

**PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)**

**BSc DEGREE EXAMINATION DECEMBER 2024
(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 of the following is (p, r) equation? a) $\frac{1}{p^2} = \frac{1}{r^2} + \frac{1}{r^4} \left(\frac{dr}{d\theta} \right)^2$ b) $\frac{1}{p^2} = \frac{1}{r^2} + \frac{1}{r^4}$ c) $\frac{1}{p^2} = \frac{1}{r^4} \left(\frac{dr}{d\theta} \right)^2$ d) $\frac{1}{p^2} = \frac{1}{r^2} + \left(\frac{dr}{d\theta} \right)^2$	K1	CO1
	2	If the evolute itself be regarded as the original curve, a curve of which is the evolute is called _____ a) centre b) cardioid c) radius of curvature d) involute	K2	CO1
2	3	If $f(x)$ is an odd function of x , then $\int_{-a}^a f(x) dx =$ _____ a) a b) 0 c) 1 d) -1	K1	CO2
	4	$\int x e^x dx =$ _____ a) $e^x(x-1)$ b) $e^x(x+1)$ c) $(x-1)$ d) $e^x(x^2-1)$	K2	CO2
3	5	$\int_0^3 \int_1^2 xy(x+y) dy dx =$ _____ a) 1 b) 26 c) 24 d) 12	K1	CO3
	6	$\int_0^1 \int_0^2 \int_0^3 dz dy dx =$ _____ a) 2 b) 4 c) 3 d) 6	K2	CO3
4	7	_____ is used to denote the process of finding the values outside the interval (x_0, x_n) . a) interpolation b) derivation c) extrapolation d) integration	K1	CO4
	8	$\int_{x_0}^{x_n} f(x) dx = \frac{h}{3}$ [sum of the first and last ordinates + 2(sum of remaining odd ordinates) + 4(sum of even ordinates). This is _____ rule. a) Trapezoidal b) Newton's c) Simpson's three-eighths d) Simpson's one-third	K2	CO4
5	9	In an infinite series of solution of a differential equation, if we retain the terms up to and including h^n and neglect terms involving h^{n+1} and higher powers of h , the Taylor algorithm used is said to be of _____ order. a) $n+1^{th}$ b) 3^{rd} c) n^{th} d) 2^{nd}	K1	CO5
	10	$y = y_0 + \int_{x_0}^x f(x) dx$. This equation is called a/an _____ equation. a) polynomial b) integral c) Trapezoidal d) Simpson	K2	CO5

cont...

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.	Prove that the radius of curvature at any point of the cycloid $x = a(\theta + \sin \theta)$ and $y = a(1 - \cos \theta)$ is $4a \cos \frac{\theta}{2}$.	K2	CO1															
	(OR)																		
	11.b.	Find the coordinates of the centre of curvature of the curve $xy = 2$ at the point (2,1).																	
2	12.a.	Find a reduction formula for $I_n = \int \sin^n x \, dx$ (n being positive integer).	K3	CO2															
	(OR)																		
	12.b.	Evaluate $\int x^3 \cos 2x \, dx$.																	
3	13.a.	Evaluate $\iint (x^2 + y^2) dx dy$ over the region for which x, y are each ≥ 0 and $x + y \leq 1$.	K3	CO3															
	(OR)																		
	13.b.	Find the volume of a segment of height h of a sphere of radius a .																	
4	14.a.	Find the first two derivatives of $(x)^{1/3}$ at $x = 50$ from the given table:	K3	CO4															
		<table><tr><td>x</td><td>50</td><td>51</td><td>52</td><td>53</td><td>54</td><td>55</td><td>56</td></tr><tr><td>$y = (x)^{1/3}$</td><td>3.6840</td><td>3.7084</td><td>3.7325</td><td>3.7563</td><td>3.7798</td><td>3.8030</td><td>3.8259</td></tr></table>			x	50	51	52	53	54	55	56	$y = (x)^{1/3}$	3.6840	3.7084	3.7325	3.7563	3.7798	3.8030
	x	50			51	52	53	54	55	56									
	$y = (x)^{1/3}$	3.6840			3.7084	3.7325	3.7563	3.7798	3.8030	3.8259									
(OR)																			
14.b.	Evaluate $\int_0^1 \frac{dx}{1+x^2}$ using Trapezoidal rule with $h = 0.2$.																		
5	15.a.	Using Taylor series method, find $y(1.1)$, given $\frac{dy}{dx} = x + y$ and $y(1) = 0$	K3	CO5															
	(OR)																		
	15.b.	Given $y' = -y$ and $y(0) = 1$, determine the values of y at $x = 0.01, 0.02$ by Euler method.																	

SECTION - C (30 Marks)

Answer ANY THREE questions

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

Module No.	Question No.	Question	K Level	CO										
1	16	Show that in the parabola $y^2 = 4ax$ at the point t , $\rho = -2a(1+t^2)^{3/2}$, $X = 2a + 3at^2$, $Y = -2at^3$. Deduce the equation of the evolute.	K2	CO1										
2	17	Evaluate $\int_0^{\pi/2} \log \sin x \, dx$.	K3	CO2										
3	18	Evaluate $\iiint xyz \, dx \, dy \, dz$ taken through the positive octant of the sphere $x^2 + y^2 + z^2 = a^2$.	K3	CO3										
4	19	Find the values of y at $x = 21$ and $x = 28$ from the following data: <table border="1"> <tr> <td>x</td><td>20</td><td>23</td><td>26</td><td>29</td></tr> <tr> <td>y</td><td>0.3420</td><td>0.3907</td><td>0.4384</td><td>0.4848</td></tr> </table>	x	20	23	26	29	y	0.3420	0.3907	0.4384	0.4848	K3	CO4
x	20	23	26	29										
y	0.3420	0.3907	0.4384	0.4848										
5	20	Apply the fourth order Runge-Kutta method to find $y(0.2)$ given that $y' = x + y$, $y(0) = 1$.	K4	CO5										

Z-Z-Z END