

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

BSc DEGREE EXAMINATION DECEMBER 2022
(First Semester)

Branch – CHEMISTRY

MATHEMATICS - I

Time: Three Hours

Maximum: 50 Marks

SECTION-A (5 Marks)

Answer ALL questions

ALL questions carry EQUAL marks

(5 x 1 = 5)

1. The radius of the curvature of a cardioid is

(i) $\rho = \frac{2}{3}\sqrt{ar}$

(ii) $\rho = \frac{1}{3}\sqrt{ar}$

(iii) $\rho = \frac{4}{3}\sqrt{ar}$

(iv) $\rho = \frac{8}{3}\sqrt{ar}$

2. $\int xe^x dx =$ _____

(i) $e^x(x+1)$

(ii) $e^x(x^2+1)$

(iii) $e^x(x-1)$

(iv) $e^x(x^2-1)$

3. A definite integral is defined as the limit of the _____ of the series.

(i) product

(ii) sum

(iii) difference

(iv) finite number

4. If the values of x are unequal intervals, we use _____ formula

(i) Newton's central difference

(ii) Newton's forward Interpolation

(iii) Newton's backward Interpolation

(iv) Newton's divided Interpolation

5. A numerical solution of a ordinary differential equations are _____ solutions.

(i) exact

(ii) pointwise

(iii) infeasible

(iv) approximate

SECTION - B (15 Marks)

Answer ALL Questions

ALL Questions Carry EQUAL Marks (5 x 3 = 15)

6. a) What is the radius of curvature of the curve $x^4 + y^4 = 2$ at the point (1,1)?

(OR)

b) Find the radius of curvature of the cardioid $r = a(1 - \cos\theta)$.

7. a) Integrate $\int e^x(\sin x + \cos x)dx$.

(OR)

b) Evaluate $\int e^{-x} \sin^2 x dx$.

8. a) Evaluate $\iint xy dx dy$ taken over the positive quadrant of the circle $x^2 + y^2 = a^2$.

(OR)

b) Find the centroid of the area enclosed by the parabola $y^2 = 4ax$, the axis of x and the latus rectum of the parabola.

9. a) Using the method of proportional parts, find y at $x=0.5$, $x=0.75$, given the following table

x	0	1	2	5
y	2	3	12	147

(OR)

b) Evaluate $\int_{-3}^3 x^4 dx$ by using Simpson's one-third rule.

Cont...

10.a) Using Taylor's method compute $y(0.2)$ correct to four decimal places given

$$\frac{dy}{dx} = 1 - 2xy \text{ and } y(0) = 0.$$

(OR)

b) Solve $\frac{dy}{dx} = x^2 + y^2$, $y(0) = 1$ by Picard's method.

SECTION -C (30 Marks)

Answer ALL questions

ALL questions carry EQUAL Marks

(5 x 6 = 30)

11.a) Prove that the radius of curvature at any point of the cycloid $x = a(\theta + \sin \theta)$ and

$$y = a(1 - \cos \theta) \text{ is } 4a \cos \frac{\theta}{2}.$$

(OR)

b) Show that the radius of curvature of the curve $r^n = a^n \cos n\theta$ is $\frac{a^n r^{-n+1}}{n+1}$.

12.a) Prove that $\int_0^{\frac{\pi}{4}} \log(1 + \tan \theta) d\theta = \frac{\pi}{8} \log 2$.

(OR)

b) Evaluate $\int x^4 (\log x)^3 dx$.

13.a) Evaluate $\iint (x^2 + y^2) dx dy$ over the region for which x, y are each ≥ 0 and $x + y \leq 1$.

(OR)

b) Find the volume bounded by the cylinder $x^2 + y^2 = a^2$ the planes $y + z = 4$ and $z = 0$.

14. a) From the following table of half yearly premium for policies maturing at different ages, Estimate the premium for policy maturing at age 63.

Age x	45	50	55	60	65
Premium y	114.84	96.16	83.32	74.48	68.48

(OR)

b) Evaluate $\int_0^1 \frac{dx}{1+x^2}$ using Trapezoidal rule with $h=0.2$. Hence obtain an approximate value of π . Can you use other formulae in this case.

15.a) Solve $\frac{dy}{dx} = x + y$, given $y(1)=0$, and get $y(1.1)$, $y(1.2)$ by Taylor series method.

Compare the result with the explicit solution.

(OR)

b) Obtain the values of y at $x=0.1$ using R.K.Method of second and fourth order.

Z-Z-Z

END

Z-Z-Z

END