

**GROUP –B**

Answer question No. 4 and **any one** from the rest.

4. Apply the principle of conservation of energy to deduce the stress-strain temperature relations for anisotropic solids in the form

$$\sigma_{ij} = C_{ijkl} \epsilon_{kl} - \beta_{ij} \theta \quad i, j = 1, 2, 3. \quad 16$$

5. Deduce generalized heat conduction equation in an isotropic thermoelastic solid in the form

$$\nabla^2 \theta - \frac{1}{k} \dot{\theta} - \eta \nabla \cdot \dot{\mathbf{u}} = -\frac{Q}{\chi} \quad 9$$

6. Show that the stress, temperature and stress, in the Laplace transform domain and in terms of a thermoelastic potential function  $\bar{\varphi}$ , are as follows :

$$\bar{\epsilon} = \frac{d^2 \bar{\varphi}}{dx^2}, \quad \bar{T} = \frac{T^*}{a} \left( \frac{d^2}{dx^2} - p^2 \right) \bar{\varphi}, \quad \bar{\sigma} = (\lambda + 2\mu) p^2 \bar{\varphi}$$

for one dimensional coupled thermoelastic problems. Find  $\bar{\varphi}$

in the region  $x \geq 0$  when  $\epsilon = 0$ ,  $\frac{\partial T}{\partial x} = -T_0 H(t)$  at  $x = 0$ . 9

**MASTER OF SCIENCE EXAMINATION, 2019**

( 2nd Year, 2nd Semester )

**MATHEMATICS****UNIT - 4.5 (B 2.12)****COUPLED FIELDS OF SOLID MECHANICS & PLASTICITY - II**

Time : Two hours

Full Marks : 50

The figures in the margin indicate full marks.

Symbols / Notations have their usual meanings.

**GROUP –A**

Answer question No. 1 and **any one** from the rest.

1. What is Dash Pot? Obtain force extension equations of string and dash pot. Obtain the differential equations of different models containing two strings and dash pot. 16
2. Obtain differential equation of torsional motion of a thin viscoelastic rod of Voigt type. If the rod is semi-infinite. Calculate twist for large time subject to the conditions

$$\theta(0,t) = \theta_0 H(t), \quad \theta = 0 \quad \text{and} \quad \frac{\partial \theta}{\partial t} = 0 \quad \text{at} \quad t = 0 \quad 9$$

3. Investigate one dimensional disturbance in a viscoelastic semi-infinite medium of general linear type for large time when the free end is acted upon by an impulsive stress. 9

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