Math 4.3

Sl.No. :

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Second Year M.Sc. Degree Examination, May - 2026
(SLM Scheme) (Non-CBCS) (IV Semester)
MATHEMATICS
Fluid Mechanics

Time : 3 Hours **Max. Marks : 80**

Instructions : 1) Answer any five full questions.
2) All questions carries equal marks.

Q1) a) Derive the relationship between stress and rate of strain components.

b) Explain in detail the general motion of fluid element.

c) Determine the velocity and acceleration at the point (2, 1, 3) at $t = 0.5$ sec, if $u = yz + t$, $v = xz - t$, $w = xy$.

[5 + 5 + 6]

Q2) a) Write short note on viscosity and coefficient of viscosity.

b) Explain the term 'Rate of strain Quadric'.

c) Explain the concept of stokes hypothesis.

[5 + 6 + 5]

Q3) a) With usual notations, derive equation of continuity.

b) A mass of a fluid moves in such a way that each particle describes a circle in one plane about a fixed axis, show that the equation of continuity is $\frac{\partial f}{\partial t} + \frac{\partial (PW)}{\partial \theta} = 0$ where W is the angular velocity of a particle whose azimuthal angle is θ at time t.

[8 + 8]

Q4) a) Derive the equation of energy with constant viscosity and heat conductivity of the fluid.

b) With usual notation. Prove the vorticity transport equation.

[8 + 8]

Q5) a) Explain the application of Buckingham - π theorem to viscons compressible fluid motion.

b) Write a short note on non-dimensional Co-efficients in the alynamics of viscous fluids.

[8 + 8]

Q6) a) Explain stagnation point in two dimensional boundary layer flow.

b) Derive the expression for coutte flow between two concentric rotating cylinders.

[8 + 8]

Q7) a) Define Poiseuille flow for such a flow obtain the velocity distribution, average velocity mass flow rate and skin fiction.

b) Obtain the velocity distribution for a generalised plane coutte flow in the form

$$u = \frac{y}{n} + p\frac{y}{n}\left(1 - \frac{y}{n}\right).$$

[8 + 8]

Q8) a) Write a short note on Jeferry - Hamel flow.

b) Explain in detail for two - dimensional steady incompressible Poiseuille flow with variable velocity.

[8 + 8]

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