Exam.Code:0039
Sub. Code: 0992

2022

B.Sc. (Hons.) Bio-Informatics

First Semester

BIN-1005: 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 two questions from each Unit. All questions carry equal marks.*

x-x-x

1 (*a*) Give an example of a function which is one-one but not onto and a function which is onto but not one-one.

(*b*) Given 4 flags of different colours, how many different signals can be generated, if a signal requires the use of 2 flags one below the other?

(*c*) How many eight digit numbers can be formed if all the digits are different?

(*d*) How many terms will be there in the expansion of $[(x + a)^2 (x - a)^2]^7$?

(*e*) Why $\lim_{x \to k} [x]$, where k is an integer and $[x]$ = greatest integer $\leq x$, does not exist?

(*f*) Show that $\int \sec x \, dx = \log |\sec x + \tan x| + C$

UNIT-1

2 (*a*) There are 200 individuals with a skin disorder, 120 had been exposed to the chemical C_1, 50 to chemical C_2, and 30 to both the chemicals C_1 and C_2. Find the number of individuals exposed to (*i*) Chemical C_1 but not Chemical C_2 and (*ii*) Chemical C_1 or Chemical C_2.

(*b*) If P(X) denotes the power set of the set X then show that $P(A \cap B) = P(A) \cap P(B)$ for any two sets A and B. Also show by a suitable example that $P(A \cup B) \neq P(A) \cup P(B)$.

(*c*) For three sets A, B and C prove that $A - (B \cup C) = (A - B) \cap (A - C)$.

3 (*a*) A relation R is defined on the set of integers, $\mathbb{Z}$, as $(x, y) \in R \Leftrightarrow x^2 + y^2 = 25$. Write down all elements of R and R^{-1}.

(*b*) Let $f(x) = \frac{1}{1 - x^2}$ and $g(x) = \frac{x^2}{1 + x^2}$, find domain and range of $F(x) = f(x) + g(x)$.

(*c*) In how many ways can one select a cricket team of 11 from 17 players, in which only 5 persons can bowl, if each cricket team must include exactly 4 bowlers?

4 (*a*) How many words, with or without meaning, each of 3 vowels and 2 consonants can be formed from the letters of the word INVOLUTE ?

(*b*) Find the coefficients of x^{32} and x^{-17} in the expansion of $(x^4 - \frac{1}{x^3})^{15}$.

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(c) Show that the middle term in the expansion of $(1+x)^{2n}$ is $2nx^n \frac{1.3.5...(2n-1)}{n!}$, where n is a positive integer.

UNIT-II

5. (*a*) Show that $\lim_{x \to 0} \frac{\sqrt{1+x+x^2}-1}{x} = \frac{1}{2}$.

(*b*) For what value of λ is the function defined by $f(x) = \begin{cases} x \sin\frac{1}{x} & if\ x \neq 0 \\ \lambda & if\ x = 0 \end{cases}$ continuous?

(c) Differentiate $(\sin x)^{\cos x} + (\cos x)^{\sin x}$ with respect to x.

6. (*a*) A cone is 10 cm in diameter and 10 cm deep. Water is poured into it at the rate of 4 cc/min. At what rate is the water level rising at the instant when the depth is 6 cms?

(*b*) Find the rate of change of the area per second of a variable circle with respect to its radius r when $r = 5$ cm.

(c) The radius of an air bubble is increasing at the rate of $\frac{1}{2}$ cm/s. At what rate is the volume of the bubble increasing when the radius is 1 cm?

7 (*a*) Evaluate $\int \frac{\tan^4\sqrt{x} \cdot \sec^2\sqrt{x}}{\sqrt{x}}\, dx$

(b) Evaluate $\int \frac{1}{\sin^2 x \cdot \cos^2 x}\, dx$

(c) Compute the area enclosed between the curves $x^2 = 4ay$ and $y^2 = 4ax$.

x-x-x