

Exam. Code : 206602

Subject Code : 4088

M.Sc. (Bioinformatics) 2nd Semester

BASIC MATHEMATICS

Paper—BI-523

Time Allowed—3 Hours]

[Maximum Marks—75

**Note :-** Attempt **five** questions, selecting at least **one** question from each section. The fifth question may be attempted from any section.

## SECTION—A

1. (a) If  $A = \{2, 3, 5\}$ ,  $B = \{1, 2, 3\}$ ,  $C = \{3, 5\}$ , find  $A \times (B \cup C)$  and  $(A \cup B) \cap C$ . 5
- (b) Let  $A = \{2, 4, 6, 8\}$ , show that the relation  $R = \{(2, 2), (4, 4), (4, 6), (6, 6), (6, 8)\}$  is neither reflexive, nor symmetric, nor transitive. 6
- (c) Define and give an example of a periodic function. 4
2. (a) Find the square root of  $3 - 4i$ . 5
- (b) Write  $\frac{(2-3i)(5+3i)}{(3+2i)(-4-i)}$  in the form  $x + iy$ , where  $x, y$  are real numbers. 5
- (c) Find conjugate of  $\frac{(1+i)^2}{3-i}$ . 5

## SECTION—B

3. (a) If  $A = \begin{bmatrix} 1 & 2 \\ -3 & 0 \end{bmatrix}$ , find  $A^2 + 3A + 5I$ . 5

(b) Evaluate  $\begin{vmatrix} 1 & a & b+c \\ 1 & b & c+a \\ 1 & c & c+b \end{vmatrix}$ . 5

(c) Evaluate  $A^{-1}$  for  $A = \begin{bmatrix} 2 & 3 \\ 1 & 2 \end{bmatrix}$ . 5

4. (a) Show that  $(\vec{a} \times \vec{b})^2 = a^2 b^2 - (\vec{a} \cdot \vec{b})^2$ . 5

(b) Find the value of  $p$  for which the vectors  $\vec{a} = 3\vec{i} + 2\vec{j} - 9\vec{k}$  and  $\vec{b} = \vec{i} + p\vec{j} + 3\vec{k}$  are perpendicular. 5

(c) If  $\vec{a} = \vec{i} + 2\vec{j} + 3\vec{k}$ ,  $\vec{b} = -\vec{i} + 2\vec{j} + \vec{k}$ ,  $\vec{c} = 3\vec{i} + \vec{j}$ , find  $(\vec{a} \times \vec{b}) \cdot \vec{c}$ . 5

## SECTION—C

5. (a) If  $s = t^3 - 2t^2 + 3t - 4$ , give the position, velocity and acceleration of the particle at the end of 2 seconds. Here  $s$  is the distance and  $t$  the time. 9

(b) Find the maximum and minimum values of  $2x^3 - 15x^2 + 36x + 10$ . 6

6. (a) Find the intervals on which the function :  
 $f(x) = x^3 - 6x^2 + 9x + 8$   
 is (i) increasing strictly (ii) decreasing strictly. 7

(b) If  $z = e^{4x} \sin 3y$ , find  $\frac{\partial z}{\partial x}$  and  $\frac{\partial z}{\partial y}$ . 4

- (c) Find the derivative of  $\left(\frac{1-x^2}{1+x^2}\right)^{1/2}$  4

**SECTION—D**

7. (a) Find  $\lim_{x \rightarrow \pi} \left(\frac{\sin x}{\pi - x}\right)$ . 4
- (b) Evaluate  $\int x^3 e^{x^4} dx$ . 6
- (c) Evaluate  $\int_0^{\frac{\pi}{2}} (\cos x - \sin x) dx$ . 5
8. (a) Find the area bounded by the curves  $y^2 = 4x$  and  $y = x$ . 6
- (b) Find the equation of the line through the point (3, 4) which makes equal intercepts on the co-ordinate axes. 4
- (c) Find the equation of the sphere whose diameter is the line joining the origin to the point (2, -2, 4). Also find its centre and radius. 5