PG/IIIS/MITM-303/19

M.Sc 3rd Semester Examination, 2019

MITM

PAPER —MITM-303

Full Marks : 50

Time : 2 hours

Answer **all** questions

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

UNIT—I

(*App. Mathematics*)

[*Marks* : 25]

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

(*a*) Explain stationary wave and progressive wave.

(*b*) Define salinity and sigma-*t* for sea water.

(*c*) Write the atmospheric air composition.

(*d*) Define dry adiabatic lapse rate and write its value.

2. Answer the following questions : 2 × 4

(*a*) Derive the equation of continuity of volume.

(*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*) Derive the basic statical relationship of meteorology. Hence find out the pressure variation with altitude for (*i*) When temperature (T) is constant with height (z) and (*ii*) T decreases at a constant rate with increasing z.

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

3. Answer any *one* question : 8×1

(*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. $3 + 5$

(*b*) Write the basic laws of physics for developing the dynamics of the ocean. Explain adiabatic process. Derive Poisson's equation and further find out a relationship between temperature and specific volume during adiabatic process. $2 + 2 + 4$

[*Internal Assessment*—05 Marks]

UNIT—II

(*Operations Research*)

[*Marks* : 25]

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

   (*a*) Explain transient state and steady state in a queuing system.

   (*b*) Write the necessary and sufficient conditions of optimization for the multivariate problem without constraint.

   (*c*) Write the assumptions in Economic Order Quantity formula.

   (*d*) Write the working procedure of solving two price breaks inventory model.

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

   (*a*) Solve the following Non-linear programing problem

   Maximize $f(x_1, x_2) = 4x_1 - x_1^2 + 8x_2 - x_2^2$

   subject to $x_1 + x_2 = 2$; $x_1, x_2 \geq 0$.

   (*b*) Explain all the six symbols a, b, c, d, e, f in any queuing model $(a/b/c) : (d/e/f)$.

(*c*) Explain different costs involved in the inventory system. Draw these costs graphs varying the quantity.

(*d*) Derive the Kuhn-Tucker conditions of the following Non-linear problem :

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

$$2x_1 + 3x_2 \leq 6,$$

$$\text{subject to } 2x_1 + x_2 \leq 4,$$

$$x_1, x_2 \geq 0.$$

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

(*a*) The following data describe three inventory items. Determine the economic order quantity for each of the three items so that these items to be accommodated with in total available storage area of 700 sq.ft.

Item	Set-up Cost (Rs.)	Demand (units per year)	Cost per unit (Rs.)	Storage area required per unit (sq. ft.)
1	100	2000	10	0·5
2	200	5000	20	0·6
3	75	10000	5	0·3

where inventory carrying charge of 20% of average inventory valuation per year and shortages are not allowed.

(*b*) Derive the difference equation for the (M/M/C : ∞/FCFS/∞) queuing system in steady state condition. Hence find the expression of P_n (probability of system having *n* customers).

[*Internal Assessment*—05 Marks]