22CHU103N

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

BSc DEGREE EXAMINATION DECEMBER 2025
(First Semester)

Branch - **CHEMISTRY**

MATHEMATICS -I FOR CHEMISTRY

Time: Three Hours Maximum: 75 Marks

SECTION-A (10 Marks)

Answer **ALL** questions

ALL questions carry **EQUAL** marks (10 × 1 = 10)

Module No.	Question No.	Question	K Level	CO
1	1	Which term correctly identifies the locus of the centers of curvature of a given plane curve? A. Evolute B. Envelope C. Involute D. Normal	K1	CO1
	2	The rate of change of a function is called its: A. Integral B. Derivative C. Limit D. Tangent	K2	CO1
2	3	Bernoulli's formula is related to: A. Differential equations B. Reduction of powers in integration C. Numerical differentiation D. Curvature of curves	K1	CO2
	4	The value of $\int 0\, dx$ is: A. 0 B. 1 C. x D. Undefined	K2	CO2
3	5	The volume of a solid bounded by surfaces can be found using: A. Line integrals B. Double or triple integrals C. Green's theorem D. Divergence theorem	K1	CO3
	6	The order of integration in a double integral can be changed if: A. The limits are independent of each other B. The function is non-continuous C. The region is simple and well-defined D. Both A and C	K2	CO3
4	7	Gregory Newton's forward interpolation formula is used when: A. The interpolation point is near the end of the table B. The interpolation point is near the beginning of the table C. The data is random D. The intervals are unequal	K1	CO4
	8	Interpolation is used to find: A. Unknown values between known data points B. Values beyond given data C. Integration limits D. Roots of equations	K2	CO4
5	9	Simpson's one-third rule is more accurate because it approximates the curve by: A. Straight-line segments B. Parabolic arcs C. Tangent lines D. Piecewise constants	K1	CO5
	10	Numerical differentiation gives: A. Approximate derivatives B. Exact integration C. Mean values D. Function constan	K2	CO5

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SECTION - B (35 Marks)

Answer ALL questions

ALL questions carry EQUAL Marks (5 × 7 = 35)

Module No.	Question No.	Question	K Level	CO
1	11.a.	Show that the radius of curvature at any point of the cycloid $x = a(\theta + sin\theta)$ and $y = a(1 - cos\theta)$ is $4acos\frac{\theta}{2}$.	K2	CO1
		(OR)		
	11.b.	Show that evolute of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ at any point on the ellipse is $(acos\theta, bsin\theta)$.		
2	12.a.	Explain how the property of definite integrals can be used to evaluate: $I = \int_0^{\pi/2} log\ sinx\ dx$.	K3	CO2
		(OR)		
	12.b.	Solve: i) $\int tan^4 x dx = \frac{tan^3 x}{3} - \int tan^3 x dx\ dy$ by putting $n = 4$ in the formula for I_n. ii) $I\int (logx)^3 x^4 dx$.		
3	13.a.	Apply the concept of centroid determination to find the coordinates of the center of mass of a plane lamina of non-uniform density in the form of a quadrant of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ where the density at any point (x, y) is given by $\rho = kxy$, with k being a constant.	K3	CO3
		(OR)		
	13.b.	Determine the expression for the surface area of a sphere in terms of its radius r.		
4	14.a.	Determine the missing y-values at $x = 21$and $x = 28$ by using Newton's Forward Interpolation method from the given data.	K3	CO4

X	20	23	26	29
Y	0.3420	0.3907	0.4384	0.4848

		(OR)		
	14.b.	Use the Trapezoidal Rule with a step size of $h = 0.2$ to evaluate the integral $\int_0^1 \frac{dx}{1+x^2}$ using the obtained approximate value of the integral, determine an approximate value of π.		
5	15.a.	Develop the Taylor series expansion of y (0.1) to four decimal places, given $\frac{dy}{dx} = x^2 + y^2$ and $y\ (0) = 1$.	K4	CO5
		(OR)		
	15.b.	Solve $y' = y - x^2$, $y(0) = 1$, by Picard's method upto the third approximation. Hence, find the value of $y(0.1), y(0.2)$.		

SECTION -C (30 Marks)

Answer **ANY THREE** questions

ALL questions carry **EQUAL** Marks (3 × 10 = 30)

<table>
<tr><th>Module No.</th><th>Question No.</th><th>Question</th><th>K Level</th><th>CO</th></tr>
<tr><td>1</td><td>16</td><td>i) From the polar equation of the parabola, show that $p^2 = ar$
ii) Find the radius of curvature of the cardioid $r = a(1 - cos\theta)$</td><td>K2</td><td>CO1</td></tr>
<tr><td>2</td><td>17</td><td>If $u_n = \int_0^a x^n e^{-x} dx$, prove that
$u_n - (n + a)u_{n-1} + a(n - 1)u_{n-2} = 0$</td><td>K3</td><td>CO2</td></tr>
<tr><td>3</td><td>18</td><td>Find the volume and position of the center of gravity of the tetrahedron bounded by the plane $\frac{x}{a} + \frac{y}{b} + \frac{z}{c} = 1$ and the coordinate planes.</td><td>K3</td><td>CO3</td></tr>
<tr><td>4</td><td>19</td><td>From the data given below, fid the number of students whose weight is between 60 and 70.
<table>
<tr><td>Weight</td><td>0-40</td><td>40-60</td><td>60-80</td><td>80-100</td><td>100-120</td></tr>
<tr><td>Students</td><td>250</td><td>120</td><td>100</td><td>70</td><td>50</td></tr>
</table></td><td>K3</td><td>CO4</td></tr>
<tr><td>5</td><td>20</td><td>Obtain the values of y at x=0.1,0.2 using R.K method of i) second order ii) third order and iii) fourth order for the differential equation $y' = -y$ given $y(0) = 1$.</td><td>K4</td><td>CO5</td></tr>
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Z-Z-Z END