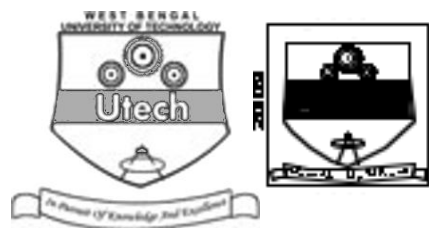


BIOMATHEMATICS – II (SEMESTER - 2)

CS/B.Sc (H) (BT)/SEM-2/BMT-204/09



1.
Signature of Invigilator

2.
Signature of the Officer-in-Charge

Reg. No.

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Roll No. of the
Candidate

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CS/B.Sc (H) (BT)/SEM-2/BMT-204/09
ENGINEERING & MANAGEMENT EXAMINATIONS, JUNE – 2009
BIOMATHEMATICS – II (SEMESTER - 2)

Time : 3 Hours]

[Full Marks : 70

INSTRUCTIONS TO THE CANDIDATES :

- This Booklet is a Question-cum-Answer Booklet. The Booklet consists of **32 pages**. The questions of this concerned subject commence from Page No. 3.
- In **Group – A**, Questions are of Objective type. You have to answer the questions in the space provided marked 'Answer Sheet'.
 - For **Groups – B & C** you have to answer the questions in the space provided marked 'Answer Sheet'. Questions of **Group – B** are Short answer type. Questions of **Group – C** are Long answer type. Write on both sides of the paper.
- Fill in your Roll No. in the box** provided as in your Admit Card before answering the questions.
- Read the instructions given inside carefully before answering.
- You should not forget to write the corresponding question numbers while answering.
- Do not write your name or put any special mark in the booklet that may disclose your identity, which will render you liable to disqualification. Any candidate found copying will be subject to Disciplinary Action under the relevant rules.
- Use of Mobile Phone and Programmable Calculator is totally prohibited in the examination hall.**
- You should return the booklet to the invigilator at the end of the examination and should not take any page of this booklet with you outside the examination hall, **which will lead to disqualification**.
- Rough work, if necessary is to be done in this booklet only and cross it through.

No additional sheets are to be used and no loose paper will be provided

FOR OFFICE USE / EVALUATION ONLY

Marks Obtained

	Group – A					Group – B					Group – C					Total Marks	Examiner's Signature
Question Number																	
Marks Obtained																	

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Head-Examiner / Co-Ordinator / Scrutineer

2336 (11/06)



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ENGINEERING & MANAGEMENT EXAMINATIONS, JUNE – 2009
BIOMATHEMATICS – II
SEMESTER – 2



Time : 3 Hours]

[Full Marks : 70

GROUP – A
(Objective Type Questions)

1. Answer any *ten* of the following :

10 × 1 = 10

A. Choose the correct alternatives for the following :

i) Let $f : R \rightarrow R$ be defined by $f(x) = 3x + 5$, $x \in R$, then f is

- a) injective but not surjective b) surjective but injective
 c) bijective d) none of these.

ii) The limit of the sequence $\left\{ \frac{n+1}{2n+1} \right\}$ $n \in N$ is

- a) 2 b) $\frac{1}{2}$
 c) -2 d) $-\frac{1}{2}$.

iii) The order and degree of the differential equation $\left(\frac{dy}{dx} \right)^2 - 5 \frac{dy}{dx} + 6 = 0$ is

- a) 1, 2 b) 2, 1
 c) 2, 2 d) 1, 1.

iv) If the straight lines $\frac{x-1}{3} = \frac{y+2}{6} + \frac{z-3}{k}$ and $\frac{x+1}{2} = \frac{y-2}{4} + \frac{z+3}{6}$ are parallel, then the value of k is

- a) -7 b) 9
 c) -9 d) 7.



v) The point where the straight line $\frac{x-2}{1} = \frac{y+3}{2} + \frac{z-2}{1}$ meets the xy -plane is

a) $(0, -7, 0)$

b) $(1, -7, 0)$

c) $(7, -1, 0)$

d) $(1, 7, 0)$.



vi) The complementary function of the differential equation $\frac{d^2y}{dx^2} + 3\frac{dy}{dx} + 2y = 0$ is

a) $Ae^x + Be^{2x}$

b) $Ae^{-x} + Be^{-2x}$

c) $Ae^x + Be^{-2x}$

d) $Ae^{-x} + Be^{2x}$.

vii) A non-empty subset H of a group (G, o) forms a sub-group if

a) $a \in H \Rightarrow a^{-1} \in H$

b) $a, b \in H \Rightarrow aob \in H$

c) $a, b \in H \Rightarrow aob^{-1} \in H$

d) $e \in H$.

