Ex/M.Sc/M/A1.6/35/2017

MASTER OF SCIENCE EXAMINATION, 2017

(2nd Year, 1st Semester)

MATHEMATICS

Unit - 3.3 (A1.6)

(Mathematical theory of elasticity)

Full Marks : 50 Time : Two Hours

The figures in the margin indicate full marks.

(Symbols/Notations have their usual meanings.)

Answer question no. 6 and any *three* from the rest.

1. Starting from generalized Hooke's law, find the stress strain relations for

   (i) monoclinic material and

   (ii) orthotropic material. 16

2. Prove that $U = \frac{1}{2}\tau_{ij}\, e_{ij}$, where symbols have their usual meanings. 16

[*Turn over*]

3. A bar of length '*l*' having rectangular cross section is bent by two equal and opposite couples *M*. If the curvature is small, determine the shapes of the edges of a vertical cross section of the bar after deformation. 16

4. State the Clapeyron's theorem, and hence prove the uniqueness of the solution of the fundamental boundary value problem. 16

5. (a) Obtain the equations of motion for plane problems in cylindrical polar co-ordinates. 8

   (b) A cylinder of uniform thickness is rotating about an axis through the centre with uniform angular velocity 'ω'. Show that the stresses are greatest at the centre of the cylinder. Show also that by making a small tubular cylinder at the centre of the cylinder, the maximum tangential stress approaches a value twice as great as that for a solid cylinder (assuming there is no external forces applied at the boundaries). 8

6. Discuss briefly plane stress and plane strain problems. 2

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