

**M. Sc. Bioinformatics Sem.-I (C.B.C.S.) (2013 Course) / Advanced
Diploma in Bioinformatics Sem.-I (C.B.C.S.) (2013 Course) :
SUMMER - 2019
SUBJECT : ESSENTIAL BIOMATHEMATICS**

Day : Monday
Date : 08/04/2019

Time : 10.00 AM TO 1:00 P.M.
Max. Marks : 60

S-2019-1463

N.B.:

- 1) **Q.No.1 and Q.No.5 are COMPULSORY.** Out of the remaining attempt **ANY TWO** questions from each section.
- 2) Answers to both the sections should be written in **SAME** answer books.
- 3) Use of non-programmable **CALCULATOR** is allowed.
- 4) Figures to the right indicate **FULL** marks.

SECTION – I

Q.1 Attempt the following: **[10]**

- a) Evaluate : $\lim_{x \rightarrow 0} \frac{\sin 3x}{5x}$.
- b) Find $\frac{dy}{dx}$ if $y = x^2 \log x$.
- c) Solve the D.E.: $x \frac{dy}{dx} = y$.
- d) Find equation of a straight line passing through (3, 1) and (4, -2).
- e) Find the polar co-ordinates of the point whose cartesian co-ordinates are (4, 3).

Q.2 Attempt the following: **[10]**

- a) Find the values of a and b if $f(x)$ is continuous in $[-2, 2]$, where
$$f(x) = \frac{\sin ax}{x} - 2, \quad \text{for } -2 \leq x < 0$$
$$= 2x + 1, \quad \text{for } 0 \leq x \leq 1$$
$$= 2b\sqrt{x^2 + 3} - 1, \quad \text{for } 1 < x \leq 2$$
- b) Show that the equation $2x^2 - xy - 3y^2 - 6x + 19y - 20 = 0$ represents a pair of lines. Also, find the acute angle between them.

Q.3 Attempt the following: **[10]**

- a) Find the particular solution of the D.E.
$$y(1 + \log x) \frac{dx}{dy} - x \log x = 0 \text{ at } y = e^2 \text{ and } x = e.$$
- b) Find the co-ordinates of the focus, equation of directrix, length of latus rectum, co-ordinates of end-points of latus rectum and focal distance for parabola $y^2 = 20x$.

Q.4 Attempt the following: **[10]**

- a) Convert cylindrical co-ordinates $\left(3, \frac{\pi}{3}, -4\right)$ to cartesian co-ordinates and spherical co-ordinates.
- b) If $\int_0^a \sqrt{x} dx = 2a \int_0^{\pi/2} \sin^3 x dx$, find the value of $\int_0^{a+1} x dx$.

P.T.O.

SECTION – II

Q.5 Attempt the following: **[10]**

- a) Find the Laplace transform of $f(t) = 6e^{-5t} + e^{3t} + 5t^3 - 9$.
- b) Find the 7th term for A.P. 3, 7, 11, 15,
- c) Find the magnitude of vector $\hat{i} + 8\hat{j} - 4\hat{k}$.
- d) Construct a matrix $A = [a_{ij}]_{3 \times 2}$ whose element a_{ij} is given by $a_{ij} = i - 2j$.
- e) By first principle, find derivative of $f(x) = 3x^2 + 4$.

Q.6 Attempt the following: **[10]**

- a) Find the Fourier series of the function $f(x) = x^2$.
- b) Find the sum of all natural numbers from 1 to 200 which are divisible by 3.

Q.7 Attempt the following: **[10]**

- a) Find the eigen values of the matrix.

$$\begin{bmatrix} 1 & -3 & 3 \\ 3 & -5 & 3 \\ 6 & -6 & 4 \end{bmatrix}$$

- b) If $\vec{a} = 2\hat{i} - 3\hat{j} + \hat{k}$ and $\vec{b} = \hat{i} + 2\hat{j} - 3\hat{k}$ are position vectors of points A and B respectively. Find \vec{AB} , $|\vec{AB}|$ and a vector of magnitude 7 along \vec{AB} .

Q.8 Attempt the following: **[10]**

- a) Explain with example application of partial differential equations in biology.
- b) Discuss enzyme kinetics equations in brief.

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