

**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	What is the range of the function $y = \sqrt{4-x}$ with domain $(-\infty, 4]$? a) $[0, \infty)$ b) $(-\infty, \infty)$ c) $(-4, \infty)$ d) $(4, \infty)$	K1	CO1
	2	If $2 - x^2 \leq g(x) \leq 2 \cos x$ for all x , then compute $\lim_{x \rightarrow 0} g(x)$ a) 2 b) -2 c) 0 d) ∞	K2	CO1
2	3	The harmonic series _____ a) converges b) diverges c) neither converges nor diverges d) both converges and diverges	K1	CO2
	4	The series $\sum_{n=0}^{\infty} \frac{(-1)^{n5}}{4^n}$ converges to _____ a) 4 b) 5 c) -1 d) 0	K2	CO2
3	5	If $f(x, y, z) = 1 - 2xy^2z + x^2y$ then what is f_{yxyz} ? a) 1 b) -4 c) 2 d) -2	K1	CO3
	6	If $w = x^2 + y^2, x = r - s, y = r + s$ then compute $\frac{\partial w}{\partial r}$ a) $4s$ b) $4r$ c) $4x$ d) $4y$	K2	CO3
4	7	The ODE $y' + p(x)y = r(x)$ is said to be in _____ form a) linear b) quadratic c) trilinear d) biquadratic	K1	CO4
	8	Give the general solution of $-ydx + xdy = 0$ a) $\frac{y}{x} = c$ b) $x + y = c$ c) $xy = c$ d) $x - y = c$	K2	CO4
5	9	Write the fundamental period of $\tan x$ a) π b) 2π c) $\pi/2$ d) $\pi/3$	K1	CO5
	10	Estimate $\int_{-\pi}^{\pi} \sin 4x \cos 3x \, dx$ a) 4 b) 3 c) 0 d) 7	K2	CO5

SECTION - B (35 Marks)

Answer ALL questions

ALL questions carry EQUAL Marks (5 × 7 = 35)

ALL questions carry EQUAL Marks

Module No.	Question No.	Question	K Level	CO																					
1	11.a.	Explain Sandwich theorem and hence find $\lim_{\theta \rightarrow 0} \sin \theta$	K2	CO1																					
	(OR)																								
	11.b.	Compute the following values and fill the table <table><tr><td>θ</td><td>$-\pi$</td><td>$-2\pi/3$</td><td>0</td><td>$\pi/6$</td><td>$3\pi/4$</td></tr><tr><td>$\sin \theta$</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>$\cos \theta$</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>$\tan \theta$</td><td></td><td></td><td></td><td></td><td></td></tr></table>			θ	$-\pi$	$-2\pi/3$	0	$\pi/6$	$3\pi/4$	$\sin \theta$						$\cos \theta$						$\tan \theta$		
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$\sin \theta$																									
$\cos \theta$																									
$\tan \theta$																									

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2	12.a.	Describe the convergence of $\sum_{n=1}^{\infty} \frac{4^n}{(3n)^n}$	K2	CO2
	(OR)			
	12.b.	Discuss the convergence of $1 + \frac{x^2}{2} + \frac{x^4}{4} + \frac{x^6}{6} + \dots$, where x is any positive real number.		
3	13.a.	If $f(x, y) = \frac{y}{x}$, then find $\lim_{(x,y) \rightarrow (0,0)} f(x, y)$ if it exists.	K2	CO3
	(OR)			
	13.b.	Compute the derivative of $f(x, y, z) = x^3 - xy^2 - z$ at $P(1, 1, 0)$ in the direction of $v = 2i - 3j + 6k$.		
4	14.a.	If the growth rate of the number of bacteria at any time t is proportional to the number present at t and doubles in 1 week, how many bacteria can be expected after 2 weeks? After 4 weeks?	K4	CO4
	(OR)			
	14.b.	Identify the solution of $\cos(x + y) dx + (3y^2 + 2y + \cos(x + y)) dy = 0$		
5	15.a.	Compute the value of a_n in the Fourier series expansion of $f(x) = \begin{cases} \pi + 2x & -\pi < x < 0 \\ \pi - 2x & 0 < x < \pi \end{cases}$	K3	CO5
	(OR)			
	15.b.	Compute the value of b_n in the Fourier series expansion of $f(x) = x^2 \cos x$ in $(-\pi, \pi)$. Also give example for the functions which is i) neither even nor odd ii) both even and odd		

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	Prove that $\lim_{\theta \rightarrow 0} \frac{\sin \theta}{\theta} = 1$	K2	CO1
2	17	Express the Taylors series expansion of $f(x) = \frac{1}{x}$ at $a = 2$	K2	CO2
3	18	a) Give any five properties of the Limit of a function of two variables. b) State the Mixed derivative theorem and verify the same for $w = xy + \frac{e^y}{y^2+1}$	K2	CO3
4	19	Identify the solution of $xy' + y = y^2 \log x$.	K4	CO4
5	20	If $f(x) = \frac{\pi-x}{2}$, then derive the Fourier series expansion in the interval $(0, 2\pi)$ and hence find $1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \dots$	K3	CO5