PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

BSc DEGREE EXAMINATION DECEMBER 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	What is the form of first order linear differential equation ? a) $\frac{dy}{dx} + Py = 0$ b) $\frac{dy}{dx} + Py = Q$ c) $\frac{dx}{dy} + Qy = P$ d) $\frac{dx}{dy} + Qy = 0$	K1	CO1
	2	What is the necessary condition for the differential equation Mdx+ Ndy =0 to be exact? a) $\frac{\partial M}{\partial y} + \frac{\partial N}{\partial x} = 0$ b) $\frac{\partial M}{\partial y} + x\frac{\partial N}{\partial x} = 0$ c) $\frac{\partial M}{\partial y} = \frac{\partial N}{\partial x}$ d) $\frac{\partial M}{\partial y} \neq \frac{\partial N}{\partial x}$	K1	CO1
2	3	A population growth follows the differential equations dP/dt = kP, where P is the population size at time t and k is a constant. If the initial population is P_0, what is the population size at time t? *a) $P(t) = P_0e^{kt}$ b) $P(t) = P_0 + kt$* *c) $P(t) = P_0e^{-kt}$ d) $P(t) = P_0kt$*	K1	CO2
	4	Name a tautochrone curve, where the time of descent is independent of the starting point? a) Parabola b) Circle c) cycloid d) Hyperbola	K1	CO2
3	5	How is the backward difference operator defned? *a). $\nabla f(x) = f(x+h)-f(x)$ b) $\nabla f(x) = f(x)-f(x-h)$* *c) $\nabla f(x) = f(x*h)$ d) $\nabla f(x) = f(x+h)$*	K1	CO3
	6	What is the order of error in the Simpson's rule? a) $O(h^2)$ b) $O(h^3)$ c) $O(h^4)$ d) O(h)	K1	CO3
4	7	Which method given below provides the result much nearer to the solution curve of exact result. a) Modified Euler's method b) Euler's method c) Improved Euler's method d) all the above	K1	CO4
	8	Choose the Euler's algorithm from the below a) $y_{m+1} = y_m + hf(x_m, y_m)$ b) $y_{m+1} = y_0 + hf(x_m, y_m)$ c) $y_{m+1} = y_m + hf(x_0, y_0)$ d) $y_{m+1} = y_1 + hf(x_m, y_m)$	K1	CO4
5	9	Enzyme Kinetics is the branch of what field? a) Enzymology b) Polynomial c) Mechanism d) Mathematica	K1	CO5
	10	Choose the First order kinetics equation from the below. a) $\frac{V_{min}[S]}{K_m+[S]}$ b) $\frac{V_{max}[S]}{K_m+[S]}$ c) $\frac{V_{min}[S]}{K_m-[S]}$ d) $\frac{V_{max}[S]}{K_m+[S]}$	K1	CO5

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: $\frac{dy}{dx} + \left[\frac{1-y^2}{1-x^2}\right]^{1/2}$	K2	CO1
		(OR)		
	11.b.	Solve $(2x+y-3)\frac{dy}{dx} - (x+2y-3)=0$		

Cont...

2	12.a.	If,in aculture of yeast,the active ferment doubles itself in three hours,by what ratio will it increase in 15 hours, on the assumption that the quantity increases at a rate proportional to itself?	K2	CO2
		(OR)		
	12.b.	A tank contains 100 litres of fresh water. 2 liters per minute of brine , run in, each containing 1 gram of salt and the mixture runs out at 1 litre per minute. Find the amount of salt present when the tank contains 150 litres of water.		
3	13.a.	Find the first two derivatives of $x^{\frac{1}{3}}$ at x=50 given the table below	K2	CO3

x	50	51	52	53	54	55	56
$Y=x^{\frac{1}{3}}$	3.6840	3.7084	3.7325	3.7563	3.7798	3.8030	3.8259

		(OR)		
	13.b.	Evaluate $\int_0^1 \frac{dx}{1+x^2}$ by Trapezoidal rule with h =0.2		
4	14.a.	Using Euler's method, solve the equation $\frac{dy}{dx} = x + y$, y(0)=1, for x=0.2,0.4,0.6	K2	CO4
		(OR)		
	14.b.	Obtain the values of y at x=0.1,0.2 using R.K method of second order and third order for $\frac{dy}{dx} = -y$ given y(0)=1.		
5	15.a.	Estimate k, the first order rate constant, for an enzyme preparation with a V_{max} of 4.6μ Moles x $liter^{-1}$ x min^{-1} under given experimental conditions K_m =2 x 10^{-6}M	K3	CO5
		(OR)		
	15.b.	Anenzymewasassayedat aninitialsubstrateconcentrationof2x10^{-5}M. In6min, halfofthe substrate has been used. The $K_m$for the substrate is 5 x 10^{-3} M. Calculate (a)k(b) Vmax		

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 $(1+xy^2)dx + (1+x^2y)dy=0$	K2	CO1
2	17	Derive the differential equation of Brachistochrone problem and solve it.	K3	CO2
3	18	The population of a certain town is shown in the following table:	K2	CO3

Year	1931	1941	1951	1961	1971
Population (thousands)	40.62	60.80	79.95	103.56	132.65

Find the rate of growth of the population in 1941 & 1961 by using suitable formula.

4	19	Using Runge Kutta method of fourth order , solve $\frac{dy}{dx} = x + y$ given y(0)=1 at x=0.2	K2	CO4
5	20	Examine the methods of plotting enzyme kinetics data.	K4	CO5

Z-Z-Z END