

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

MSc(SS) DEGREE EXAMINATION DECEMEBR 2024
(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 and b , is called a ____ a) identity function b) constant function c) linear function d) power function	K1	CO1
	2	A moving object's ____ during an interval of time is found by dividing the distance covered by the time elapsed. a) average speed b) free fell c) average rate change d) recent	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) $\frac{1}{22}$	K1	CO2
	4	A convergent series that is not absolutely convergent is ____ a) conditionally convergent b) absolute convergent c) alternating series d) divergence	K2	CO2
3	5	A region in the plane is ____ if it lies inside a disk of the finite radius. a) closed b) bounded c) unbounded d) finite	K1	CO3
	6	The value of $f(x, y, z) = \sqrt{x^2 + y^2 + z^2}$ at the point (3,0,4) is ____ a) 3 b) 2 c) 5 d) 7	K2	CO3
4	7	$M(x, y)dx + N(x, y)dy = 0$ is called an/a ____ a) implicit solution b) contour lines c) general solution d) exact differential equation	K1	CO4
	8	Which of the following is another word for perpendicular? a) contour lines b) angle of intersection c) orthogonal d) orthonormal	K2	CO4
5	9	If $f(x)$ is an even function, then ____ a) $f(x) = -x$ b) $f(-x) = -f(x)$ c) $f(-x) = f(x)$ d) $f(-x) = x$	K1	CO5
	10	The smallest positive period is often called the ____ a) fundamental period b) partial sums c) coefficients d) periodic function	K2	CO5

SECTION - B (35 Marks)

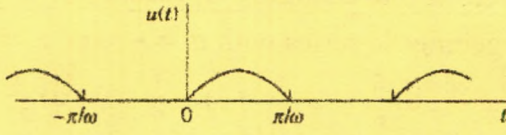
Answer **ALL** questions

ALL questions carry **EQUAL** Marks

(5 × 7 = 35)

Module No.	Question No.	Question	K Level	CO
1	11.a.	If $f(x) = \sqrt{x}$ and $g(x) = x + 1$, find i) $(f \circ g)(x)$ ii) $(g \circ f)(x)$ iii) $(f \circ f)(x)$ iv) $(g \circ g)(x)$	K2	CO1
		(OR)		
	11.b.	Evaluate $\lim_{x \rightarrow 0} \frac{\sqrt{x^2 + 100} - 10}{x^2}$.		

Cont...

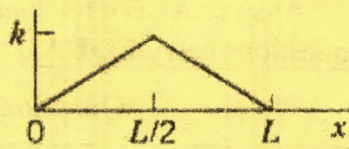
2	12.a.	Show that the sequence $\{1, -1, 1, -1, 1, -1, \dots, (-1)^{n+1}, \dots\}$ diverges.	K3	CO2
	(OR)			
	12.b.	Investigate the convergence of the following series: i) $\sum_{n=0}^{\infty} \frac{2^n+5}{3^n}$ ii) $\sum_{n=1}^{\infty} \frac{(2n)!}{n!n!}$		
3	13.a.	Use the Chain Rule to find the derivative of $w = xy$ with respect to t along the path $x = \cos t$, $y = \sin t$. What is the derivative's value at $t = \frac{\pi}{2}$?	K3	CO3
	(OR)			
	13.b.	Find the derivative of $f(x, y) = xe^y + \cos(xy)$ at the point $(2, 0)$ in the direction of $v = 3i - 4j$.		
4	14.a.	Solve the logistic equation $y' = Ay - By^2$.	K4	CO4
	(OR)			
	14.b.	Solve the equation $\cos(x + y)dx + (3y^2 + 2y + \cos(x + y))dy = 0$.		
5	15.a.	Derive Euler formula.	K4	CO5
	(OR)			
	15.b.	A sinusoidal voltage $E \sin \omega t$, where t is time, is passed through a half-wave rectifier that clips the negative portion of the wave,  Solve the Fourier series of the resulting periodic function $u(t) = \begin{cases} 0 & \text{if } -L < t < 0 \\ E \sin \omega t & \text{if } 0 < t < L \end{cases}$ $p = 2L = \frac{2\pi}{\omega}$, $L = \frac{\pi}{\omega}$		

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	Describe common functions in calculus.	K4	CO1
2	17	State and prove the Ratio test.	K4	CO2
3	18	Your company manufactures stainless steel right circular cylindrical molasses tanks that are 25 ft high with a radius of 5 ft. How sensitive are the tanks' volumes to small variations in height and radius?	K4	CO3
4	19	Solve $2xyy' = y^2 - x^2$.	K4	CO4
5	20	Find the two half-range expansions of the function $f(x) = \begin{cases} \frac{2k}{L} x & \text{if } 0 < x < \frac{L}{2} \\ \frac{2k}{L} (L - x) & \text{if } \frac{L}{2} < x < L \end{cases}$ 	K4	CO5

Z-Z-Z END