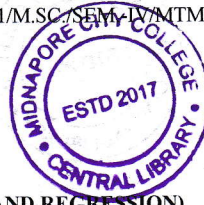Total pages: 02

PG (CBCS)
M.Sc. Semester-IV Examination, 2023
MATHEMATICS
PAPER: MTM 403
(MAGNETO HYDRO-DYNAMICS & STOCHASTIC PROCESS AND REGRESSION)

Full Marks: 50   **Time: 2 Hours**

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.

<u>Write the answer for each unit in separate sheet</u>

UNIT: 403.1
MAGNETO HYDRO-DYNAMICS
F.M. - 20

1. Answer any **TWO** from the following questions: 2×2=4
    a) Explain the Lorentz Force.
    b) What is the current density vector in a medium in motion.
    c) Why does MHD wave propagate along longitudinal and transverse directions?
    d) Interpret the pressure term appeared in the equation of conducting laminar viscous flow.

2. Answer any **TWO** from the following questions: 2×4=8
    a) Compare the Maxwell's electromagnetic field equations when the medium is at   rest and in motion.
    b) Write down the equations of motion of a conducting viscous fluid in the presence of a magnetic field.
    c) State and prove Alfven's theorem.
    d) Describe the Ferraro's Law of Iso-rotation.

3. Answer any **ONE** from the following questions: 1×8=8
    a) Find the velocity of a viscous conducting liquid between parallel walls in a transverse magnetic field.
    b) "The magnetic body force is a combination of tension and pressure"- Justify it.

[Internal Assessment- 05]

(P.T.O.)

UNIT: 403.2
STOCHASTIC PROCESS AND REGRESSION
F.M. - 20

4. Answer any **TWO** from the following questions: 2×2=4
    a) Write the postulates of poisson process.
    b) Write the transition probability matrix for Gambler's ruin problem.
    c) What is Ergodic process?
    d) Define Markov chain and order of the Markov chain in stochastic process.

5. Answer any **TWO** from the following questions: 2×4=8
    a) Suppose that the probability of a dry day following a rainy day is $\frac{2}{3}$ and that the probability of a rainy day following a dry day is $\frac{1}{2}$. If May 11 is a dry day then find the probability that May 13 is dry day.
    b) Suppose a two-state homogeneous Markov chain has the following transition probability matrix:
    $$P = \begin{bmatrix} 1-a & a \\ b & 1-b \end{bmatrix}, 0 \le a, b \le 1, |1-a-b| < 1.$$
    Prove that (by using Chapman-Kolmogorov equation) the n-step transition probability matrix $P(n)$ is given by
    $$P(n) = \begin{bmatrix} \frac{b+a(1-a-b)^n}{a+b} & \frac{a-a(1-a-b)^n}{a+b} \\ \frac{b-b(1-a-b)^n}{a+b} & \frac{a+b(1-a-b)^n}{a+b} \end{bmatrix}.$$
    c) Derive the equation of the plane of regression containing three variables.
    d) When do you say that a state j is accessible from a state i? When do you say that the two states i and j communicate?

6. Answer any **ONE** from the following questions: 1×8=8
    a) Prove that $r_{1.23...p} = \left(1 - \frac{|R|}{R_{11}}\right)^{1/2}$ where the symbols have their usual meanings.
    b) Describe the pure birth process and deduce the corresponding Yule-Furry process. What will be the probability generating function for this process?

[Internal Assessment- 05]

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