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MAMT-07

Viscous Fluid Dynamics

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

2nd Year Examination, 2023 (June)

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 answer 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. Discuss the temperature distribution of plane- Couette flow with transpiration cooling.

2. Obtain the viscous stress in the flow between two concentric rotating cylinder when the inner cylinder being at rest. Also find torque.

3. State and prove Buckingham π-theorem.

4. Explain Stake's flow past a sphere.

5. Define the following :

(a) Lift and drag coefficient.

(b) Euler's number.

(c) Vorticity.

(d) Thermal conductivity.

(e) Boundary layer theory.

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. The Velocity field at point is given by $1 + 2y - 3z$, $4 - 2x + 5z$, $6 + 3x - 5y$. Show that it represents a rigid body motion.

2. Deduce Kelvin's circulation theorem.

3. A 1:20 model of an air-duct is to be tested in water which is 45 times more viscous and 850 times denser than air. What should be the pressure from in the prototype if the pressure drop is $3kg/cm^2$ in the model when tested under hydrodynamically similar conditions?

4. Define plane Couette flow and Volume rate of flow.

5. Obtain an expression for the flow between two parallel Porous plates.

6. Discuss the temperature distribution in Generalised Couette flow.

7. Write a note on characteristic parameters of boundary layer theory.

8. Define normal and shearing strain.
