MA/MSCMT-07

December - Examination 2016

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. Use of calculator is allowed in this paper.

Section - A $8 \times 2 = 16$

Note: Section 'A' contains 08 very short answer type questions. Examinees have to attempt all questions. Each question is of 02 marks and maximum word limit is 30 (Thirty) words.

1) (i) Define stress tensor.

(ii) Define prandtl number.

(iii) Define skin friction.

(iv) Define couette flow.

(v) Define steady flow.

(vi) Write Navier - Stoke's equations.

(vii) Define separation of boundary layer flow.

(viii) Define Newtonian fluid.

Section - B $4 \times 8 = 32$

Note: Section 'B' contains 08 short answer type questions. Examinees will have to answer any 04 (four) questions. Each question is of 08 marks. Examinees have to delimit each answer in maximum 200 words.

2) Establish relation between stress and rate of strain components.

3) State and prove Buckingham π-theorem.

4) Show that velocity distribution is linear in flow between two parallel plates, when one plate is at rest and the other moving with a uniform velocity U in the own plane.

5) Discuss the flow due to a plane wall suddenly set in motion.

6) Discuss starting flow in plane couette motion.

7) Write short note on theory of very slow motion.

8) Derive displacement thickness in boundary layer flow.

9) Write short note on thermal boundary layer.

Section - C

$2 \times 16 = 32$

Note: Section 'C' contains 04 long answer type questions. Examinees will have to answer 02 (two) questions. Each questions is of 16 marks. Examinees have to delimit each answer in maximum 500 words.

10) Discuss Hagen-Poiseuille flow in a circular pipe and obtain velocity distribution, maximum velocity, average velocity, volume rate of flow and coefficient of skin-friction.

11) Discuss stoke's flow past of a sphere.

12) Discuss boundary layer flow along a flat plate in the direction of uniform flow of velocity U_∞, given below the boundary conditions:

$y = 0, \quad x > 0 \quad : \quad u = 0, \ \nu = 0$

$y \to \infty, \ \forall x \quad : \quad u = U_\infty$

13) Discuss flow due to a rotating disc. (Kàrmàn flow)

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