**2026**

**COMPUTER APPLICATION**

Course Name : Mathematics - II

Course Code : BCA-DSC-3034

Full Marks : 60

Time : $2^{1}/_{2}$ Hours

*The figures in the margin indicate full marks for the questions.*

1. Answer the following questions : $1 \times 8 = 8$

a) Which of the following represents the derivative of $x^2$ ?

(i) $x$ (ii) $2x$ (iii) $x^3$ (iv) 2

b) Which theorem states that if a function is continuous on [a, b], differentiable on (a, b) and $f(a) = f(b)$, then there exists at least one point $c$ where $f'(c) = 0$ ?

(i) Taylor's Theorem (ii) Rolle's Theorem

(iii) Bayes' Theorem (iv) Mean Value Theorem

c) Which of the following is used to determine local maxima and minima of a differentiable function ?

(i) First derivative (ii) Frequency

(iii) Adjacency matrix (iv) Bisection method

d) In a graph, the points are called :

(i) Edges (ii) Vertices (iii) Paths (iv) Cycles

e) Which graph representation uses a two-dimensional array to represent connections between vertices ?

(i) Adjacency list (ii) Adjacency matrix

(iii) Linked list (iv) Stack

f) The difference between the exact value and an approximate value is related to :

(i) Graph (ii) Error

(iii) Probability (iv) Frequency

g) Which graphical representation is commonly used for a continuous frequency distribution ?
(i) Histogram (ii) Pie chart
(iii) Simple bar diagram (iv) Line graph

h) Which theorem is used to calculate conditional probabilities by relating prior and posterior probabilities ?
(i) Rolle's Theorem (ii) Taylor's Theorem
(iii) Bayes' Theorem (iv) Lagrange's Theorem

2. Answer the following questions (***any six***) : 2×6=12

a) Find the derivative $f(x) = x^3 + 2x^2 - 5x + 4$

b) Define continuity of a function. Give one condition for a function to be continuous at a point.

c) What is a simple graph ? Give one example.

d) Define indegree and outdegree of a vertex in a directed graph.

e) Find the maximum or minimum value of $f(x) = x^2 - 4x + 3$

f) Find the degree of each vertex in the following graph :
$v = \{A, B, C, D\}$, $E = \{AB, AC, BC, CD\}$

g) Write the adjacency matrix for the graph with vertices $A, B, C$ and edges $AB$, $BC$, $CA$

h) Using the Bisection Method, find the first approximation of the root of $f(x) = x^2 - 4$ in the interval [1,3]

3. Answer the following questions (***any four***) : 5×4=20

a) A function is given by $f(x) = x^3 - 3x^2 - 9x + 5$ . Find its critical points and determine whether they correspond to maxima or minima.

b) Use the Newton-Raphson method to obtain an approximation to the root $x^2 - 2 = 0$, taking $x_0 = 1.5$

c) What is a forest in graph theory ? Explain the relationship between a tree and a forest.

d) Construct a frequency distribution from a given set of observations and explain the meaning of frequency and cumulative frequency.





e) Explain histogram, frequency polygon, and frequency curve. Differentiate between them

f) Verify Rolle's Theorem for : $f(x) = x^2 - 6x + 8$ on the interval $[2, 4]$.

4. Answer the following questions (***any two***) : 10×2=20

a) Using Taylor's theorem, expand $\ln(1 + x)$ about $x = 0$, up to the term containing $x^4$, Hence obtain an approximate value of $\ln(1.1)$

b) Evaluate the following limit using an appropriate method :

$$\lim_{x \to 0} \frac{\sin x - x + \frac{x^3}{6}}{x^5}$$

c) Consider the following adjacency matrix :

$$A = \begin{bmatrix} 0 & 1 & 1 & 0 & 0 \\ 1 & 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 1 & 1 \\ 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 & 0 \end{bmatrix}$$

(i) Draw the corresponding graph.
(ii) Find the degree of every vertex.
(iii) Determine whether the graph contains a cycle.
(iv) Determine whether it is connected.
(v) Write the adjacency list representation.

d) A bag contains 5 red, 4 blue, and 3 green balls. Two balls are drawn successively without replacement.
Find :
(i) The probability that both balls are red.
(ii) The probability that the first ball is blue and the second is green.
(iii) The probability that at least one ball is red.
(iv) The probability that the two balls are of different colours.

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