Sl. No. Of Question Paper: 316 Your Roll No....................

Unique Paper Code : 290679

Name of Course : B.A. (Programme) III Application Course

Name of Paper : Mathematics for Social Sciences E

Semester : VI

Duration : 2 hours

Maximum Marks : 55

<u>*Instructions for Candidates:*</u>

Question No. 1 is compulsory and carries 15 marks. Attempt four more questions selecting at least one question from each section. Each question carries 10 marks.

1. (i) Find x, if $[1\ 2\ 1]\begin{bmatrix}1 & 2 & 0\\ 2 & 0 & 1\\ 1 & 0 & 2\end{bmatrix}\begin{bmatrix}0\\ 2\\ x\end{bmatrix}=0,$

(ii) Find all second order partial derivatives of the following function $z=3x^4+2x^2y^2+4x^2y$

(iii) Solve the differential equation $\cancel{\frac{dy}{dx}}\ \frac{dx}{dt}=3x^3t$ and find the integral curve that passes through $(t, x) = (1, 2)$.

(iv) Show that : $\begin{vmatrix}x+4 & 2x & 2x\\ 2x & x+4 & 2x\\ 2x & 2x & x+4\end{vmatrix}=(5x+4)(4-x)^2$

(v) If $\vec{a}=6\hat{i}-\hat{j}+8\hat{k},\ \vec{b}=-2\hat{i}-\hat{j}-\lambda\hat{k}$, find λ such that $\vec{a}+\vec{b}$ and $\vec{a}-\vec{b}$ are orthogonal.

5×3=15

SECTION-I

2. (i) Find the area of the region bounded by the curves $y=4x^2$ and $y^2=4x$

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(ii) The marginal cost production is found to be MC= 3000+40x + 2x², where x is the number of units produced. The fixed cost of production is Rs.16,000. Find the total cost function

3. (i) If $\vec{a} = 2\hat{i} + 2\hat{j} + 3\hat{k}$, $\vec{b} = -\hat{i} + 2\hat{j} + \hat{k}$ and $\vec{c} = 3\hat{i} + \hat{j}$ are such that $\vec{a} + \lambda\vec{b}$ is perpendicular to $\vec{c}$, then find the value of λ.

(ii) Solve the following differential equation 5
$(2x - y + 1)dx + (2y - x - 1)dy = 0$.

SECTION –II

4. (i) Show that matrix $A = \begin{bmatrix} \frac{1}{3} & \frac{2}{3} & \frac{2}{3} \\ \frac{2}{3} & \frac{1}{3} & -\frac{2}{3} \\ -\frac{2}{3} & \frac{2}{3} & -\frac{1}{3} \end{bmatrix}$ is orthogonal

(ii) Let $A = \begin{bmatrix} 2 & \sqrt{2} \\ \sqrt{2} & 1 \end{bmatrix}$. Find the characteristic equation of A verify Cayley Hamilton theorem for A.

5. (i) Solve the following system of linear equations by Cramer's rule. 5
$2x - 3y - 4z = 29$; $2x + 5y - z = -15$; $3x - y + 5z = -11$

(ii) Examine the consistency of the following system of equations
$3x - y - 2z = 2$; $2y - z = -1$; $3x - 5y = 3$

SECTION-III

6. (i) The production function of a firm is given by $Q = 20L^2K + 2L^3 - 4K^3$, show that $L\frac{\partial Q}{\partial L} + K\frac{\partial Q}{\partial K} = 3Q$.

(ii) Find the angle between vectors $\vec{a} = \hat{i} - 2\hat{j} + 3\hat{k}$ and $\vec{b} = 3\hat{i} - 2\hat{j} + \hat{k}$,

7. (i) Use graphical method to solve the following linear programming problem:
Minimize $z = 3x + 5y$
subject to the constraints
$x + 3y \geq 3$; $x + y \geq 2$, $x, y \geq 0$

(i) The joint cost function of a firm producing two products is given by $C(x, y) = 6x^2 - 9x - 3xy - 7y + 5y^2 + 20$ where x and y denote their units. Find the values of x and y that minimize C(x, y). Also find the minimum cost.