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PG (NEW) CBCS

M.Sc. Semester-III Examination, 2019

APPLIED MATHEMATICS WITH OCEANOLOGY AND COMPUTER PROGRAMMING

PAPER: MTM-303

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

Write the answer for each unit in separate sheet

Unit-1:

MTM 303.1: Dynamical Oceanology and Meteorology

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

a) State the first law of thermodynamics.

b) Explain stationary wave and progressive wave.

c) Define salinity and sigma-t for sea water.

d) What do you mean by inertial and non-inertial frame?

2. **Answer any two questions of the following:** **4×2=8**

a) Prove that, the differences of specific heats at constant pressure and constant volume is inversely proportional to the molecular weight.

b) Prove that, the path of the particle describes an ellipse of a progressive wave in the surface of a cannel of finite depth.

c) Explain potential temperature and show that a parcel of dry air moving adiabatically will conserve its potential temperature.

d) Show that, in the isothermal atmosphere $p = p_0 e^{\frac{g}{RT}(z-z_0)}$ where p_0 is the pressure at the height z_0.

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

a) Derive hydrostatic equation. Prove that the total energy of progressive wave is $\frac{1}{2}\rho g a^2 \lambda$ where a, λ is the wave amplitude and wave length respectively. **3+5=8**

b) Derive the equation of state for moist unsaturated air in the form

$$R_m = \frac{\epsilon R_d}{1-(1-\epsilon)\frac{e}{p}}.$$

(Turn over)

Unit-2:

MTM 303.2: Operations Research

4. Answer any two questions of the following: **2×2=4**

a) Discuss 'steady state' and 'transient state' in queueing system.

b) What are the limitations of the Lagrangian multiplier technique?

c) What do you mean by economic lot-size?

d) What is the relation between queue length and system length in $(M/M/N:\infty/FCFS)$ queuing system?

5. Answer any two questions of the following: **4×2=8**

a) Solve by using Lagrangian Multiplier method

$$Min\ z = 2x_1^2 - 24x_1 + 2x_2^2 - 8x_2 + 2x_3^2 - 12x_3 + 200$$
$$sub.to\ x_1 + x_2 + x_3 = 11,\ \ x_1, x_2, x_3 \geq 0.$$

b) The demand for an item is 18000 units per year. The inventory carrying cost is Rs. 1.20 per unit time and the cost of shortage is Rs. 500. The ordering cost isRs. 400. Assuming that the replenishment rate is instantaneous, determine the optimum order quantity, shortage quantity, cycle length.

c) A telephone exchange has two long distance operators. The telephone company finds that, during the peak load, long distance all arrive in a Poisson fashion at an average rate of 15 per hour. The length of service on these calls is approximatelyexponentially distributed with mean length 5 minutes.

i) What is the probability that a subscriber will have to wait for this long distance call during the peak hours of the day?

ii) If the subscriber waits and are serviced in turn, what is the expected waiting time?

d) Solve by using Kuhn-Tucker conditions method the following problems

$$Max\ z = 8x_1 + 10x_2 - x_1^2 - x_2^2$$
$$sub.to\ 3x_1 + 2x_2 \leq 6,\ \ x_1, x_2 \geq 0.$$

(Turn over)

6. Answer any one question of the following: 8×1=8

a) Find the optimum order quantity for an inventory control system with finite rate of production, no shortages, uniform demand, zero lead time and usual assumptions. Find optimum time period also. Deduce the EOQ formula for it.

b) Derive the differential equations for $(M/M/C:N/FCFS/\infty)$ queueing system in transient state.

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