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PG CBCS
M.Sc. Semester-III Examination, 2020
MATHEMATICS
PAPER: MTM 303
DYNAMICAL OCEANOLOGY AND METEOROLOGY&OPERATIONS RESEARCH

Full Marks: 40   **Time: 2 Hours**

Write the answer for each unit in separate sheet
UNIT- 303.1

Answer any <u>two</u> questions: **10X2=20**

1. Derive the necessary conditions of thermo dynamical equilibrium of a finite volume of sea water.   10

2. Derive the equation of motion in ocean and write down the boundary conditions for obtaining solutions to the equations.   10

3. (a) Derive the Poisson's equation for adiabatic process.
   (b) Derive the pressure gradient force in an atmosphere.
   (c) Define Mixing ratio and specific humidity and find the relation between them.
                                                                        3+4+3

4. (a) Write down the basic physical laws used in oceanology.
   (b) Define salinity and sigma-t for sea water. Derive the equation of continuity of volume.
   (c) Classify the forces in the sea and write down its physical significance.   2+5+3

UNIT- 303.2

Answer any <u>two</u> questions: **10X2=20**

5. Derive the probability distribution of the waiting time excluding service time of the (M/M/1: ∞/FCFS/∞) queuing system. Hence derive the expression the average waiting time in queue and the average waiting time in system.   6+4

6. a) What are the objectives of the inventory management?
   b) Derive the EOQ formula of purchasing inventory model with shortages, infinite replenishment rate and zero lead time in the system.   2+8

7. Define convex programming problem. By Kuhn-Tucker conditions solve the following:
$$Max\ Z = 7x_1^2 + 6x_1 + 5x_2$$
$$\text{s. t.}\quad x_1 + 2x_2 \leq 10$$
$$x_1 - 3x_2 \leq 9$$
$$x_1, x_2 \geq 0.$$
                                                                        10

8. A telephone exchange has two long distance operators. The telephone company finds that during the peak hour, long distance calls arrive in a Poisson process at an average rate of 15 per hour. The length of service on these calls is approximately exponentially distributed with mean length of 5 mints.

I. What is the average idle time of each operator in a day (assuming a 8-hours day)?

II. What is the probability that a customer, on arrival, will have to wait for the long distance call?

III. What is the expected waiting time of a customer in the system?   10

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