MA/MSCMT-07

June - Examination 2018

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 the given instructions.

Section - A **8 × 2 = 16**

(Very Short Answer Type Questions)

Note: Section 'A' contain Eight (08) Very Short Answer Type Questions. Examinees have a attempt all questions. Each question is of 2 marks and maximum word limit may be thirty words.

1) (i) Define Normal Strain.

(ii) Define Circulation.

(iii) State Buckingham - π theorem.

(iv) Write coefficient of skin friction at stationary plate.

(v) Define Boundary Layer.

(vi) Define Suction and Injection.

(vii) Define displacement thickness.

(viii)Explain unsteady motion.

Section - B **4 × 8 = 32**

(Short Answer Type Questions)

Note: Section 'B' contain Eight Short Answer Type Questions. Examinees will have to answer any four (04) questions. Each question is of 08 marks. Examinees have to delimit each answer in maximum 200 words.

2) Prove that the stress at a point is completely known if the nine components of stress tensor at that point are known.

3) Prove that the vorticity $\vec{\Omega}$ satisfies the differential equation
$\frac{D\overline{\Omega}}{Dt} = (\overline{\Omega}.\nabla)\, q + v\nabla^2 (\overline{\Omega})$

4) Describe Hiemenz flow.

5) Explain Stoke's second problem.

6) Describe starting flow in plane-couette motion.

7) Write a short note on Prandtl's boundary layer theory.

8) Explain forced convection laminar boundary layer flow past a flat plate for $P_r = 1$.

9) Derive two dimensional boundary layer equations for the viscous incompressible fluid over a plane solid wall using asymptotic approach.

Section - C $2 \times 16 = 32$

(Long Answer Type Questions)

Note: Section 'C' contain 4 Long Answer Type Questions. Examinees will have to answer any two (02) questions. Each question is of 16 marks. Examinees have to delimit each answer in maximum 500 words.

10) Explain

(a) Nusselt Number

(b) Prandtl Number

(c) Reynolds Number

(d) Grashoff Number

11) Discuss the generalized plane couette flow. Derive the results for various characteristics for plane coquette flow.

12) Describe temperature distribution in a pipe when walls of pipe are at constant temperature.

13) Discuss Stoke's flow past a sphere. Derive the results for various characteristics for Stoke's flow past a sphere.

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