PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

MSc DEGREE EXAMINATION MAY 2018
(Fourth Semester)

Branch –**MATHEMATICS**

FLUID DYNAMICS

Time: Three Hours Maximum: 75 Marks

Answer **ALL** questions
ALL questions carry **EQUAL** marks (5 x 15 = 75)

1 a Give an account of (i) Pressure (ii) Viscosity of the fluid properties. (15)

OR

b Derive the fluid motion by Eulerian method. (10)

c Describe the vorticity in polar coordinate system. (5)

2 a Verify the equality of shearing stresses $\sigma_{yz} = \sigma_{zy}, \sigma_{xz} = \sigma_{zx}$ and $\sigma_{xy} = \sigma_{yx}$. (7)

b Derive the transformation formulae for the rates of the strain. (8)

OR

c State and prove Navier – Stokes equation. (12)

d Derive the viscous incompressible fluid of energy equation. (3)

3 a State and prove Stokes theorem of circulation. (8)

b Calculate the circulation Γ of a circulatory flow ($v_r = v_z = 0$) with the constant vorticity (Ω_z = constant) from both the circulation and Stoke's theorem. (7)

OR

c State and prove the Momentum theorem. (8)

d Show that the velocity potential $\phi = \frac{a}{2}(x^2 + y^2 - 2z^2)$ satisfies the Laplace equation and represents the flow against a fixed place wall. (7)

4 a State and prove the Reynolds law of dynamically similarity. (8)

b Solve the shearing stress of viscous fluid which flow between two coaxial cylinders. (7)

OR

c Derive the velocity distribution of the Hagen – Poiseuille flow through a pipe. Also solve the average and maximum velocity distribution. (15)

5 a Solve the Prandtl boundary layer equation along a flat plate in account of the Blasius solution. (15)

OR

b Find the solution of two dimensional boundary layer on a surface with pressure gradient. (8)

c Derive the momentum integral equation of the boundary layer. (7)

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