

M.Sc. 4th Semester Examination, 2020

Applied Mathematics With Oceanology And Computer Programming

Paper: MTM – 403

Full Marks: 50

Time : 2 hours

The figures in the right hand margin indicate marks

Unit – I: Magneto Hydro-Dynamics

Answer **Q. No. 1** and any **two** questions from the rest.

- | | |
|--|---------|
| 1. Answer any two questions : | 2x2 = 4 |
| (a) Write down the magnetic induction equation in dimension less form. | |
| (b) What is Lorentz force? | |
| (c) Define Alfven's wave. | |
| 2. Find the velocity for Hartman flow between two non-conducting parallel plates separated by a distance 2L. | 8 |
| 3. State and prove Alfven's theorem. | 8 |
| 4. Find the magnetic body force per unit volume for a conducting fluid in a magnetic field. | 8 |

(Internal Assessment: 05 Mark)

[Internal Assessment : 05 Marks]

Unit-II :Stochastic Process and Regression

Answer question 1 and any two from the rest.

5. Answer any **two** question:

2×2

- (a) Define Markov Chain with example. Also, define its order.
- (b) Define transient and persistent States. When a persistent state is called null-persistent.
- (c) State Galton-Watson branching process.

6. Answer the questions:

- (a) Suppose that probability of a dry day(state 0) following a rainy day(state 1) is $\frac{1}{3}$ and that the probability of a rainy day following a dry day is $\frac{1}{2}$ and t.p.m

$$P = \begin{pmatrix} \frac{1}{2} & \frac{1}{3} \\ \frac{1}{3} & \frac{2}{3} \end{pmatrix}$$

If May 1 is a dry day then find the probability that May 3 and May 5 are dry day.

- (b) If $\{X_n, n \geq 0\}$ be a Markov chain with three states 0,1,2 and transition matrix

$$\begin{pmatrix} \frac{3}{4} & \frac{1}{4} & 0 \\ \frac{1}{4} & \frac{1}{2} & \frac{1}{4} \\ 0 & \frac{3}{4} & \frac{1}{4} \end{pmatrix}$$

and the initial distribution $\Pr\{X_0 = i\} = \frac{1}{3}, i = 0,1,2.$

Find $\Pr\{X_2 = 2, X_1 = 1, X_0 = 2\}.$

4+4

(3)

7. Answer the questions:

- (a) Write transition matrix for the problem of random walk between reflecting barriers.
- (b) State and prove Chapman-Kolmogorov equation.
- (c) Prove that the state j is persistent iff $\sum_{n=0}^{\infty} p_{jj}^n = \infty$ 2+3+3

8. What do you mean by Weiner Process? Deduce the differential equation of Weiner Process. 2+6

[Internal Assessment : 05 Marks]

