

PG CBCS
M.SC. Semester-III Examination, 2021
DEPARTMENT OF MATHEMATICS
PAPER: MTM 303
(DYNAMICAL OCEANOLOGY AND METEOROLOGY & OPERATIONS
RESEARCH)

Full Marks: 50**Time: 2 Hours****Write the answer for each unit in separate sheet****UNIT- MTM 303.1****Answer any TWO questions of the following:**

10X2=20

1. Define first and second laws of thermodynamics. Derive the Poisson's equation in terms of specific volume and temperature in an adiabatic process for an air parcel. Also derive the dry adiabatic lapse rate for an air parcel. 2+4+4
2. a) Write down the basic physical laws used in oceanography.
 b) Derive the z -component of equation of motion in oceanography.
 c) Explain the terms "Coriolis force" and "thermohaline motion". 2+5+3
3. Derive the equation of continuity of volume of a sea water. How the density, temperature and salinity are measured in ocean water. 6+4
4. a) 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.
 b) Define relative vorticity and if wind rotates as a solid body about the center of a low pressure system, and the tangential velocity is 10 m/s at radius 300 km, find the relative vorticity. 5+5

[Internal Assessment- 5 Marks]**UNIT- MTM 303.2****Answer any TWO questions from the following:**

10X2=20

1. Derive the steady state difference equations of the $M/M/1 : N/FCFS/\infty$ queueing system. Hence, find the p_n and p_0 . 5+3+2
2. a) A shop produces three items in lots. The demand rate for each item is constant and can be assumed to be deterministic. No back orders are to be allowed.

[P. T. O]

[2]

The pertinent data for the items are given in the following table:

Item	I	II	III
Set-up cost(Rs.)	100	90	120
Cost per unit(Rs.)	10	10	9
Yearly demand rate (units)	5000	6000	4000

The shop uses an inventory carrying charge of 30% of average inventory valuation per annum. Determine the economic lot quantities for the three items, subject to the condition that the total value of the average inventory levels of these items does not exceed Rs. 7000.00

b) What is the importance of inventory management? 8+2

3. a) Solve the following Non-linear programming problem

$$\text{Maximize } f(x_1, x_2) = 7x_1^2 - 6x_1 + 5x_2^2$$

$$\text{subject to } x_1 + 2x_2 \leq 10$$

$$x_1 - 3x_2 \leq 9$$

$$x_1, x_2 \geq 0$$

b) What is lead time? 8+2

4. a) Solve by using Lagrangian multiplier method the following problem

$$\text{Maximize } z = x_1^2 + 3x_2^2 + 5x_3^2$$

$$\text{subject to } x_1 + x_2 + 3x_3 = 2$$

$$5x_1 + 2x_2 + x_3 = 5$$

$$x_1, x_2, x_3 \geq 0$$

b) The demand for an item in a company is 18000 units per year. The company can produce the item at a rate 3000 per month. The cost of one set-up is Rs. 500 and the holding cost of one unit per month is Rs. 0.15. The shortage cost of one unit is Rs. 20 per month. Determine the optimum manufacturing quantity and the shortage quantity. Also determine the manufacturing time and time between setups. 6+4

[Internal Assessment- 5 Marks]