200 mm internal diameter and 50 mm thickness carries a fluid at an internal pressure of 10 MN/m^2. Calculate the maximum and minimum intensities of circumferential stresses and radial stresses across the section. Also sketch the radial stress distribution and circumferential stress distribution across the section. **(10)**

Q5 Write the expression for orientation of neutral axis in unsymmetrical bending. A simply supported I-beam of 2-m span carries a central load of 4 kN (Fig.1). The load acts through the centroid, the line of action is inclined at 30^0 to the vertical direction. Determine the maximum stress. The thickness of flanges and web is 10 mm. **(10)**

Q6 A crane hook having a trapezoidal horizontal cross-section is 50 mm wide inside and 30 mm wide outside. Thickness of the section is 60 mm. the crane hook carries a vertical load of 20 kN whose line of action is 50 mm from the inside edge of the section. The centre of curvature is 60 mm from the inside edge. Determine the maximum tensile and compressive stresses in the section. **(10)**

Q7 Briefly explain the Strain Compatibility Equations in 3-dimensional elasticity. **(10)**
The state of stress at a point is given by the following stress components in kPa $\sigma_x = 200, \sigma_y = 100, \sigma_z = 50, \tau_{xy} = 30, \tau_{yz} = 20, \tau_{zx} = 40$. Determine the principal stresses and principal planes.

Q8 **Answer any TWO from the following :** **(2 x 5)**

(a) Draw and explain the salient features of S-N curve
(b) Briefly explain why sharp corners in loaded components are avoided
(c) Define the term laminate of composite materials.
(d) State and explain Principal Stress theory of failure

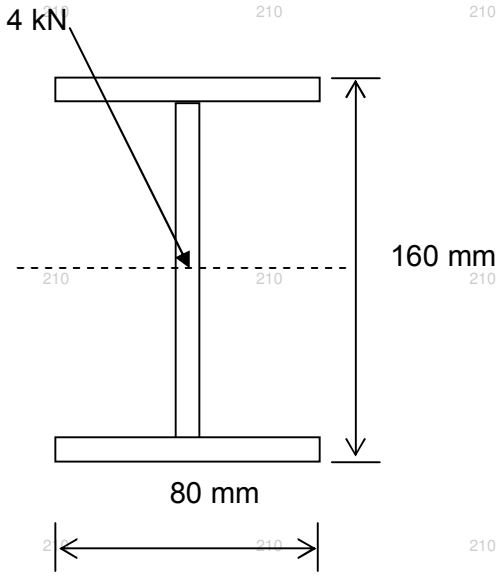

Figure 1