

**APPLIED MATHEMATICS WITH OCEANOLOGY AND
COMPUTER PROGRAMMING [P.G.]**

M.Sc. Fourth Semester End Examination-2024

[Regular & Supplementary Paper]

PAPER-MTM-405

Full Marks: 50

Time: 02 Hrs

The figures in the right-hand margin indicate marks

*Candidates are required to give their answers in their own words as
far as practicable*

Illustrate the answers wherever necessary.

[Use separate answer script for each group]

405 A

[Dynamic Meteorology]

F.M. – 25

I. Answer any two questions of the following:

2x2=4

- a. Define frontal surface and front in the atmosphere.
- b. What is 'Rossby wave'?
- c. What types of equation are used for numerical weather forecasting
- d. What is 'storm surge'?

(2)

2. Answer any two questions of the following: 2x4=8

- a. Defining front genesis and frontolysis, derive the condition for front genesis and frontolysis.
- b. Explain briefly thunderstorm formation in the atmosphere.
- c. How does 'hurricane' generate?
- d. Write notes on 'surface of discontinuity'.

3. Answer any one question of the following: 1x8=8

- a. Discuss the wind distribution near the frontal surface. Derive the angle between the frontal surface and earth's surface in the atmosphere. 2+6
- b. Write the mathematical formulation of pressure distribution near fronts. How is pressure troughs formed at fronts? 8

[Internal Assessment – 5]

405 B

[Operational Research Modelling]

F.M. - 25

1. Answer any two questions of the following: 2x2= 4

- a) Define joint marginal and conditional entropies.
- b) What are MTBF and MTTF?
- c) What do you mean by memory less channel and channel matrix?

(3)

- d) What are the main objectives of encoding procedure?
- e) Find the path which minimizes the functional

$$J = \int_0^1 (1+x^2) dt \text{ where } x(0)=1, x(1)=2$$

Answer any two questions of the following: 2x8= 16

2. a) Explain the Pontryagin's Maximum principle and illustrate it with the help of an example.

b) Use Shannon's encoding procedure to find the code for the alphabets A,B,C,D using the following information.

Alphabet	A	B	C	D
Probability	0.1	0.4	0.3	0.2

4+4

3. a) Obtain the necessary condition for the functional

$$I[y(x)] = \int_{x_1}^{x_2} f(x, y, y', y'') dx \text{ to be extremum satisfying the boundary}$$

conditions $y(x_1) = y_1, y(x_2) = y_2, y'(x_1) = y_1'$ and $y'(x_2) = y_2'$

b) Find the curve passing through the points (x_1, y_1) and (x_2, y_2) which related about the x-axis gives a minimum surface area.

5+3

4. A transmitter and receiver have information consisting of three letters. The joint probabilities for communication are given below.

[Contd....P/4]

(4)

$P(x_i, y_i)$	y_1	y_2	y_3
x_1	0.25	0.28	0.05
x_2	0.06	0.12	0.02
x_3	0.04	0.08	0.10

Determine $H(X)$, $H(Y)$ and $H(X/Y)$ for this channel.

8

[Internal Assessment – 5]