ME Mech / Sem I / Choice base / S H 2018 05/12/2018

Paper / Subject Code: 60703 / Advanced Stress Analysis.

Duration: **3 hours** Max Marks: **80**

Note: Attempt **any 4** questions
Figures to the right indicate full marks
Assume data wherever required and mention it clearly

Q1 **(i)** The stress tensor w.r.t. o-x-y-z system is given by $\begin{vmatrix} 50 & 30 & 10 \\ 30 & 30 & -10 \\ 10 & -20 & -50 \end{vmatrix}$ Find the new stress tensor if o—y axis is turned though 30° in O-X-Y plane. **10**

(ii) State and derive stress optic law in 2-D **10**

Q2 **(i)** Write the stress equations of equilibrium **5**

(ii) Given the strains at a point as **15**

$$\varepsilon_x = 0.01, \varepsilon_y = -0.005, \varepsilon_z = 0.005, \tau_{xy} = 0.03, \tau_{yz} = 0.01, \tau_{zx} = -0.08$$

Determine the principal strains and their directions

Q3 **(i)** The state of strain at a point is given by **10**

$$\varepsilon_x = 0.001, \varepsilon_y = 0.003, \varepsilon_z = 0, \tau_{xy} = 0, \tau_{yz} = 0.001, \tau_{zx} = -0.004$$

Determine the stress tensor at this point. Take $E = 210 \times 10^6 \, kPa$, *and* $\nu = 0.28$
Also compute Lame's constant

(ii) Check whether the following strain tensor is compatible **10**

$$e_x = 12x^2 - 6y^2 - 4z$$

$$e_y = 12y^2 - 6x^2 + 4z$$

$$e_z = 12x + 4y - z + 5$$

$$\tau_{xy} = 4z - 24xy - 3$$

$$\tau_{yz} = y = z - 4$$

$$\tau_{zx} = 4x + 4y - 6$$

Q4 **(i)** The stress tensor is given by

$$\sigma_x = 110\ N/mm^2, \sigma_y = 55\ N/mm^2, \sigma_z = -550\ N/mm^2$$

$$\tau_{xy} = -440\ N/mm^2, \tau_{YZ} = 55\ N/mm^2, \tau_{zx} = 0$$ **10**

Find the strain tensor, Take Shear Moduls $0.8 \times 10^5\ N/mm^2$ $E = 2 \times 10^5\ N/mm^2$ *and* $\nu = 0.28$,

(ii) Draw a neat sketch of Wheat stone circuit and prove that **10**

$$\Delta E = \frac{Vr}{(1+r)^2}\left[\frac{\Delta R_1}{R_1} - \frac{\Delta R_2}{R_2} + \frac{\Delta R_3}{R_3} - \frac{\Delta R_4}{R_4}\right]$$

Q5 **(i)** What are the types of load consider on an elastic body? Draw the diagram to show the different stress on elastic body **10**

(ii) Explain the following rosette analysis **10**

(i) Two element rosette analysis (ii) Rectangular rosette analysis

Q6 Write short notes on **(Any Two)**

(i) Calibration and temperature compensation of strain gauges **10**

(ii) What is corrosion? List the various types of corrosion & explain cavitations corrosion and methods to prevent it. **10**

(iii) Write short note on construction and use of "CRO" tube for the dynamic strain measurement **10**

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