H.T.No. | | | | | | | | | | |

Code No: ME1901 **GEC-R14**

M. Tech I Semester Supplementary Examinations, February 2018

ADVANCED MECHANICS OF SOLIDS

(Machine Design)

Time: 3 Hours **Max. Marks: 60**

Note: Answer any **FIVE** questions. All Questions carry equal Marks.

5 × 12 = 60M

1. The state of stress at a point is given by σ_{xx} = -90MPa, σ_{yy} = -60 MPa, σ_{zz} = 40MPa,σ_{xy} = 70 MPa, σ_{yz} = -40 MPa, and σ_{zx} = -55MPa.

   i) Determine the stress invariants I_1,I_2 ,I_3 and three principal stresses and shear stress. (8M)

   ii) Show that I_1,I_2 , I_3 are same relative to (x,y,z) axis and relative to principal axis (1,2,3) (4M)

2. Derive Winkler Bach formula for bending of curved beams. (12M)

3. Locate the shear center for the beam cross section shown in Figure 1**.** The walls of the cross section have constant thickness t = 2.00mm. (12M)

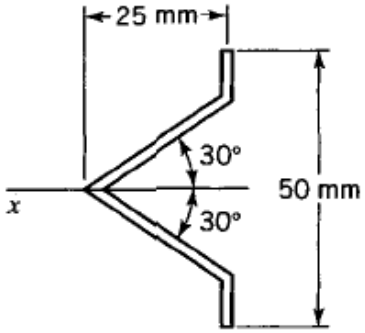

Figure 1

4. a) Derive the deflection in straight beams when subjected to nonsymmetrical bending. (6M)

   b) Derive the allowable bending moment in straight beams when subjected to non - symmetrical bending. (6M)

5. a) Write equilibrium and compatibility conditions of elastic solids. (6M)

   b) Explain Airy's stress function. (6M)

6. For a circular disk of inner radius a, outer radius b, and constant thickness *t* << b, the formulas for stress-strain relation in polar coordinates are (where μ = Poisson ratio).

   $\sigma_{rr} = \frac{E}{1-\mu^2}(\epsilon_{rr} + \mu\epsilon_{\theta\theta}) - \frac{E\alpha T}{1-\mu}$ *and* $\sigma_{\theta\theta} = \frac{E}{1-\mu^2}(\mu\epsilon_{rr} + \epsilon_{\theta\theta}) - \frac{E\alpha T}{1-\mu}]$

   i) Derive the equation $\sigma_{rr\ (max)}$ at r= $\sqrt{ab}$ (6M)

   ii) Derive the equation $\sigma_{\theta\theta\ (max)}$ at r = a (6M)

7. The aluminum hollow thin wall torsion member in figure 2 has dimensions as shown. Its length is 3m. If the member is subjected to the torque T=11 KN-m.Take G=27.1Gpa

   i) Determine the maximum shear stress. (6M)

   ii) Determine the angle of twist. (6M)

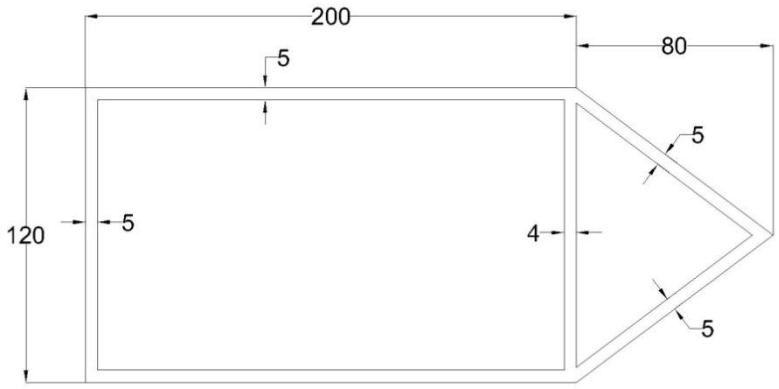

Figure 2(All dimensions are in mm)

8. Define stress function and derive the stress function equation for 2-dimensional problem when the weight of the body is taken into consideration. (12M)

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