MA/MSCMT-07

June - Examination 2019

M.A./M.Sc. (Final) Mathematics Examination

Viscous Fluid Dynamics

Paper - MA/MSCMT-07

Time : 3 Hours] **[Max. Marks :- 80**

Note: The question paper is divided into three sections A, B and C. Write answers as per given instructions.

Section - A $8 \times 2 = 16$

(Very Short Answer Questions)

Note: Answer **all** questions. As per the nature of the question delimit your answer in one word, one sentence or maximum upto 30 words. Each question carries 2 marks.

1) (i) Define Newtonian Fluid.

(ii) Write equations of motion for a Viscous incompressible fluid.

(iii) Define Reynolds number.

(iv) Define Plane Couette flow.

(v) Define the term recovery temperature for flow between parallel plates.

(vi) Define Prandtl number.

(vii) Define Drag and Lift.

(viii) Write Prandtl boundary layer equations for a two dimensional unsteady incompressible flow.

Section - B

$4 \times 8 = 32$

(Short Answer Questions)

Note: Answer **any four** questions. Each answer should not exceed 200 words. Each question carries 8 marks.

2) Derive Navier Stoke's equation to viscous fluids in cartesion co-ordinates.

3) Describe the motion of a viscous fluid of uniform density between parallel plates, the motion being steady where one plate is at rest and the other is in motion.

4) Obtain an exact solution of the two dimensional flow of a viscous incompressible fluid in the neighborhood of a stagnation point in a plane. (Hiemenz flow)

5) State and prove Buckingham π - theorem.

6) Find the drag on a sphere in stokes flow.

7) Discuss the temperature distribution in Hagen-Poisecuille flow in a circular pipe, when the wall of the pipe is kept at a constant temperature gradient.

8) Derive Prandtl - Mires equation.

9) Describe the courtte flow.

Section - C $2 \times 16 = 32$

(Long Answer Questions)

Note: Answer **any two** questions. You have to delimit your each answer maximum upto 500 words. Each question carries 16 marks.

10) Discuss the Blasius - Topfer solution for the boundary layer on a flat plate and calculate the coefficient of Skin-friction.

11) Discuss the stokes second problem.

12) Find the velocity distribution in the steady flow of a viscous incompressible fluid along an infinitely long circular pipe due to an applied pressure gradient. Calculate the volume rate of flow through any cross-section of the pipe.

13) Write short note on the following :–

(i) Oseer's flow past a sphere.

(ii) Boundary Layer Separation.

(iii) Nusselt number for heat transfer.

(iv) Kelvin's circulation theorem.

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