LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

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

FIFTH SEMESTER – **APRIL 2012**

# MT 5405 - FLUID DYNAMICS

Date : 27-04-2012 Dept. No. Max. : 100 Marks

Time : 1:00 - 4:00

Section A

Answer **ALL** questions: 10 × 2 = 20

1. Define Stream tube.
2. Show that the velocity field the stream lines are circular.
3. Write down the boundary condition for the flow when it is in moving.
4. Prove that the fluid motion is possible if .
5. What is the complex potential of source with strength *m* situated at the origin?
6. Find the stream function *ψ*, if *ϕ* = *A*(*x*2 – *y*2) represents a possible fluid motion
7. Define velocity potential.
8. Define vortex lines.
9. Find the vorticity components of a fluid motion, if the velocity components are

*u* = *c*(*x* + *y*), *v* = – *c*(*x* + *y*).

1. Define camber.

Section B

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

1. Find the equation of streamlines and path lines of a flow given by .
2. Explain pitot tube.
3. Derive the equation of continuity.
4. Derive the Bernoulli’s equation of motion for the fluid.
5. Prove that for the complex potential  the streamlines and equipotentials are circles.
6. Obtain the complex potential due to the image of a doublet with respect to the circle.
7. Let , (A, B, C are constants) be the velocity vector of a fluid motion. Find the equation of vortex lines.
8. State and prove the theorem of Kutta-Joukowski.

Section C

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

1. **(a)The velocity components for a two dimensional fluid system can be given in the Eulerian system by** ****. **Find the displacement of a fluid particle in the Lagrangian system**

(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)

1. (a)Derive the Euler’s equation of motion.

(b)Draw and explain the working of a Venturi tube. (12 + 8)

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)

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