

**MA/MSCMT-07**

December - Examination 2017

**M.A./M.Sc. (Final) Mathematics Examination****Viscous Fluid Dynamics****Paper - MA/MSCMT-07****Time : 3 Hours ]****[ Max. Marks :- 80**

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**Note:** The question paper is divided into three sections A, B and C.

**Section - A****8 × 2 = 16**

(Very Short Answer Type Questions)

**Note:** Section 'A' contain 8 very short Answer Type Questions. Examinees have to attempt all questions. Each question is of 02 marks and maximum word limit is thirty words.

- 1) (i) State Kelvin's circulation theorem.
- (ii) What do you mean by critical Reynolds number?
- (iii) Define Brinkman number.
- (iv) Define TORQUE.
- (v) Give the expression for the Velocity distribution for the flow in plane coquette flow with porous boundaries.
- (vi) Define unsteady motion.

(vii) What do you mean by incompressible fluid motion.

(viii) Write the vector form of equation of continuity.

### Section - B

$4 \times 8 = 32$

(Short Answer Type Questions)

**Note:** Section 'B' contain 08 short Answer Type Questions. Examinees will have to answer any four (04) question. Each question is of 08 marks. Examinees have to delimit each answer in maximum 200 words.

- 2) Explain inspection analysis.
- 3) Explain flow between two parallel porous plates.
- 4) Explain steady laminar flow of viscous incompressible fluid between two infinite stationary parallel plates.
- 5) Obtain Blasius series solution for  $f'(\eta)$  about  $\eta = 0$
- 6) Write a short note on Thermal Boundary layer.
- 7) What is the physical importance of non-dimension parameters. Discuss the Froude number.
- 8) Describe plane coquette flow with porous wall.
- 9) The stress tensor at a point P is:  $\sigma_{ij} = \begin{vmatrix} 7 & 0 & -2 \\ 0 & 5 & 0 \\ 2 & 0 & 4 \end{vmatrix}$  Determine the stress vector on the plane at P whose unit normal is

$$\hat{n} = \frac{2}{3} \hat{i} - \frac{2}{3} \hat{j} + \frac{1}{3} \hat{k}$$

**Section - C****2 × 16 = 32**

(Long Answer Type Questions)

**Note:** Section 'C' contain 04 Long Answer Type Questions. Examinees will have to answer any two (02) questions. Each question is of 16 marks. Examinees have to delimit each answer in maximum 500 words.

- 10) Obtain Navier-stokes equation of motion in Cartesian coordinates for two dimensional incompressible viscous flow.
  - 11) Discuss the flow due to a plane wall suddenly set in motion in its own plane in an infinite mass of viscous incompressible fluid, which is otherwise at rest.
  - 12) Discuss stagnation point flow of a incompressible visocus fluid (Hiemang flow).
  - 13) Discuss Oseen's flow past a sphere.
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