LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

**B.Sc.** DEGREE EXAMINATION – **MATHEMATICS**

FIFTH SEMESTER – **NOVEMBER 2012**

# MT 5405 - FLUID DYNAMICS

Date : 10/11/2012 Dept. No. Max. : 100 Marks

Time : 9:00 - 12:00

Section A

Answer **ALL** questions: 10 × 2 = 20

1. Define stream tube.
2. Show that is a possible motion.
3. The velocity vector q is given by determine the equation of stream line.
4. Write down the boundary condition for the flow when it is moving.
5. What is the complex potential of a source with strength m situated at the points z=z1
6. Find the stream function *ψ*, if *ϕ* = *A*(*x*2 – *y*2) represents a possible fluid motion
7. Find the vorticity vector for the velocity 
8. Define vortex tube and vortex filament.
9. What is lift of an aerofoil?
10. Define camber.

Section B

Answer any **FIVE** questions: 5 × 8 = 40

1. **Explain Material, Local and Convective derivative fluid motion.**
2. Find the equation of streamlines and path lines of a flow given by 
3. Explain the construction of a Venturi tube.
4. Prove that for the complex potential  the streamlines and equipotentials are circles.
5. For an incompressible fluid. Find the vorticity vector and equations of stream line.
6. Derive the equation of continuity.
7. Find the stream function *ψ*(*x*, *y*, *t*) for a given velocity field *u* = 2*Axy*, *v* = *A*(*a*2 + *x*2 – *y*2).
8. State and prove the theorem of Kutta-Joukowski.

Section C

Answer any **TWO** questions: 2 × 20 = 40

1. (a) For a two-dimensional flow the velocities at a point in a fluid may be expressed in the Eulerian coordinates by *u* = *x* + *y* + *t* and *v* = 2*x*+2*y* + *t*. Determine the Lagrange coordinates as functions of the initial positions,  and the time *t*.

(b) If the velocity of an incompressible fluid at the point (*x*, *y*, *z*) is given by  where . Prove that the fluid motion is possible and the velocity potential is . (10 + 10)

**20. Derive the Euler’s equation of motion and deduce the Bernoulli’s equation of motion.**

21. (a)What arrangement of sources and sinks will give rise to the function?

(b)Obtain the complex potential due to the image of a source with respect to a circle. (12+8)

22. (a)Discuss the structure of an aerofoil.

(b)Derive Joukowski transformation. (8+12 )