C 82517 (Pages : 2) Name..............................

Reg. No..............................

FOURTH SEMESTER M.Sc. DEGREE EXAMINATION, JUNE 2015

(CUCSS)

Mathematics

MT 4E 05—OPERATION RESEARCH

Time : Three Hours Maximum : 36 Weightage

Part A (Short Answer Type Questions)

Answer **all** *the questions.*
Each question carries 1 weightage.

1. Describe the terms : chain, path, cycle, circuit and component with reference to graphs.
2. What is meant by spanning tree of minimum length ?
3. Prove that the maximum flow in a graph is equal to the minimum of the capacities of all possible cuts in it.
4. Describe the generalized problem of maximum flow.
5. Describe the concept of deletion of variables in Linear Programming Problems.
6. What do you mean by Parametric Linear Programming ?
7. Using an example discuss the concept of dynamic programming.
8. What is meant by goal programming ?
9. Write the general form of a Quadratic Programming Problem.
10. What is meant by sensitivity analysis ?
11. Describe briefly the Rosenbrock method to locate the minimum of a function.
12. Define separable function. Write an example for a separable function.
13. How do we choose the direction of steepest descent in conjugate gradient method ?

(14 x 1= 14 weightage)

Part B (Paragraph Type Questions)

Answer any **seven** *questions.*
Each question carries 2 *weightage.*

14. Show that if $\{x_i\}$ and $\{y_i\}$ are two flows in a graph, then $\{ax_i + by_i\}$, where a and b are real constants, is also a flow.
15. A factory can manufacture two products A and B. The profit on a unit of A is Rs. 80 and of B is Rs. 40. The maximum demand for A is 6 units per week and of B it is 8 units. The manufacturer has set up a goal of achieving a profit of Rs. 640 per week. Formulate the problem as goal programming.

Turn over

16. **Minimize** $f = (x_1 + 1)(x_2 - 2)$ **over the region** $0 \le x_1 \le 2,\ 0 \le x_2 \le 1$ **by writing the Kuhn-Tucker conditions and obtaining the saddle points.**

17. **Minimize** $f(X) = \frac{c_1}{x_1 x_2 x_3} + c_2 x_2 x_3$ **subject to** $g_1(X) = c_3 x_1 x_3 + c_4 x_2 x_1 = 1$, $c_i > 0$, $x_j > 0$, $i = 1, \ldots, 4$, $j = 1, 2, 3$.

18. **Describe the idea of computational economy in dynamic programming.**

19. **Determine max** $(u_1^2 + u_2^2 + u_3^2)$ **subject to** $u_1 u_2 u_3$ **6, where** u_1, u_2, u_3 **are positive integers.**

20. **Describe briefly the one dimensional search plans.**

21. **Describe the serial multistage model in dynamic programming.**

22. **Write the conjugate gradient algorithm in multidimensional search.**

(7 x 2 = 14 weightage)

Part C (Essay Type Questions)

Answer any **two** *questions.*
Each question carries **4 weightage.**

23. **A building activity has been analyzed as follows.** v_j **stands for a job :**

   (i) v_1 and v_2 can start simultaneously, each one taking 10 days to finish.

   (ii) v_3 can start after 5 days and v_4 after 4 days of starting v_1.

   (iii) v_4 can start after 3 days of work on v_3 and 6 days of work on v_2.

   (iv) v_5 can start after v_1 is finished and v_2 is half done.

   (v) v_3, v_4 and v_5 take respectively 6, 8 and 12 days to finish.

   Find the critical path and the minimum time for completion of the building.

24. **Find the maximum on negative flow in the network described below. Arc** (v_j, v_k) **being denoted as** (j, k). v_a **is the source of** v_b **is the sink :**

Arc	(a, 1)	(a, 2)	(1, 2)	(1, 3)	(1, 4)	(2, 4)	(3, 2)	(3, 4)	(4, 3)	(3, b)	(4, b)
Capacity	8	10	3	4	2	8	3	4	2	10	9

25. **Use the method of steepest ascent to go two steps towards the maximum of** $f(X) = -2x_1^2 - x_2^2 - x_3^4 - x_4^4$ **starting at the point** $(-1, 1, 0, -1)$.

26. **Find the minimum of** $f(x) = x^4 - 4x^3 - 6x^2 - 16x + 4$ **by Fibonacci method in the interval** $0 < x < 9$ **using a grid of 17 equally spaced internal points.**

(2 x 4 = 8 weightage)