M.Sc 3rd Semester Examination, 2010

APPLIED MATHEMATICS WITH OCEANOLOGY AND COMPUTER PROGRAMMING

PAPER—MA-2103

(*Operations Research/Dynamical Oceanology and Meteorology*)

Full Marks : 50

Time : 2 hours

The figures in the right-hand margin indicate marks

(Students have to answer either Operations Research or Dynamical Oceanology and Meteorology)

(*Operations Research*)

Aswer **Q. No. 1** and any **two** from rest

1. Answer any *four* questions : 2 x 4

(*a*) What is the basic difference between simplex method and revised simplex method to solve an LPP.

(*Turn Over*)

(*b*) What is the necessity of using 'post optimal analysis' ?

(*c*) Describe dynamic programming technique briefly.

(*d*) Explain EOQ model.

(*e*) What do you mean by integer programming problem ?

(*f*) Write two differences between linear programming problem and quadratic programming problem.

2. (*a*) Solve the linear programming problem by revised simplex method.

$$\text{Max. } Z = 6x_1 - 2x_2 + 3x_3$$

subject to

$$2x_1 - x_2 + 2x_3 \leq 2$$

$$x_1 + 4x_3 \leq 4$$

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

8

(*b*) Use Kuhn-Tucker conditions to solve the NLPP :

$$\text{Max. } Z = -x_1^2 + 2x_1 + x_2$$

subject to the constraints

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

$$2x_1 + x_2 \leq 4$$

$$x_1, x_2 \geq 0.$$

8

3. (*a*) Consider the LPP

$$\text{Max. } Z = 3x_1 + 4x_2 + x_3 + 7x_4$$

subject to the constraints

$$8x_1 + 3x_2 + 4x_3 + x_4 \leq 7$$

$$2x_1 + 6x_2 + x_3 + 5x_4 \leq 3$$

$$x_1 + 4x_2 + 5x_3 + 2x_4 \leq 8$$

$$x_1, x_2, x_3, x_4 \geq 0.$$

Find the optimum solutions. Now if a linear constraint $2x_1 + 3x_2 + x_3 + 5x_4 \leq 4$ be added to the constraints of the problem, check whether there is any change in the optimal solution of the original problem. 8

(*b*) Show that the functional 8

$$J = \int_{x_0}^{x_1} F(y, y', y'', \ldots, y^{(n)}, x)\, dx$$

will be stationary only if

$$F_y - \frac{d}{dx}(F_{y'}) + \frac{d^2}{dx^2}(F_{y''}) - \ldots + (-1)^n \frac{d^n}{dx^n}(F_{y^{(n)}}) = 0.$$

4. (*a*) Explain Wolf's method to solve a quadratic programming problem. 8

(*b*) Derive an economic lot size formula for optimum production quantity of a single product so as to minimize the total average variable cost per unit time, under the assumptions demand rate is uniform, lead time zero, production rate is finite, shortage are allowed and backlogged. 8

[*Internal Assessment* : 10 Marks]

(*Dynamical Oceanology and Meteorology*)

Aswer any **five** questions

1. Define adiabatic process. In adiabatic process establish the relations between temperature and pressure, temperature and specific volume. What is adiabatic lapse rate? $1\frac{1}{2}+5+1\frac{1}{2}$

2. Prove that a parcel of dry-air moving adiabatically will conserve its potential temperature. Write the conditions of stability of air. 8

3. What is aerological diagram? Write the importance of this diagram. Deduce the condition of area-equivalence. Define salinity of the sea-water. 1 + 1 + 4 + 2

4. Deduce Gibb's general thermodynamical relation for sea-water. Hence deduce Gibb's-Duhem relation. 5 + 3

5. Deduce the equation of motion of the sea-water. 8

6. Approximate the equations of continuity equations of motion and energy by Boussiness approximation. 8

7. Deduce the two equations of conservation of mass of sea-water. Show that

$$W = \frac{R^*}{M} \oint_C T \, d(\ln p)$$

for the atmosphere, where symbols have their usual meanings. 5 + 3

[*Internal Assessment* : 10 Marks]