

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)
MSc(SS) DEGREE EXAMINATION DECEMBER 2025
(First Semester)

Branch – SOFTWARE SYSTEMS (five years Integrated)

CALCULUS AND ITS APPLICATIONS

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	A function of the form $f(x) = mx + b$ for constants m, b is called____ a) identity function b) constant function c) linear function d) power function	K1	CO1
	2	If $f(x) = \sqrt{x}$ and $g(x) = x + 1$, then $(f \circ g)(x)$ a) x b) $\sqrt{x+1}$ c) $\sqrt{x}$ d) $x+1$	K2	CO1
2	3	The Geometric Series with $a = \frac{1}{9}$ and $r = \frac{1}{3}$ is ____ a) $\frac{1}{6}$ b) $\frac{2}{6}$ c) $\frac{-1}{9}$ d) $\frac{1}{22}$	K2	CO2
	4	Find the $\sum_{n=1}^{\infty} \frac{-n}{2n+5} =$ ____ a) ∞ b) diverges c) 1 d) -0.5	K2	CO2
3	5	The value of $\frac{\partial f}{\partial x}$ at the points (4,-5) if $f(x,y) = x^2 + 3xy + y - 1$ a) 7 b) 13 c) -7 d) -13	K2	CO3
	6	The domain of the function $f(x,y) = \sqrt{y-x^2}$ a) $y = -x^2$ b) $y = x^2$ c) $x = -y$ d) $x = y^2$	K2	CO3
4	7	If the differential equation $Mdx + Ndy = 0$, then the exactness is a) $\frac{\partial M}{\partial y} = \frac{\partial N}{\partial x}$ b) $\frac{\partial M}{\partial x} = \frac{\partial N}{\partial y}$ c) $\frac{\partial M}{\partial y} = -\frac{\partial N}{\partial x}$ d) none of these	K1	CO4
	8	The solution of the differential equation $\frac{dy}{dx} = y - 20$, $y(0) = 40$ is ____ a) $y = 20(e^x + 1)$ b) $y = 10(e^x + 1)$ c) $y = 20(e^{-2x} + 1)$ d) $y = 20(e^{-x} + 1)$	K2	CO4
5	9	If the function $f(x)$ is even, then which of the following is zero? a) a_n b) b_n c) a_0 d) nothing is zero	K1	CO5
	10	Identify RLC Circuit governed ODE equations a) $LI'' + RI' + \frac{1}{C}I = E'(t)$ b) $LI'' + I' - \frac{1}{C}I = E'(t)$ c) $LI'' + RI' + CI = E'(t)$ d) $LI'' + RI' - \frac{1}{C}I = E(t)$	K2	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.	Find $f \circ g, g \circ f, f \circ f$ & $g \circ g$ and its domain if $f(x) = \sqrt{x}$ and $g(x) = x + 1$.	K3	CO1
		(OR)		
	11.b.	i) Show that $\lim_{x \rightarrow 1} (5x - 3) = 2$ ii) Find the horizontal asymptotes of the graph of $f(x) = \frac{x^3 - 2}{ x ^3 + 1}$		

Cont...

2	12.a.	Find the sum of the telescoping series $\sum_{n=1}^{\infty} \frac{1}{n(n+1)}$	K3	CO2
	(OR)			
	12.b.	State and Prove Montonic Sequence Theorem		
3	13.a.	Find the derivatives of $f(x, y, z) = x^3 - xy^2 - z$ at $P_0(1,1,0)$ in the direction of $v = 2i - 3j + 6k$.	K3	CO3
	(OR)			
	13.b.	Analyze $\lim_{(x,y) \rightarrow (0,0)} \frac{4x^2y^2}{x^2+y^2}$ if it exists		
4	14.a.	Solve the initial value problem by using integrating factor $\cos(x + y) dx + (3y^2 + 2y + \cos(x + y))dy = 0$.	K3	CO4
	(OR)			
	14.b.	Solve the logistic equation, $y' = Ay - By^2$.		
5	15.a.	Find the Fourier series of the function $f(x) = \begin{cases} -k & \text{if } -\pi < x < 0 \\ k & \text{if } 0 < x < \pi \end{cases}$	K3	CO5
	(OR)			
	15.b.	Find the Fourier series of the function $f(x) = x + \pi$ if $-\pi < x < \pi$		

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	i) Evaluate $\lim_{x \rightarrow 0} \frac{\sqrt{x^2+100}-10}{x^2}$ ii) Evaluate that $\lim_{x \rightarrow c} f(x) = L$ & $\lim_{x \rightarrow c} g(x) = M$, prove that $\lim_{x \rightarrow c} (f(x) + g(x)) = L + M$	K3	CO1
2	17	i) Does $\sum_{n=1}^{\infty} \frac{\ln n}{n^{\frac{3}{2}}}$ converges? ii) Test the series convergence or divergence $\sum_{n=1}^{\infty} \frac{4^n n! n!}{(2n)!}$	K3	CO2
3	18	Find the absolute maximum and minimum values of $f(x, y) = 2 + 2x + 2y - x^2 - y^2$ on the triangular region in the first quadrant bounded by the lines $x = 0$, $y = 0$, $y = 9 - x$.	K3	CO3
4	19	Discuss the existence of $y' = 1 + y^2$, $y(0) = 0$, and also discuss the uniqueness of $y' = \sqrt{ y }$, $y(0) = 0$.	K3	CO4
5	20	Determine the two half range expansion of the function $f(x) = \begin{cases} \frac{2k}{L}x & \text{if } 0 < x < \frac{L}{2} \\ \frac{2k}{L}(L-x) & \text{if } \frac{L}{2} < x < L \end{cases}$	K3	CO5