Registration no:

Total Number of Pages: 02   **B.Tech**
                                                                                                            PCME4307

6th Semester Regular / Back Examination 2016-17
## ADVANCED MECHANICS OF SOLIDS
BRANCH: MECH
### Time: 3 Hours
Max Marks: 70
Q.CODE: Z236
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)   Prove that stress is a tensor quantity. What do mean by order of a tensor.
  b)   What are direction cosines ? Write properties of direction cosines.
  c)   What are stress invariants ? State expressions for 3rd (I_3) stress invariants in term of stresses in 3D Cartesian coordinate system.
  d)   What do you understand by strain compatibility of equations?
  e)   State shear centre. What is its significance?
  f)   Give graphical representation of a hoop stress and radial stress of a thick cylinder subjected to internal and external pressure.
  g)   Why the trapezoidal cross section of a crane hook is preferred over a rectangular cross section?
  h)   Derive the rule of mixture for Young's modulus.
  i)   What do you mean by stress concentration. What are its effects. How to avoid the stress concentration.
  j)   What is Soderberg law of fatigue design?

Q2 a) With the help of a neat sketch, state Maxwell's reciprocal theorem.   **(3)**
  b)   By using Castigliano's theorem, calculate vertical deflection at the middle of a simply supported beam which carries a uniformly distributed load of intensity 'w' over the full span.   **(7)**

Q3   Find the eccentricity of the shear centre for the channel section shown in Figure below,
            If   V = 100 N.   **(10)**
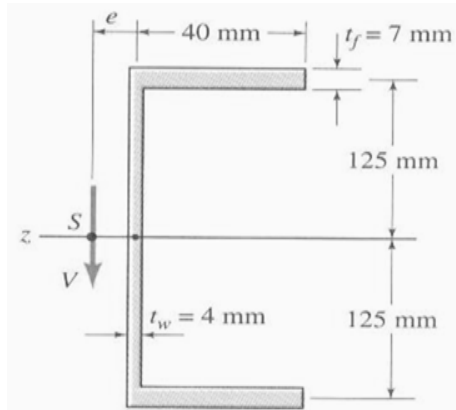
Q4 A compound thick cylinder is formed by shrinking a tube of external diameter 300 mm over another tube of internal diameter 150 mm. After shrinking, the diameter at the junction of the tube is found to be 250 mm and radial compression as 28 MPa. Find the original difference in radii at the junction. Assume E= 200 GPa. **(10)**

Q5 Figure below shows a crane hook lifting a load of 150 kN. Determine the maximum Compressive and tensile stresses in the critical section of the crane hook. **(10)**

Section along AB
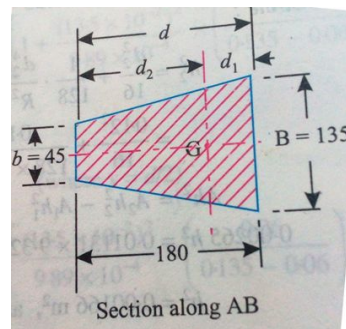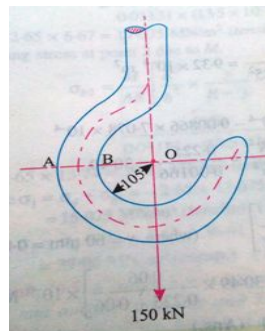
Q6 a) State 3D stress equilibrium equations in Cartesian coordinate system for a moving body considering body forces. **(5)**

b) Given state of stress $\sigma_{ij} = \begin{vmatrix} 3 & -10 & 0 \\ -10 & 0 & 30 \\ 0 & 30 & -27 \end{vmatrix}$ **(5)**

Decompose into hydrostatic state and deviatoric state of stress.

Q7 What is a shear flow diagram? Explain how would you obtain the shear centre of a channel section of suitable dimension. **(10)**

Q8 **Distinguish between the following (Any TWO):** **(5 x 2)**
a) Symmetrical bending and unsymmetrical bending
b) Analysis of thin shells and thick shells under internal pressure.
c) Lamina and laminates.
d) Hydrostatic stress and deviatoric stress.