2303080303040002
Examination March 2024
MASTER OF SCIENCE (MATHEMATICS) (THIRD SEMESTER)
FLUID DYNAMICS

[Time: Three Hours] **[Max. Marks:70]**

Instructions:
1. Fill up strictly the following details on your answer book
   a. Name of the Examination : **MASTER OF SCIENCE (MATHEMATICS) (THIRD SEMESTER)**
   b. Name of the Subject : **FLUID DYNAMICS**
   c. Subject Code No : **2303080303040002**
2. Sketch neat and labelled diagram wherever necessary.
3. Figures to the right indicate full marks of the question.
4. All questions are compulsory.
5. All questions carry equal marks.

Seat No:

Student's Signature

Q.1 Attempt any Two **14**

A. 1. Define unit vector and prove that the dot product of two mutually perpendicular unit vector is zero.

2. Find the magnitude and direction of the cross and dot product of the two vectors $\vec{u} = 9\vec{\imath} + 3\vec{\jmath} + 3\vec{k}\ and\ \vec{v} = 2\vec{\imath} + 2\vec{\jmath}$

B. 1. Find the magnitude and direction of the cross product of the two vectors
$$\vec{u} = 3\vec{\imath} + 4\vec{\jmath} + 4\vec{\jmath}\ and\ \vec{v} = 2\vec{\imath} + 2\vec{\jmath}$$

2. If $f(\vec{r}) = y^2\ sin(xz)$, find $\nabla f(\vec{r})$ at a point (1,2,3). Also, can we find $\nabla^2 f(\vec{r})$ at a same point?

C. Discuss the Divergent, Grad, Curl and Laplace operator with illustrations.

Q.2 Attempt any Two **14**

A. Define shear stress and normal stress.

B. Define fluid, pressure and viscosity.

C. Discuss the Lagrange method to describe the fluid flow.

Q.3 Attempt any Two **14**

A. Discuss the line of flow and derive the equation for the path line.

B. Define steady uniform, steady non-uniform, unsteady uniform and unsteady non-uniform flow of fluid.

C. Derive the equation of streak line, path line and stream line of flow.

Q.4 Attempt any Two **14**

A. Prove that pressure at a point is same in all directions for the static fluid.

B. Derive the equation for acceleration of fluid particle.

C. Define the equation of Continuity and derive the equation of continuity of fluid flow in Cartesian coordinate system.

Q.5 Attempt any Two **14**

A. Derive the Euler's equation of motion along the stream line when body force is due to the pull of gravity.

B. Derive the Bernoulli's equation fluid mechanics.

C. Derive the integral form of Euler's equation.

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