

December 2023

B.Sc. (Chemistry) 1<sup>st</sup> SEMESTER  
Mathematics (BCHT-MD-105)

Time: 3 Hours

Max. Marks:75

- Instructions:**
1. It is compulsory to answer all the questions (1.5 marks each) of Part -A in short.
  2. Answer any four questions from Part -B in detail.
  3. Different sub-parts of a question are to be attempted adjacent to each other.

**PART -A**

- Q1 (a) What is the value of  $\int_0^5 e^x dx$  (1.5)
- (b) Discuss the continuity of the function  $f(x) = \begin{cases} 2x - 1 & ; x < 2 \\ \frac{3x}{2} & ; x \geq 2 \end{cases}$  (1.5)
- (c) Define limit of a function at a point. (1.5)
- (d) Write down the procedure of finding maxima and minima of a function by second derivative test. (1.5)
- (e)  $\int \frac{1}{\sqrt{a^2+x^2}} dx$  is equal to (1.5)
- (f) Show that the derivative of  $2x^3 - 9x^2 + 12x + 9$  at  $x=1$  and  $x=2$  are equal (1.5)
- (g) Find out the rate of change of area of a circle with respect to its radius (1.5)
- (h) What is the position vector of a point R which divide line segment PQ in the ratio  $m : n$  if the position vector of the P and Q are given. (1.5)
- (i) Check whether the vectors  $2\hat{i} - 2\hat{j} + \hat{k}$  and  $\hat{i} - \hat{j} - 4\hat{k}$  are perpendicular or not (1.5)
- (j) Find out the magnitude of the vector  $5\hat{i} - \hat{j} + 2\hat{k}$  (1.5)

**PART -B**

- Q2 (a) Find out the point of discontinuity of the function, if any, of the function  $f(x) = \begin{cases} x^3 - x^2 + 2x - 2, & \text{if } x \neq 1 \\ 4 & \text{if } x = 1 \end{cases}$  (8)
- (b) Find out the point of local maxima and local minima of the function  $f(x) = x^3 - 6x^2 + 9x + 15$  (7)

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Q3 (a) Differentiate  $e^{\tan 3x} + 3\cos^{-1}x$  (8)

(b) If  $y = \sin^{-1}x$  (7)

Find out the value of  $(1 - x^2) \frac{d^2y}{dx^2} - x \frac{dy}{dx}$

Q4 (a) Solve  $4x^3 - 24x^2 + 44x - 24 > 0$  (8)

(b) Differentiate  $\sin(\cos(x^2))$  with respect to  $x$  (7)

Q5 (a) Evaluate  $\int_0^2 x^2 dx$  as a limit of sum. (8)

(b) Solve  $\int \frac{x-1}{(x+1)(x-2)} dx$  (7)

Q6 (a) Evaluate  $\int (\sin^3 x \cos^3 x) dx$  (8)

(b) If  $\hat{i} + \hat{j} + \hat{k}$ ,  $2\hat{i} + 5\hat{j}$ ,  $3\hat{i} + 2\hat{j} - 3\hat{k}$  and  $\hat{i} - 6\hat{j} - \hat{k}$  are the position vectors of the point A, B, C and D respectively, then find out the angle between  $\overline{AB}$  and  $\overline{CD}$  (7)

Q7 (a) Find out the dot and cross product of (8)

$3\hat{i} - \hat{j} + 2\hat{k}$  and  $\hat{i} + 4\hat{j} + \hat{k}$

(b) If  $\vec{A} = 5\hat{i} - \hat{j} - 3\hat{k}$  and  $\vec{B} = \hat{i} + 3\hat{j} - 5\hat{k}$  then show that  $\vec{A} - \vec{B}$  and  $\vec{A} + \vec{B}$  are perpendicular. (7)

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