

M.Sc. 2nd Semester Examination, 2014

**APPLIED MATHEMATICS WITH OCEANOLOGY
AND COMPUTER PROGRAMMING**

(*General Theory of Continuum Mechanics*)

PAPER – MTM - 204

Full Marks : 50

Time : 2 hours

Answer **Q.No.1** and any **four** from the rest

The figures in the right-hand margin indicate marks

1. Answer any *two* questions : 4 × 2
- (a) Establish the stress vector and stress tensor relationship. 4
- (b) What is the concept of a image ? Find the image of a source with respect to a straight line. 1 + 3
- (c) Define strain quadric. Prove that the

(*Turn Over*)

(2)

extension of a line element through the centre of strain quadric in the direction of any central radius vector is equal to the inverse of the square of the radius vector.

1 + 3

2. Derive the Euler's Equation of motion for a perfect fluid. 8
3. State and Prove the Cauchy's first equation of motion. Deduce also the equation of equilibrium when the continuum in static equilibrium. 2 + 5 + 1
4. Give Geometrical interpretation of small strain components. 8
5. State and prove the Keloia's Minimum Energy theorem for a perfect fluid. 8
6. Define strain Quadric. If $e_{11} = k(x_1^2 - x_2^2)$, $e_{22} = kx_1x_2$, $e_{12} = k'x_1x_2$, $e_{13} = e_{23} = e_{33} = 0$, where e_{ij} be the small strain component at a point in a continuum and k, k' be constants, find the corresponding displacement, provided that $u_3 = 0$. 8

(3)

7. Two identical closed cylinders of height C with their bases on the same horizontal plane are filled, one with water and the other with air of such density as to support a column h of water, $h < c$. If a communication be opened between them at their bases, the height x to which water rises is given by the equation

$$cx - x^2 + ch \log\left(\frac{c-x}{c}\right) = 0. \quad 8$$

[*Internal Assessment* : 10 Marks]
