

MAMT-07/MSCMT-07/MAT-203

December - Examination 2025

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

MATHEMATICS

VISCOUS FLUID DYNAMICS

Paper : MAMT-07/MSCMT-07/MAT-203

[Time: 3 Hours]

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

1. (i) Write the Newton's law of viscosity.
- (ii) What is Fourier's law of heat conduction?
- (iii) State Kelvin's circulation theorem.
- (iv) Define starting flow.
- (v) Define thermal boundary layer.
- (vi) Write down equation of energy of a viscous incompressible fluid in spherical polar coordinates.
- (vii) Write the name of two approaches to derive boundary layer equations in 2-D form.
- (viii) Define separation of boundary layer flow.

Section-B

4×8=32

(Short Answer Type Questions)

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

2. Velocity field at point is given by $1 + 2y - 3z$, $4 - 2x + 5z$, $6 + 3x - 5y$. Show that it represents a rigid body motion.
3. Derive the expression for circulation.

4. Explain steady laminar flow of viscous incompressible fluid between two infinite stationary parallel plates.
5. Find the drag on a sphere in stoke's flow.
6. 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.
7. Write a short note on Prandtl's boundary layer theory.
8. Derive boundary layer equations for the flow past a solid plane wall by using asymptotic approach.
9. Discuss Hiemenz flow.

Section-C

2×16=32

(Long Answer Type Questions)

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

10. Define the following with their physical significance -
 - (a) Eckert number
 - (b) Grashoff number
 - (c) Pe'clet number
 - (d) Brinkman number
 - (e) Skin friction coefficient
11. Describe temperature distribution in a pipe when walls of pipe are at constant temperature.
12. Discuss Oseen's flow past a sphere.
13. Obtain Blasius-Topfer solution for the boundary layer flow on a flat plate.
