# 2017

## M.Sc.

### 3rd Semester Examination

### APPLIED MATHEMATICS WITH OCEANOLOGY AND COMPUTER PROGRAMMING

**PAPER—MTM-303(OR)**

*Full Marks* : 50

*Time* : 2 Hours

*The figures in the right-hand margin indicate full marks.*

*Candidates are required to give their answers in their own words as far as practicable.*

*Illustrate the answers wherever necessary.*

*(Operational Research)*

Answer *Q. No. 1* and any *four* questions from the rest.

1. Answer any *four* questions : 4×2

   (a) Why revised simplex method is better than the simplex method ?

   (b) What are the costs involved in inventory management ?

*(Turn Over)*

(c) State mixed integer programming problem. Write two method which are used to solve mixed IPP.

(d) What do you mean by post optimality analysis ?

(e) State Bellman's principle of optimality.

(f) Write down the difference between the quadratic and non linear programming problems ?

2. (a) Solve the following LPP by revised simplex method

Max $Z = 2x_1 + 2x_2$

subject to $5x_1 + 3x_2 \le 8$

$x_1 + 2x_2 \le 4$

and $x_1, x_2 \ge 0.$ 8

3. (a) A small shop produces three parts I, II, III in lots. The shop has only 650 sq/ft storage space. The appropriate data for the three items are presented in the following table :

| *Item* | *I* | *II* | *III* |
|---|---|---|---|
| Demand per year | 5,000 | 2,000 | 10,000 |
| Set-up cost (Rs) | 100 | 200 | 70 |
| Cost per unit (Rs) | 10 | 15 | 5 |
| Floor space required (sq/unit) | 0.5 | 0.8 | 0.3 |

The shop uses an iventory carrying charge of 20 percent of average inventory valuation per annum. If no stock outs are allowed, determine the optimal lots size for such item. 8

4. Derive the conditions of the discrete changes of cost vector(C) of the following LPP

Max $z = CX$

Subject to $AX = b$

Such that the optimal results are unchanged. 8

5. Solve the following IPP using Branch and Bound method.

Max $z = x_1 - 2x_2$

Subject to $4x_1 + 2x_2 \leq 15$

$x_1, x_2 \geq 0$ and integers. 8

6. A system is characterized by the following ordinary differential equations : 8

$\frac{dx_1}{dt} = x_2, \frac{dx_2}{dt} + x_2 = u,$ where $u$ is the control variable chosen in such a way that the cost functional

$$\frac{1}{2}\int_0^a (x_1^2 + 4u^2)dt$$

is minimized. Show that, if the boundary conditions satisfied by the state variables are $x_1(0) = a$, $x_2(0) = b$, where $a$, $b$ are constants and $x_1 \to 0, x_2 \to 0$ as $t \to \infty$, the optimal choice for $u$ is $u = -\frac{1}{2}x_1(t) + (1 - \sqrt{2})x_2(t)$.

7. Solve the following quadratic programming problem by Wolfe's modified simplex method and test whether the solution is global optimum or not

Minimize $f(x) = -8x_1 - 16x_2 + x_1^2 + 4x_2^2$

Subject to $x_1 + x_2 \le 5$

$x_1 \le 3$

$x_1 \ge 0, x_2 \ge 0$ 8

8. Using Decomposition principle, reduce the following problem to an elegant form of LPP which can be solved by simplex method.

Minimize $z = -x_1 - x_2 - 2y_1 - y_2$

Subject to $x_1 + 2x_2 + 2y_1 + y_2 \le 40$

$x_1 + 3x_2 \le 30$

$2x_1 + x_2 \le 20$

$y_1 \le 10$

$y_2 \le 10$

$x_1 \ge 0, x_2 \ge 0, \quad y_2 \ge 0, y_2 \ge 0.$ 8

**[Internal Assessment—10 Marks]**

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