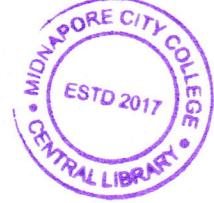


PG (CBCS)
M.SC. Semester- IV Examination, 2026
APPLIED MATHEMATICS
PAPER: MTM 402B
(MAGNETO HYDRO-DYNAMICS)



Full Marks: 20

Time: 1 Hour

The figures in the right-hand margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.

GROUP-A

1. Answer any **TWO** questions: 2×2 = 4
- Describe the working principle of MHD power generator.
 - Define **Lorentz force** in the context of MHD flow.
 - What is meant by magnetic flux and magnetic diffusion?
 - Define Hartmann number and explain its significance.

GROUP-B

2. Answer any **TWO** questions: 2×4 = 8
- Describe applications of MHD flow in engineering and astrophysics.
 - Write down the Maxwell's electromagnetic field equations of moving media and hence deduce the magnetic induction equation.
 - State and prove Alfven's theorem.
 - Define 'Hall current' and write down its key effects in magneto-hydrodynamic.

GROUP-C

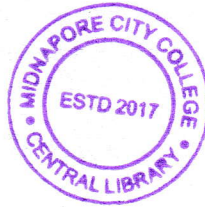
3. Answer any **ONE** question: 1×8 = 8
- A viscous, incompressible conducting fluid of uniform density are confined between a channel made by an infinitely conducting horizontal plate $z = -L$ (lower) and a horizontal infinitely long non-conducting plate $z = L$ (upper). Assume that a uniform magnetic field H_0 acts perpendicular to the plates. Both the plates are in rest. Find the velocity of the fluid and the magnetic field. Draw a sketch of the velocity profiles for various values of the Hartmann number. 6+2

(P.T.O.)

b) (i) For a conducting fluid in a magnetic field, show that the magnetic body force per unit volume, i.e. $\mu(\nabla \times H) \times H$ is equivalent to a tension μH^2 per unit area along the lines of force, together with a hydrostatic pressure $\frac{1}{2}\mu H^2$, where symbols have their usual meaning.

(ii) Explain the concept of Alfvén waves in magneto-hydrodynamics and describe their significance in plasma physics.

5+3



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