M.Sc. Third Semester End Examination, 2023

Applied Mathematics with Oceanology and Computer Programming

PAPER-MTM-303

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 TWO UNITS

Unit - I
[Dynamical Oceanology and Meteorology]
Full Marks - 25

Answer any two questions: **2x2=2**

1. In a sample of sea water, define the salinity and concentration of that sample
2. What is Gibbs potential function?
3. Define the term 'dry adiabatic lapse rate' and write its value.
4. Write down a short note on 'internal waves'.

Answer any two questions: **2x4=8**

5. Define potential temperature and show that a parcel of dry air moving adiabatically will conserve its potential temperature.
6. Define Gibbs relation for sea water in Oceanology. What is specific entropy defining in a thermodynamical system? 3+1
7. Classify the forces in the sea and write down its physical significance.
8. Define chemical potential of a component in finite volume of sea water. Establish the relation $c_w = 1 - s$ between salinity and concentration of pure water. 2+2

Answer any one question: **1x8=8**

9. (i) Explain the Humidity Variable 'Mixing Ratio' and 'Specific Humidity'.
   (ii) Explain adiabatic process. Derive Posson's equation and further find out a relationship between temperature and specific volume during adiabatic process. 3(1+4)
10. Discuss how to satisfy the equation of continuity of volume for "estuarine flow" at a long, narrow coastal inlet which has a river at the inland end. Define relative vorticity and if wind roates as a solid body about the centre of a low pressure system and the tangential velocity is 10m/s at radius 300 km, find the relative vorticity. 4+4

Unit - II
[Operation Research]
Full Marks - 25

Answer any two questions: **2x2=4**

1. Find the average length of the waiting line in M/M/1 system.
2. Write the significance of Lagrange multipliers in constraint optimization problem.
3. Describe the customers behaviour in queueing system.

Answer any two questions: **2x8=16**

4. A food processing company uses 25,000/- kg of cornflower every year. The quantity-discount price of cornflower provided in the table below:

Quantity	Unit price (Rs./kg)
1-749	70
750-1499	65
1500 and above	60

   The order processing charges are Rs. 500/- order. The handling plus carry-over charges on an annual basis are 20% of the purchase price of the corn flour per kg. Find the optimal order quantity (in kg) and total inventory cost.
5. Show that for a single service station, Poisson arrivals and exponential service time, the probability that exactly n calling

units are in the queuering system is $P_n = (1-\rho)\rho^n$, $n \geq 0$ where ρ is the traffic intensity.

6. Derive the Kuhn-Tucher necessary conditions of the following non-linear problem.

$$Max\ f = 2x_1 - x_1^2 + 4x_2$$

$$Subject\ to \begin{matrix} 2x_1 + 3x_2 \leq 6 \\ 2x_1 + x_2 \leq 4 \end{matrix}$$

and hence solve it 4+4

Internal Assessment - 05