Unit IV

7. (a) State generalized Hooke's law and derive its form for an orthotropic medicine.

    (b) Define various elastic constants such as Poisson's ratio (σ), Young's modulus (E) and Bulk modulus (K). Also prove that

$$\sigma = \frac{\lambda}{3k - \lambda}.$$

8. Explain connection of strain energy function with Hooke's law.

CC-317

M. Sc. EXAMINATION, Dec. 2017

(Third Semester)

(Main & Re-appear)

MATHEMATICS

MAT-615-B

Mechanics of Solids-I

Time : 3 *Hours*]   [*Maximum Marks :* 100

Before answering the question-paper candidates should ensure that they have been supplied to correct and complete question-paper. No complaint, in this regard, will be entertained after the examination.

Note : Attempt *Five* questions in all, selecting at least *one* question from each Unit. All questions carry equal marks.

Unit I

1. (a) Prove that every second order tensor a_{ij} can be uniquely expressed as a sum of a symmetric and a skew-symmetric tensor.

(b) Define the alternating tensor $\in_{ijk}$. Show that $\in_{ijk}$ is a tensor of order 3.

2. (a) Show that eigen values of a real symmetric tensor μ_{ij} are real.

(b) Show that the gradient of a scalar point function is a first order tensor.

Unit II

3. (a) Explain geometrical interpretation of shearing strains.

(b) Show that the principal strains are real and principal directions of strain are orthogonal to each other.

4. (a) Define affine transformation. Show that infinitesimal affine transformation has a component representing rigid body motion and pure deformation.

(b) Write a note on the geometrical meaning of first strain invariant.

Unit III

5. (a) Define the stress tensor and show that stress tensor is symmetric.

(b) Derive the Cauchy's equation of equilibrium.

6. (a) Discuss Mohr's diagram for maximum shearing stress.

(b) The state of stress at a point is given by the matrix :

$$\begin{bmatrix} 1 & 1 & 0 \\ 1 & -1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

Show that the normal component of the stress vector on a plane with normal in the direction (1, 1, 2) has unit magnitude. Also find shearing stress in magnitude and direction.