THE AMERICAN COLLEGE, MADURAI

(An Autonomous Institution Affiliated to Madurai Kamaraj University)

Re-accredited (2nd Cycle) by NAAC with Grade "A", CGPA – 3.46 on a 4-point scale

Backlog Arrear Examination, March 2021

PGM 4528 **Differential Geometry and Fluid Dynamics**

75 Marks **Marks: 75**

Answer any FIVE Questions **5 X 15 = 75**

1. (a) Derive equation of continuity. Also derive equation of continuity for a variable cross section.

   (b) Establish the relation $\tau = 2\omega$, connecting the angular velocity ω, and the vorticity vector τ.

2. State and Prove Euler's equation of motion. Deduce Bernoulli's equation. Also derive Bernoulli's equation for potential flows under conservative body forces.

3. State and Prove Weiss's sphere theorem. Also discuss about the image of a doublet in a sphere when the axis of the doublet passes through the centre of the sphere.

4. State and Prove the Theorem of Blasius. For an infinite circular cylinder in uniform stream, with circulation, find the components of the force and the moment.

5. State and prove Serret-Frenet equations.

6. Prove that the position vector of any point on the surface of revolution generated by the curve $[g(u), 0, f(u)]$ in the XOZ plane is $r = [g(u)\cos v\,, g(u)\sin v\,, f(u)$ where v is the angle of rotation about the $z-$axis.
7. Show that any curve $u = u(t), v = v(t)$ on a surface $r = r(u, v)$ is a geodesic if and only if the principal normal at every point on the curve is normal to the surface.

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