

RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

SECOND YEAR [2015-18]

B.A./B.Sc. THIRD SEMESTER (July – December) 2016

Mid-Semester Examination, September 2016

Date : 15/09/2016

MATHEMATICS (General)

Time : 12 noon – 1 pm

Paper : III

Full Marks : 25

[Use a separate Answer Book for each group]

Group – A

1. Answer any one question : [1×5]
- a) Define basic solution of a system of linear equations. Find a basic feasible solution of the system— [2+3]
- $$x_1 + 4x_2 - x_3 = 3$$
- $$5x_1 + 2x_2 + 3x_3 = 4$$
- b) Solve the following L.P.P by graphical method : [5]
- Minimize $z = 2x_1 + 3x_2$
- subject to $5x_1 + 9x_2 \leq 45$
- $$2x_1 + 3x_2 \geq 6$$
- $$x_2 \leq 4$$
- $$x_1, x_2 \geq 0$$
2. Answer any one question : [1×10]
- a) i) Prove that (2, 4, 1) is a feasible solution to the system of equations
- $$2x_1 - x_2 + 2x_3 = 2$$
- $$x_1 + 4x_2 = 18$$
- Is it a basic solution? If not, then reduce it to a basic feasible solution. [1+1+4]
- ii) Define convex set. Prove that the set of all feasible solutions of an L.P.P is a convex set. [1+3]
- b) i) Solve the following L.P.P by simplex method : [6]
- Maximize $z = 3x_1 - x_2$
- subject to $2x_1 + x_2 \geq 2$
- $$x_1 + 3x_2 \leq 3$$
- $$x_2 \leq 4$$
- and $x_1, x_2 \geq 0$
- ii) A firm uses raw materials A, B and C for production of two products. One unit of the first product needs 3 kg of A, 10 kg of B and 8 kg of C and that of the second product needs 5 kg of A, 12 kg B and 6 kg of C. The firm has a stock of 800 kg of A, 1200 kg of B and 1500 kg of C. The profits per one unit of each product are Rs. 1.50 and Rs. 2.00 respectively. Pose an L.P.P for this so that the profit may be maximum. [4]

Group – B

(Answer any two questions)

[2×5]

3. If P be the point with co-ordinates (2, 3, -1) then find the equation of the plane through P at right angle to the straight line OP, where O is the origin.

4. Find the shortest distance between the lines

$$\frac{x-3}{1} = \frac{y-5}{-2} = \frac{z-7}{1} \quad \text{and} \quad \frac{x+1}{7} = \frac{y+1}{-6} = \frac{z+1}{1}.$$

5. Find the values of 'a' for which the plane $x+y+z=a$ is a tangent plane to the sphere $x^2+y^2+z^2=27$.

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