

JJ347

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

EXAMINATION, 2020

(Tenth Semester)

(B Scheme) (Re-appear)

(B.Sc. (Hons.) M.Sc. (MATHEMATICS))

MAT624H

Applied 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) Derive Beltrami-Michell compatibility condition for plane stress deformation.
(b) Derive displacement components for plane strain deformation in terms of airy stress function.
2. (a) Derive stresses and displacement components in terms of two analytic function.
(b) Explain rotating shaft.
3. Discuss the solution of beam stretched by its own weight.
4. (a) Show that maximum shearing stress occurs on the boundary of the cross-section.

- (b) Let D_0 be the torsional rigidity of circular cylinder, D_e be the torsional rigidity of elliptic cylinder and D_t be that of equilateral cross-section. Show that for cross-section of equal area :

$$D_e = kD_0 \quad D_t = \frac{2\pi\sqrt{3}}{15} D_0, \quad K = \left(2ab/a^2 + b^2\right) \leq 1,$$

where a, b are the semi-axis of the elliptic section.

5. (a) Write exponential form of harmonic wave and also explain harmonic wave in phase and out of phase.
(b) Explain propagation of P and S-wave.
6. Explain propagation of Love wave.
7. Explain Ritz method in one and two-dimensional and using Ritz method, find the approximate solution to the problem of extremising the functional :

$$I(z) = \iint_D \left[z_x^2 + z_y^2 - 2z \right] dx dy$$

where the region R is a square $-a \leq x \leq a, -a \leq y \leq a$ and $z = 0$ on the boundary of the square.

8. Explain the following :
(a) Trefitz methods
(b) Rafalson method.