(i) Printed Pages: 4 Roll No. .....

(ii) Questions : 9 Sub. Code : 0 9 5 9

Exam. Code : 0 0 3 3

B.Sc. (Hons.) Biotechnology 1st Semester

(2122)

MATHEMATICS

Paper : BIOT-103A-T

Time Allowed : Three Hours] **[Maximum Marks : 67**

Note :—Attempt **five** questions in all, including Question No. **1** (Section A) which is compulsory and selecting **two** questions each from Sections B and C.

SECTION—A

1. (a) Find $\frac{dy}{dx}$ if $2x + 3y = \sin x$. 2

(b) Evaluate $\int_{-\frac{\pi}{4}}^{\frac{\pi}{4}} \sin^2 x \, dx$. 2

(c) Find the general solution of the differential equation

$\frac{dy}{dx} = \sqrt{4 - y^2}$. 2

(d) $\lim_{x \to \frac{\pi}{2}} \frac{\tan 2x}{x - \frac{\pi}{2}}$. 3

(e) Determine the degree and order of the differential equation

$$\left(\frac{d^2y}{dx^2}\right)^2 + \cos\left(\frac{dy}{dx}\right) = 0.$$ 2

(f) If the universal set X = {1, 2, 3, 4, 5, 6, 7, 8, 9}, A = {2,3, 4, 6} and B = {2,4, 5, 7, 8} find (B – A) and (A ∪ B). 2

(g) Find the mean and median of the following data :

12, 6, 8, 9, 7, 10, 13, 23 2

SECTION—B

2. (a) Find the modulus and principal argument of the complex number $-1 + \sqrt{3}i$. 4

(b) Find the multiplicative inverse of $\sqrt{5} + 3i$. 4

(c) Convert $\frac{1+3i}{1-2i}$ in polar form. 5

3. (a) Prove that $\sqrt{3}$ is an irrational number. 4

(b) Evaluate $\lim_{x \to 2} \frac{3x^2 - x - 10}{x^2 - 4}$. 4

(c) Evaluate $\lim_{x \to 0} \frac{\sqrt{1+x} - 1}{x}$. 5

4. (a) Let f : R → R be defined by f(x) = 3 – 4x. State whether the function is bijective or not. 4

(b) Let f, g : R → R be defined by f(x) = cos x and g(x) = $3x^2$ then show that f∘g, g∘f are not equal. 4

(c) Draw the graph of the function f(x) = x^3, x ∈ ℝ. 5

5. (a) Find the domain and range of the function $f(x) = x^2 + 2$, x is a real number. 4

(b) Find all the points of discontinuity of f, where f is defined by :

$$f(x) = \begin{cases} x + 2 & \text{if } x < 0 \\ 1 & \text{if } x = 0 \\ -x + 2 & \text{if } x > 0 \end{cases}$$ 5

(c) In a school there are 20 teachers who teach Mathematics or Physics. Of these, 12 teach Mathematics and 4 teach both Physics and Mathematics. How many teach Physics ? 4

SECTION—C

6. (a) Find $\frac{dy}{dx}$ when $x = 4t$, $y = \frac{4}{t}$. 4

(b) Find the interval in which the function

$$f(x) = 2x^3 - 3x^2 - 36x + 7$$

is (i) increasing (ii) decreasing. 5

(c) Find the local maximum and minimum values of the function f given by $f(x) = x^3 - 3x^2 + 3$. 4

7. (a) Evaluate $\int \frac{dx}{x^2 - 6x + 13}$. 4

(b) Using integration find the area of the region enclosed by the circle $x^2 + y^2 = a^2$. 5

(c) Evaluate $\int \frac{x^2 + 1}{x^2 - 5x + 6} dx$. 4

8. (a) Solve the following Linear Programming Problem graphically :

Maximize $Z = 4x + y$

subject to the constrains :

$x + y \leq 50,$

$3x + y \leq 90,$

$x \geq 0, y \geq 0$ 7

(b) Draw a histogram and frequency polygon of the following frequency distribution :

Class interval	100–110	110–120	120–130	130–140	140–150
Frequency	8	18	23	30	64

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9. (a) Find the variance and standard deviation for the following data :

x_i	4	8	11	17	20	24	32
f_i	3	5	9	5	4	3	1

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(b) Find the mean deviation about the median for the following data :

Class	0–10	10–20	20–30	30–40	40–50	50–60
Frequency	6	7	15	16	4	2

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