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GANDHI INSTITUTE OF ENGINEERING AND TECHNOLOGY UNIVERSITY, ODISHA, GUNUPUR

(GIET UNIVERSITY)

Ph.D. Second Semester Supplementary Examinations, May – 2025

WPPEMT2027 – Fluid Dynamics

(Mathematics)

Time: 3 hrs | Maximum: 70 Marks

(The figures in the right hand margin indicate marks.)

(14 x 5=70 Marks)

Answer ***ANY FIVE*** questions | Marks

1. Prove that the pressure p at a point P in a moving inviscid fluid is same in all direction. — 14
2. Derive Stream function for an Axi-Symmetric Flow (Stoke's Stream Function) — 14
3. a Derive complex potential for two dimensional irrotational in compressive flow. — 7
   b Derive Complex velocity potentials for standard two dimensional flow. — 7
4. A two dimensional doublet of strength $\mu\hat{\imath}$ per unit length is at a point z = ia in a stream of velocity $-V\hat{\imath}$ in a semi-infinite liquid of constant density occupying the half plane y > 0 and having y = 0 as a rigid impermeable boundary, $\hat{\imath}$being the unit vector in the positive x-axis. Show that the complex potential of the motion is
   $W = Vz + 2\mu z/(z^2+a^2)$
   Also show that for $0<\mu<4a^2V$, there are no stagnation points on the boundary and that the pressure on it is a minimum at the origin and maximum at the points $(\pm a\sqrt{3}, 0)$. — 14
5. Derive the expressions for the shearing stress on the outer and the inner cylinder for steady flow between concentric rotating cylinders. — 14
6. Derive the expression for Energy dissipation due to viscosity. — 14
7. Explain Translational motion of fluid element. — 14
8. Derive the expressions for Steady viscous flow in tubes of uniform cross-section. — 14

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