2008

APPLIED MATHEMATICS WITH OCEANOLOGY AND COMPUTER PROGRAMMING

PAPER—MA 1204

Full Marks : 50

Time : 2 hours

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

The figures in the right-hand margin indicate marks

Candidates are required to give their answers in their own words as far as practicable

Illustrate the answers wherever necessary

(*Continuum Mechanics*)

1. Deduce the constitutive equation of perfect fluid. 4

2. (*a*) Find the change in angle between two line elements in material and Eulerian method.

(*b*) Define a image. Find the image of a simple source with respect to a line. 8 + 4

3. (*a*) If W be the stress potential or strain-energy function for an unit volume of an elastic body then show that

$$T_i = \frac{\partial W}{\partial e_i}$$

where T_i and e_i be the stress and strain tensors respectively.

(*b*) Define stress quadratic. 10 + 2

4. (*a*) Prove that the normal stress across any plane through the centre of stress quadric is equal to the inverse of the square of the central radius vector of the quadric normal to the plane.

(*b*) State and prove Kelvin's circulation theorem for perfect fluid. Hence show that the fluid motion of once irrotational is always irrotational. 4 + 8

5. (*a*) Prove that the extremum values of normal stress at a point of a continuum are principal stresses.

(*b*) Find the stream line and path line of a fluid motion for the velocity fied

$$v_1 = \frac{x_1}{1+t},\ v_2 = x_2,\ v_3 = 0.$$

8 + 4

6. (*a*) Find the condition for a given surface $F(x, y, z, t) = 0$ to be a boundary surface of a fluid motion.

(*b*) Define source, sink and doublet. Find the complex potential for a doublet. 6 + 6

[*Internal Assessment*: 10]
