No. of Printed Pages : 02 **Roll No. .....**

II347

Dual Degree-B.Sc. (Hons.) (Mathematics)-M. Sc. (Mathematics)

EXAMINATION, 2020

(Ninth Semester)

(B Scheme) (Main & Re-appear)

(B.Sc. (Hons.) M.Sc. (Mathematics))

MAT623H

MECHANICS OF SOLIDS

Time : 2½ *Hours*] [*Maximum Marks :* 75

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 *Four* questions in all. All questions carry equal marks.

1. (a) The stress matrix at a point P in a material is given as :

$$\tau_{ij} = \begin{bmatrix} 3 & 1 & 1 \\ 1 & 0 & 2 \\ 1 & 2 & 0 \end{bmatrix}$$

Find the normal stress and the shear stress on the octahedral plane element through the point.

(b) Show that stress tensor is symmetric.

2. Show that maximum shearing stress is equal to one-half the difference between the greatest and least normal stresses and act on the plane that bisect the angle between the directions of the largest and smallest principal stresses.

3. (a) Prove that the necessary and sufficient condition for an infinitesimal affine transformation $\xi_i = \alpha_{io} + (\alpha_{ij} + \delta_{ij})$, to represent a rigid body motion is that the matrix α_{ij} is skew-symmetric.

(b) Define strain quadric of Cauchy and show that normal to the quadric surface at the end point of a radius vector is parallel to the displacement vector.

4. (a) Show that principle directions of strain are normal to the quadric surface of Cauchy.

(b) Explain geometrical meaning of equation of compatibility.

5. (a) Find the stess strain relation for the homogeneous isotropic media.

(b) Explain physical interpretations of bulk modulus when body is subjected to hydrostatic pressure.

6. (a) Derive Beltrami-Michell compatibility equations in terms of the stresses for an isotropic solid.

(b) Prove that $\nabla^2\theta = -\left(\frac{1+\sigma}{1-\sigma}\right) div\ f$, where the symbols have their usual meaning.

7. Discuss the problems of a circular ring under the action of couples.

8. Show that total work done by the external forces in changing the configuration of the natural state to the state at time *t* is equal to the sum of the kinetic energy and strain energy.