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Total Pages : 3

**322203**

May-2026

**B.Sc. (Chemistry) - IInd SEMESTER**

**Elementary Calculus**

**(OSU-120-V)**

Time : 3 Hours]

[Maximum 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**

1. (a) What is the condition for a function to be continuous at a point? (1.5)
- (b) Evaluate  $\lim_{x \rightarrow \infty} \frac{2x+3}{x+1}$ . (1.5)
- (c) Differentiate  $y = (x^2 + x)(x + 1)$  with respect to  $x$  using product rule. (1.5)

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- (d) Use chain rule to differentiate  $y = \cos(3x^2)$  with respect to  $x$ . (1.5)
- (e) Differentiate  $y = \tan^{-1}(2x)$  with respect to  $x$ . (1.5)
- (f) Find  $\frac{d^2y}{dx^2}$  for  $y = e^x + \sin x$ . (1.5)
- (g) Integrate  $\int xe^x dx$  by parts. (1.5)
- (h) Evaluate  $\int_0^{\pi} \cos x dx$ . (1.5)
- (i) Find the components of a vector with magnitude 5 making an angle of  $60^\circ$  with  $x$ -axis (in 2D). (1.5)
- (j) State the formula for the scalar dot product of two vectors. (1.5)

**PART - B**

2. (a) Find the derivative of  $y = \frac{x^2}{\sqrt{x^2+1}}$  using quotient and chain rule. Also find its second derivative. (8)
- (b) For the function  $f(x) = 2x^3 - 15x^2 + 36x + 10$  determine the intervals in which the function is increasing or decreasing. (7)
3. (a) Determine the maxima and minima values of the function  $f(x) = x^3 - 6x^2 + 9x$ . (8)
- (b) Evaluate  $\int_0^1 xe^{-x} dx$  by integration by parts. (7)

4. (a) Find  $\int \frac{1}{x^2+4x+3} dx$  using partial fractions. (8)
- (b) Evaluate  $\int_0^{\frac{\pi}{2}} x \cos x dx$  by integration by parts. (7)
5. (a) If  $\vec{a} = 2\hat{i} + 3\hat{j} + \hat{k}$  and  $\vec{b} = \hat{i} + \hat{j} + 2\hat{k}$ , then find  $\vec{a} \cdot \vec{b}$  and the angle between them. (8)
- (b) Find the position vector of the point dividing the line segment joining points with position vectors  $\vec{p} = \hat{i} + 2\hat{j}$  and  $\vec{q} = 3\hat{i} + 4\hat{j}$  in the ratio 1 : 3 internally. (7)
6. (a) Let  $\vec{a} = \hat{i} + \hat{j} + \hat{k}$ ,  $\vec{b} = 2\hat{i} - \hat{j} + 3\hat{k}$ ,  $\vec{c} = 3\hat{i} + 2\hat{j} - \hat{k}$ . Compute  $(\vec{a} \times \vec{b})$  and the scalar triple product  $[\vec{a} \vec{b} \vec{c}]$ . (8)
- (b) Find  $\frac{dy}{dx}$  if  $x^2y + y^3 = 8$ . (7)
7. (a) Differentiate  $y = x^x$  using logarithmic differentiation. Also, find the second derivative. (8)
- (b) For  $f(x) = \sin x + \cos x$ , find the critical points in the interval  $[0, 2\pi]$ . (7)