Roll No. ------------------

**MAMT-07**

**Viscous Fluid Dynamics**

MA/M.Sc. Mathematics (MAMT/MSCMT)

2ndYear Examination2024 (Dec.)

**TIME: 2 Hours Max Marks: 70**

Note: This paper is of Seventy (70) marks divided into two (02) Sections A and B. Attempt the questions contained in these sections according to the detailed instructions given therein.***Candidates should limit their answers to the questions on the given answer sheet. No additional (B) answer sheet will be issued.***

**SECTION – A**

**Long-answer - type questions**

**Note: Section ‘A’ contains Five (05) long-answer-type questions of Nineteen (19) marks each. Learners are required to answer any two (02) questions only. (2×19=38)**

1. If the velocity field point is given by . Then show that it represent a rigid body motion.
2. Discuss and derived the Navier-Stokes equation of motion.
3. State and prove Buckingham π-theoram.
4. Discuss stagnation point flow of an incompressible, viscous fluid (Hiemanz flow).
5. Discuss the temperature distribution in plane Poiseuille flow

**SECTION – B**

**Short – answer – type questions**

**Note: Section ‘B’ contains eight (08) short- answer type questions of Eight (08) marks each. *Learners are required to answer any Four (04) questions only.* (4×8=32)**

1. If the stress tensor at a point P is

.

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

1. A 1:20 model of an air-duct is to be tested in water which is 45 times more viscous and 850 times more dense than air. What should be the pressure drop in the prototype if the pressure drop is 3 kg/cm2 in the model when tested under hydrodynamically similar conditions ?
2. Define following non-dimensional coefficients

**(a)** Lift and drag coefficient

**(b)** Skin friction coefficient

**(c)** Nusselt number

**(d)** Recovery factor

1. Discuss the plane Poiseuille flow between two parallel plates.
2. Discuss the starting flow in plane Couette Motion
3. Explain Stoke's flow past a sphere
4. Write a note on boundary layer theory
5. Obtain Crocco's first integral for