Total No. of Questions : 8]

SEAT No. : ____

P714

[Total No. of Pages : 3

[5117]-4
F.Y.B.Sc.
BIOTECHNOLOGY
Bb - 104 : Mathematics and Statistical Methods for Biologists

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***Use of non-programmable scientific calculator is allowed.***
4) ***Solve each section on separate answer paper.***

SECTION - I

(Mathematics)

Q1) Attempt each of the following: **[5 × 2 = 10]**

a) Write modulus and principal argument of $\frac{(1+i)^2}{2i}$.

b) If $z = \tan^{-1}xy$, then find $z_x + z_y$.

c) Find adjoint of the matrix

$$A=\begin{bmatrix} 1 & 0 & 5 \\ -1 & 2 & 3 \\ 4 & 1 & 2 \end{bmatrix}$$

d) Show that the sequence $a_n = 1+\frac{1}{1!}+.....+\frac{1}{n!}$ is monotonically increasing.

e) Examine the convergence of the series $\sum_{n=0}^{\infty}\left(\frac{3}{7}\right)^n$.

P.T.O.

Q2) Attempt any four of the following: **[4 × 2½ = 10]**

a) Find rank of the matrix

$$A = \begin{bmatrix} 1 & 3 & 5 & 4 \\ 4 & -7 & -3 & -1 \\ 3 & 2 & 7 & 8 \end{bmatrix}$$

b) Examine convergence of the series $\sum_{n=0}^{\infty} \frac{5^n}{n!}$.

c) Check whether the vectors (1, 2, 3), (0, –1, 2), (0, 3, 1) are linearly dependent.

d) Check for exactness and hence solve the following differential equation $(3x + 2y^2)dx = 2xy\,dy$.

e) Solve : $x^5 - 1 = 0$.

f) If $u = x \log(xy)$, find $\frac{\partial^3 u}{\partial x^2 \partial y}$.

Q3) Attempt any two of the following: **[2 × 5 = 10]**

a) Solve the following system of linear equations.

$x + y + z = 1$

$x + y - 2z = 3$

$2x + y + z = 2$

b) Find the stationary points and determine the nature of the given function $f(x, y) = x^2 + 3y + y^2$.

c) Discuss convergence of the sequence $\sqrt{3},\ \sqrt{3\sqrt{3}},\ \sqrt{3\sqrt{3\sqrt{3}}}$,.....

Q4) Attempt any one of the following: **[1 × 10 = 10]**

a) Find all eigenvalues and eigenvectors of A. Also find P (if it exists) that diagonalizes A.

$$\begin{bmatrix} 2 & 0 & -2 \\ 0 & 3 & 0 \\ 0 & 0 & 3 \end{bmatrix}$$

b) i) State and prove De Moivre's theorem for positive integers.

ii) Solve $\frac{dy}{dx} = \frac{y - x}{y + x}$.

SECTION - II

Q5) Attempt each of the following: **[5 × 2]**

a) State the classical definition of probability.

b) Define : median.

c) Explain the term Type II error.

d) State additive property of Poisson distribution.

e) Define kurtosis.

Q6) Attempt any four of the following: **[4 × 2.5]**

a) Four cards are drawn at random from a well shuffled pack of 52 cards. Find probability that all cards are of same suit.

b) What is multiple and partial correlation.

c) Write a short note on discrete probability distribution.

d) State merits of arithmetic mean.

e) Explain hypothesis with illustration.

f) Find range and median of the data given 55, 75, 80, 95, 120, 200, 250, 100, 67, 90.

Q7) Attempt any two : **[2 × 5]**

a) Define Gaussian distribution & state its additive property.

b) Compute standard deviation of the following frequency data.

Marks	10-20	20-30	30-40	40-50	50-60	60-70
No.of Students	6	5	4	6	3	1

c) Write a short note on random sampling.

Q8) Attempt any one of the following: **[1 × 10]**

a) Describe the test procedure for testing equality of means and variances of two populations.

b) What do you mean by analysis of variance (ANOVA) technique.