viii) Let $f : \mathbb{R} \rightarrow \mathbb{R}$ and $g : \mathbb{R} \rightarrow \mathbb{R}$ be defined by $f(x) = x + 1$, $x \in \mathbb{R}$ and $g(x) = 3x$, $x \in \mathbb{R}$, where \mathbb{R} is the set of real numbers. Then $gof(x)$ is equal to

a) $3x + 1$

b) $3x + 3$

c) $x + 3$

d) $x + 4$.

ix) If $\vec{\alpha} = 3\hat{i} + 4\hat{j} + \hat{k}$ and $\vec{\beta} = 2\hat{i} - \hat{j} + 4\hat{k}$, then $\vec{\alpha} \cdot \vec{\beta}$ is equal to

a) 6

b) 2

c) 5

d) 0

x) The order of the differential equation $\frac{d^2y}{dx^2} + y\frac{dy}{dx} + y^2 = 0$ is

a) 2

b) 1

c) 3

d) none of these.

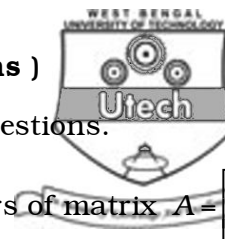
B. Write the answers very briefly :

xi) Define equivalence relation on a set S .

xii) Define group.

**GROUP – B****(Short Answer Type Questions)**Answer any *three* of the following questions.

3 × 5 = 15



2. Find the eigenvalues and the corresponding eigenvectors of matrix $A = \begin{bmatrix} -2 & 4 \\ 4 & 4 \end{bmatrix}$.
3. A relation ρ defined on the set Z by $a\rho b$ if and only if $a^2 + b^2$ is a multiple of 2. Examine if ρ is an equivalence relation.
4. Find the point where the straight line $\frac{x-2}{1} = \frac{y+3}{-1} = \frac{z-1}{-6}$ meets the plane $3x + y + z = 8$.
5. Find the equations of the straight line passing through the point $(-1, 1, -3)$ and perpendicular to the straight line $\frac{x-3}{-2} = \frac{y+1}{3} = \frac{z-2}{-4}$.
6. Find the rank of the matrix $\begin{pmatrix} 1 & 1 & 2 \\ 2 & 4 & 4 \\ 3 & 3 & 7 \end{pmatrix}$.
7. Show that the mapping $f : \mathbb{R} \rightarrow \mathbb{R}$ defined by $f(x) = 2x + 3$ $x \in \mathbb{R}$ is bijective.

GROUP – C**(Long Answer Type Questions)**Answer any *three* of the following questions.

3 × 15 = 45

8. a) If $f(x) = x$, when $x < 1$

$$= 2 - x, \text{ when } x \geq 1$$

show that $f'(1)$ does not exist.

5

- b) Show that Rolle's theorem is not applicable for the function $f(x) = |x|$ in $-1 \leq x \leq 1$.

5

- c) Using Gamma function, evaluate $\int_0^{\infty} e^{-x^2} dx$.

5



9. a) Show that the sequence $\{x_n\}$, where $x_n = \frac{n+1}{4n+1}$, $n \in \mathbb{N}$ is of convergent.
- b) Find the radius of convergence and interval of convergence the power series $\sum_{n=1}^{\infty} a_n x^n$, where a_n is given by $a_n = \frac{1}{\log(n+1)}$.
- c) Compute $f(x)$ in Fourier series in the interval $-2 < x < 2$ if

$$f(x) = 0, \text{ for } -2 < x < 1$$

$$= 1, \text{ for } 0 < x < 2$$

15

10. a) Prove that the set D of all odd integers forms a group with respect to the composition $*$ defined by $a * b = a + b - 1$ for all $a, b \in D$. 5

- b) Define the sub-group of a group G and give an example. State the necessary and sufficient condition for a non-empty subset S of a group G to be a sub-group of G . 5

- c) Define a cyclic group and find the generators of the cyclic group $G = \{1, -1, i, -i\}$ with respect to multiplication, where $i^2 = -1$. 5

11. a) Solve : $\frac{d^2 y}{dx^2} + a^2 y = \sec ax$. 5

- b) Solve : $\frac{d^2 y}{dx^2} - 7 \frac{dy}{dx} + 6y = (x-2)e^x$. 5

- c) Solve : $\frac{d^2 y}{dx^2} + 2 \frac{dy}{dx} + y = e^{-x} \log x$. 5

12. a) Test the convergence of the series $\frac{1}{2^3} - \frac{(1+2)}{3^3} + \frac{(1+2+3)}{4^3} - \frac{(1+2+3+4)}{5^3} + \dots$. 5

- b) Examine the nature of the series $\left(\frac{2^2}{1^2} - \frac{2}{1}\right)^{-1} + \left(\frac{3^3}{2^3} - \frac{3}{2}\right)^{-1} + \left(\frac{4^4}{3^4} - \frac{4}{3}\right)^{-3} + \dots$ 5

- c) Test the convergence of the series $\frac{1}{1.2.3} + \frac{3}{2.3.4} + \frac{5}{3.4.5} + \dots$ 5

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END