22MBU416N

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

BSc DEGREE EXAMINATION MAY 2025
(Fourth Semester)

Branch - **MICROBIOLOGY**

MATHEMATICS FOR LIFE SCIENCES

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	Find the solution of differential equation $y' = 0$ a) circle b) straight line c) constant d) hyperbola	K2	CO1
	2	The degree of the differential equation $(y')^2 - 5y = 0$ is a) 1 b) 2 c) 3 d) 4	K2	CO1
2	3	Identify the solution of Brachistochrone problem? a) Straight line b) Cycloid c) parabola d) hyperbola	K3	CO2
	4	Identify the shortest distance between two points? a) circle b) parabola c) straight line d) hyperbola	K3	CO2
3	5	What is the first backward difference of y(n)? a) [y(n)+y(n-1)]/T b) [y(n)+y(n+1)]/T c) [y(n)-y(n+1)]/T d) [y(n)-y(n-1)]/T	K2	CO3
	6	What is the minimum number of subintervals required for Simpson's $3/8^{th}$ rule? a) 2 b) 4 c) 3 d) 5	K2	CO3
4	7	Which of the following method is used to solve ordinary differential equations? a) Runge-Kutta Method b)Gauss Elimination method c) Lagrange's interpolation d) Numerical Integration	K2	CO4
	8	The formula used for consistency of Rung-kutta method is _____. a) a+b=0 b) a-b=0 c) a+b=1 d) a+b=1/2	K2	CO4
5	9	When the velocity of enzyme activity is plotted against substrate concentration, which of the following is obtained? a) Hyperbolic curve b) Parabola c) Straight line with positive slope d) Straight line with negative slope	K4	CO5
	10	The molecule which acts directly on an enzyme to lower its catalytic rate is _____. a) Repressor b) Inhibitor c) Modulator d) Regulator	K4	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.	Solve the Bernoulli differential equation: $y' + y = xy^2$	K2	CO1
		(OR)		
	11.b.	Solve the exact differential equation $x^2ydx - (x^3+y^3)dy = 0$.		
2	12.a.	Prove that a straight line is the shortest connection between two points.	K3	CO2
		(OR)		
	12.b.	Find the solution of simple harmonic motion.		
3	13.a.	From the following table find $f'(30)$.	K2	CO3
		(OR)		
	13.b.	Evaluate $\int_0^1 \frac{1}{1+x^2} dx$ by using Simpson's rule and Find π.		
4	14.a.	Apply the fourth order Runge - Kutta method for $y' = x + y$ with initial condition $y(0) = 1$ and find the value of y when $x = 0.2$	K2	CO4
		(OR)		
	14.b.	Find $y(0.2)$ for $y' = \frac{x-y}{2}, y(0) = 1$, with step length 0.1 using Improved Euler method.		
5	15.a.	Explain the steady state approach with an example.	K4	CO5
		(OR)		
	15.b.	Given reaction $E + S \Leftrightarrow ES \rightarrow E + P$, where $k_1 = 10^7\, M^{-1} sec^{-1}$, and $k_{-1} = 10^2\, sec^{-1}$ and $k_p = 2 * 10^{-2}\, sec^{-1}$,. Calculate k_s and k_m.		

x	30	31	32	33	34	35	36
$f(x)$	85.90	86.85	87.73	88.63	89.52	90.37	91.1

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	Solve the Bernoulli differential equation: $y' + 2xy = x^3y^3$.	K2	CO1
2	17	Explain Brachistochrone problem.	K3	CO2
3	18	Given that x: 1.0, 1.1, 1.2, 1.3, 1.4, 1.5, 1.6 Y: 7.989, 8.403, 8.781, 9.129, 9.451, 9.750, 10.031 Find the value of $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at x = 1.1.	K2	CO3
4	19	Solve the equation $\frac{dy}{dx} = 1 - y$ with initial condition $y(0) = 0$ using Eulers algorithm and tabulate solutions at $x =$ 0.1,0.2,0.3,0.4. Also compare with the exact solution.	K2	CO4
5	20	Explain the methods of plotting Enzyme kinetic data.	K4	CO5

Z-Z-Z END