Section–C **2×16=32**

(Long Answer Type Questions)

Note :– Answer any *two* questions. You have to delimit your each answer maximum up to **500** words. Each question carries 16 marks.

10. Discuss Hagen-Poiseuille flow in a circular pipe and obtain velocity distribution, maximum velocity, average velocity, volume rate of flow and coefficient of skin-friction.

11. Describe temperature distribution in a pipe when walls of pipe are at uniform temperature gradient.

12. Derive the expression for Stoke's second problem.

13. Obtain Blasius-Topfer solution for the boundary layer flow on a flat plate.

MAMT-07/MSCMT-07

June – Examination 2024

M.A./M.Sc. (Final) Examination

MATHEMATICS

(Viscous Fluid Dynamics)

Paper : MAMT-07/MSCMT-07

*Time : **3** Hours*] [*Maximum Marks : **80***

Note :– The question paper is divided into three Sections A, B and C. Write answers as per the given instructions.

Section–A **8×2=16**

(Very Short Answer Type Questions)

Note :– Answer all questions. As per the nature of the question delimit your answer in one word, one sentence or maximum up to **30** words. Each question carries 2 marks.

1. (i) Define Normal Strain.

   (ii) What do you mean by critical Reynolds number ?

   (iii) Define stagnation point and boundary layer.

   (iv) Write equations of continuity of a viscous incompressible fluid motion with constant fluid properties in cylindrical polar coordinates and spherical polar coordinates.

   (v) Define Oseen flow.

   (vi) Define unsteady motion.

   (vii) Define Starting flow.

   (viii) Define volume rate of flow.

Section–B **4×8=32**

(Short Answer Type Questions)

Note :– Answer any *four* questions. Each answer should not exceed **200** words. Each question carries 8 marks.

2. The stress tensor at a point P is :

$$\sigma_{ij} = \begin{bmatrix} 7 & 0 & -2 \\ 0 & 5 & 0 \\ 2 & 0 & 4 \end{bmatrix}$$

   Determine the stress vector on the plane at P whose unit normal is :

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

3. Discuss the flow between two parallel plates which are kept at a finite distance apart.

4. Write short notes on the following :

   (a) Eckert Number

   (b) Mach Number

5. Explain distribution of temperature in a pipe when the wall of pipe is kept at a constant temperature ?

6. Write short note on theory of very slow motion.

7. Explain asymptotic approach to solve velocity boundary layer equations in two dimensional form.

8. Obtain Blasius series solution for $f(\eta)$ about $\eta = 0$.

9. Explain the order of magnitude approach to solve velocity boundary layer equations in two dimensional form.