Janki Devi Bajaj Government Girls College, Kota

Sample Paper

M.Sc. (Mathematics) Semester -III

Paper-I (functional Analysis)

Time : 1 Hour **Total Marks : 15 Marks**

1. Define **[5 Marks]**

(i) Metric
(ii) Pseudo Metric
(iii) Distance
(iv) Diameter
(v) Closed Sphere

2. Prove that the mapping $d: \mathbb{R}^2 \times \mathbb{R}^2 \to \mathbb{R}$ defined by $d(x,y) = |x_1 - y_1| + |x_2 - y_2|$, where $x = (x_1, x_2), y = (y_1, y_2), z = (z_1, z_2) \in \mathbb{R}^2$, is a metric on $\mathbb{R}^2$.

OR

Let $d(x,y) = \min\{2, |x-y|\}$.Show that d is a metric for $\mathbb{R}$ **[5 Marks]**

3. In a metric space each closed sphere is a closed set.

OR

If A is nowhere dense, then $\bar{A} = X$. **[5 Marks]**

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Sample Paper

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Paper-II (Topology)

Time : 1 Hour **Total Marks : 15 Marks**

4. Define **[5 Marks]**

(vi) T-Open set
(vii) Sier Pinki Space
(viii) Euclidean Topology for $\mathbb{R}$
(ix) Comparable Topology
(x) T-Closed set

5. Show characterization of a Topological space in terms of Closed sets.

OR

Give an example of a topological space different from the discrete and indiscrete spaced in which open sets are exactly the same as closed sets. **[5 Marks]**

6. Find all possible topologies for the set $X = \{a, b, c\}$.

OR

Show that for any collection of topologies on X there exists a unique smallest topology larger than each member of the collection. **[5 Marks]**

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Sample Paper

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Paper-III o(i) (Operation research)

Max Marks-15

There are five questions; students are instructed to attempt three questions. Each question shall be of five marks.

1.Use two phase method to solve the following L.P.P.

$$Max\ z = 3x_1 - 4x_2 + 3x_3$$
$$\text{s.t.}\quad 2x_1 + x_2 - 6x_3 = 20$$
$$6x_1 + 5x_2 + 10x_3 \leq 20$$
$$8x_1 - 3x_2 + 6x_3 \leq 50$$
$$and \quad x_1, x_2, x_3 \geq 0$$

2.Using bounded variable method, solve the following L.P.P

$$Max\ z = 2x_1 + x_2$$
$$\text{s.t.}\quad x_1 + 2x_2 \leq 20$$
$$x_1 + x_2 \leq 6$$
$$x_1 - x_2 \leq 2$$
$$x_1 - 2x_2 \leq 1$$
$$0 \leq x_1 \leq 3, \qquad 0 \leq x_2 \leq 2$$

3.Using Revised simplex method to solve the following L.P.P.

$$Max\ z = x_1 + x_2$$
$$\text{s.t.}\quad 3x_1 + 2x_2 \leq 6$$
$$x_1 + 4x_2 \leq 4$$
$$and \quad x_1, x_2 \geq 0$$

4.Use duality to solve the following L.P.P.

$$Max\ z = 3x_1 + x_2$$
$$\text{s.t.}\quad x_1 + x_2 \geq 1$$
$$2x_1 + 3x_2 \geq 2$$
$$and \quad x_1, x_2 \geq 0$$

5.Solve the following I.L.P.P by Branch and Bound Algorithm:

$$Min\ z = x_1 + 4x_2$$
$$\text{s.t.}\quad 2x_1 + x_2 \leq 8$$
$$x_1 + 2x_2 \geq 6$$
$$and \quad x_1, x_2 \geq 0,\ x_1, x_2\ are\ integers.$$

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Sample Paper

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Paper-IV (Fluid Mechanics)

Time : 1 Hour **Total Marks : 15 Marks**

1. Define **[5 Marks]**
   (i) Shear Stress
   (ii) Shear Strain
   (ii) Viscosity
   (iv) Stream Line
   (v) Path Line

2. The velocity vector **q** is given by
   $$\boldsymbol{q} = \boldsymbol{i}x - \boldsymbol{j}y$$
   Determine the equation of stream line.
   OR
   Write down relationship between the Langrangian and Eulerian methods. **[5 Marks]**

3. The velocity components for a two-dimensional flow system can be given in the Eulerian system by
   $$u = 2x + 2y + 3t, v = x + y + \frac{1}{2}t$$
   Find the displacement of a fluid particle in the Langrangian system.
   OR
   Define the Langrangian method and the Eulerian method. **[5 Marks]**

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Sample Paper

M.Sc. (Mathematics) Semester -III

Paper-V (Mathematical Statistics)

Time : 1 Hour **Total Marks : 15 Marks**

1. Define **[5 Marks]**

(i) Geometric distribution function
(ii) Hypergeometric distribution function
(iii) Poisson distribution function
(iv) Multinomial distribution function
(v) Negative binomial distribution function

2. Find Moment Generating Function and Cumulants of Poisson distribution.

OR

Find Moments of Poisson distribution. **[5 Marks]**

3. Find Moment Generating Function and Cumulants of Negative Binomial distribution.

OR

Write down Moments of Hypergeometric distribution. **[5 Marks]**

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