

(i) Printed Pages: 4

Roll No. ....

(ii) Questions : 9

Sub. Code : 

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Exam. Code : 

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B.Sc. (Hons.) Biotechnology 1<sup>st</sup> 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

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

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

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

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

- (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  $(A \cup B)$ . 2

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

$$12, 6, 8, 9, 7, 10, 13, 23 \quad 2$$

### 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  $\lim_{x \rightarrow 2} \frac{3x^2 - x - 10}{x^2 - 4}$ . 4

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

4. (a) Let  $f : \mathbb{R} \rightarrow \mathbb{R}$  be defined by  $f(x) = 3 - 4x$ . State whether the function is bijective or not. 4

- (b) Let  $f, g : \mathbb{R} \rightarrow \mathbb{R}$  be defined by  $f(x) = \cos x$  and  $g(x) = 3x^2$  then show that  $f \circ g, g \circ f$  are not equal. 4

- (c) Draw the graph of the function  $f(x) = x^3, x \in \mathbb{R}$ . 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 :

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

(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 :

$$\text{Maximize } Z = 4x + y$$

subject to the constrains :

$$x + y \leq 50,$$

$$3x + y \leq 90,$$

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

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- (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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