K-455

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MAMT-07

VISCOUS FLUID DYNAMICS

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

2nd Year Examination, 2023 (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. Define the stress at a point in a fluid and show that it is a symmetric second order tensor.

2. State and prove Navier-Stokes equations of motion.

3. Discuss the plane poiseuille flow between two parallel plates.

4. Discuss the temperature distribution in plane –Couette flow.

5. Explain Stoke's flow past a sphere.

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. What type of the motion do the following velocity components constitute?

$u = a + by - cz$; $v = d - bx + ez$ and $w = f + cx - ey$ where a, b, c, d, e, f are arbitrary constants.

2. A 1: 20 model of an air-duct is to be tested in water 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 3kg/cm^2 in the model when tested under hydro dynamically similar conditions?

3. Show that the volume rate of flow is given by $Q = \frac{27\ P a^4}{20\sqrt{3}\mu}$

in the steady flow of a viscous incompressible fluid through a tube with uniform equilateral triangular cross section.

4. Obtain an expression for the flow between two parallel porous plates.

5. What is meant by porous boundaries?

6. Obtain Crocco's first integral for $P_r = 1$.

7. Write a Prandtl's boundary leyer theory.

8. Define normal strairi and shearing strain.
