

(16) SARDAR PATEL UNIVERSITY

M.Sc. Integrated Biotechnology, First semester

Tuesday, 11th December, 2012

Time: 10:30 a.m. to 1:30 p.m.

Course Code: PS01CIGB06Course Title: Biomathematics

Total marks: 70

Note: Figures to right indicate marks.

Q.1 Choose the most appropriate alternative for the following:

[8]

- The function $f(x) = 5x + 11$ represents
(a) Parabola opening upward (b) Parabola opening downward (c) Straight line (d) Circle
- Derivative of $\sec x + 1$ is
(a) $\sec(2x)$ (b) $\sec x \tan x + 1$ (c) $\sec x \tan x$ (d) None of these
- Partial derivative of $x^3 + y^3$ with respect to y is
(a) $3x^2$ (b) $3y^2$ (c) $3x^2 + 3y^2$ (d) None of these
- Integration of e^x with respect to x is
(a) e^x (b) 1 (c) 0 (d) None of these
- The order of the inverse of any 2×2 matrix, if it exists, will be
(a) 2×2 (b) 3×3 (c) 2×3 (d) 3×2 .
- If function $f(x)$ satisfy $f(x) < f(x_0)$ for all x_0 in some neighborhood of x , then x is _____ of $f(x)$.
(a) Local Maxima (b) Local Minima (c) Saddle point (d) None of these.
- For derivative of composite function, _____ rule is used
(a) Chain (b) Addition (c) Quotient (d) None of these.
- For two matrices A and B , AB is defined only if, Number of columns in $A =$ Number of _____ in B
(a) Columns (b) Rows (c) elements (d) Both (a) and (b)

Q.2 Attempt any five of the following:

[14]

- Find *coordinates* of vertex of the parabola $y = 2x^2 + 3x + 11$.
- Determine *slope* and *y-intercept* for $7x + 3y + 2 = 0$.
- Evaluate: $\lim_{x \rightarrow 3} \frac{x^3 - 27}{x^2 - 9}$.
- Find $\frac{dy}{dx}$ for $y = e^{2x}$ using chain rule.
- Find $\frac{\partial z}{\partial x}$ if $z = 2 \sin x \cos y$.

6. Identify *order & degree* of the differential equation: $\left(\frac{d^3 y}{dx^3}\right)^3 + 2\left(\frac{dy}{dx}\right)^5 - 5 = 0$.
7. Evaluate AB if it exists for $A = \begin{pmatrix} -2 & 2 \\ -1 & 1 \end{pmatrix}$ and $B = \begin{pmatrix} 4 & -1 \\ 1 & 4 \end{pmatrix}$.
8. Define: Row Echelon form of a matrix.
9. Give rule of *integration by parts* and explain LIATE criterion.

- Q.3 A. Define Cartesian product of two sets and give its biological application. [6]
 B. (i) Find *domain* and *range* of the function $f(x) = \frac{x-1}{5x}$. [6]
 (ii) Give coordinates of vertex of parabola defined by $f(x) = 2x^2 + 5x - 11$.

OR

- B. (i) Simplify: $\log(\log x^2) - \log(\log x)$. [6]
 (ii) Prove that, $\sin\theta(\operatorname{cosec}\theta + \sin\theta \sec^2\theta) = \sec^2\theta$.

- Q.4 A. Evaluate: (i) $\lim_{x \rightarrow \infty} \frac{4x^3 - 7x^2 + 5x - 1}{8x^3 - 7x^2 + 3x - 1}$ (ii) $\lim_{x \rightarrow 0} \frac{a^x - b^x}{x}$ [6]

- B. (i) Find $\frac{dy}{dx}$ for $y = \frac{\sin x}{2x+1}$. [6]
 (ii) Find out local minimum and local maximum values, if they exists, for the function of several variable: $f(x, y) = x e^y - 2y + \frac{1}{2}x^2 - 3x$.

OR

- B. (i) Find $\frac{\partial^2 z}{\partial x \partial y}$ for $z = x^2 + y^2$. [6]
 (ii) Find out local minimum and local maximum values, if they exists, for the function of single variable: $f(x) = x^3 + 2x^2 - 4x - 8$.

- Q.5 A. Evaluate: (i) $\int \frac{(x+1)}{(x-1)(x+2)} dx$ (ii) $\int (\log x)^2 dx$. [6]

- B. Solve the differential equations: [6]
 (i) $\frac{dy}{dx} = ye^x$ (ii) $(1+x^2) dy = xy dx$.

OR

- B. (i) Evaluate: $\int \sin(2x+1)dx$ [6]
(ii) Solve the differential equation: $e^{x+y} dx = dy$

- Q.6 A. (i) Find the *inverse* of the matrix $\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$, if it exists. [6]

- (ii) Evaluate rank of the matrix $\begin{bmatrix} 1 & 2 & 3 \\ 2 & 4 & 6 \\ 3 & 6 & 10 \end{bmatrix}$

- B. Find the *eigenvalues* and the corresponding *eigenvectors* of the matrix $\begin{bmatrix} 2 & 0 & 1 \\ 0 & 2 & 0 \\ 1 & 0 & 2 \end{bmatrix}$. [6]

OR

- B. Find the *eigenvalues* and the corresponding *eigenvectors* of the matrix $\begin{bmatrix} 3 & 5 \\ -2 & -4 \end{bmatrix}$. [6]
