1125
M.Sc. (Bio-Informatics) First Semester
MBIN-8002: Mathematics

Time allowed: 3 Hours

Max. Marks: 60

**NOTE**: *Attempt* <u>*five*</u> *questions in all, including Question No. 1 which is compulsory and selecting atleast one question from each Unit.*

x-x-x

I.  Attempt the following:-

a)  For sets A, B and C does $A \cup C = B \cup C$ imply $A = B$? Support your answer.

b)  Evaluate:-

$$\left[ i^{18} + \left( \frac{1}{i} \right)^{25} \right]^3$$

c)  Evaluate:

$$\sum_{r=0}^{n} 3^r \, {}^nC_r$$

d)  Insert 3 geometric means between 1 and 256.

e)  For $A = \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$, find A. (adj.A)

f)  Prove that

$$\begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{pmatrix} \begin{pmatrix} 9 & 8 & 7 \\ 6 & 5 & 4 \\ 3 & 2 & 1 \end{pmatrix} \neq \begin{pmatrix} 9 & 8 & 7 \\ 6 & 5 & 4 \\ 3 & 2 & 1 \end{pmatrix} \begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{pmatrix}$$

g)  Evaluate $\int_{-1}^{1} x^{17} \cos^4 x \, dx$

h)  Eliminate parameter a in the equation

$$y^2 = 4ax$$

to write a differential equation.

(8x1½)

P.T.O.

## UNIT – I

II.   a) Let A = {1, 2, 3, 4 }, B = {1, 5, 9, 11, 15, 16 } and
f = {(1, 5), (2, 9), (3, 1), (4, 5), (2,11)}

Are the following true:-
i)      f is a relation from A to B
ii)     f is a function from A to B
iii)    Justify your answer in each case.

b) If Z and W are two complex numbers, prove that

$$|Z + w|^2 + |Z - W|^2 = 2 (|Z|^2 + |W|^2)$$

c) Convert $\frac{1+3i}{1-2i}$ into its polar form.

III.   a) Use Binomial theorem to compare $(1.01)^{1000000}$ with 10000.

b) In an AP, if $p^{th}$ term is $\frac{1}{q}$ and $q^{th}$ term is $\frac{1}{p}$,    prove that the sum of its first pq

terms is $\frac{1}{2}$ (pq + 1) where p $\neq$ q.

c) Find the sum

8 + 88 +888 + ............. Upto n terms.

## UNIT – II

IV.   a) Find limits

i) $\underset{\theta \to 0}{Lim} \frac{1-\cos\theta}{\theta^2}$

ii) $\underset{x \to 1}{Lim} \frac{e^x-e}{x-1}$

b) Find $\frac{dy}{dx}$   if   i) y = $\frac{Sin\ x + x^2}{e^x}$    ii) $x^y = y^x$

c)  Find two positive numbers x and y such that x + y = 16 and that $x^3 + y^3$ is
minimum possible.

V. a) Evaluate $\int \sec x\, dx$

b) Use definition to find $\int_0^2 e^x\, dx$

c) Solve $\dfrac{dy}{dx} + \dfrac{y}{x} = e^{-x}$

## UNIT- III

VI. a) Solve the system of equation

$$x + 2y + 3z = -2$$
$$2x + 3y + x = 1$$
$$3x + y + 2z = 1$$

b) If

$$A = \begin{pmatrix} 1 & 0 & 2 \\ 0 & 2 & 1 \\ 2 & 0 & 3 \end{pmatrix}$$

Show that $A^3 - 6A^2 + 7A + 2I = 0$ and hence express $A^4$ as a quadratic polynomial in A.

c) Prove that

$$\begin{vmatrix} -a^2 & ab & ac \\ ba & -b^2 & bc \\ ca & cb & -c^2 \end{vmatrix} = 4\, a^2 b^2 c^2$$

VII. a) If $\ell \wedge m = m$ and $m \wedge n = n$ then prove that $\ell \wedge n = n$

b) Write down the truth table for the statements pattern:-

$\ell \wedge m$ where $\ell \equiv \sim q \to \sim r$, $m \equiv \sim r \to \sim q$

c) If, p, q, r ..........are elements of Boolean algebra, simplify $p \cdot (p \cdot q + r)^1$

$x$-$x$-$x$