

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

MSc(SS) DEGREE EXAMINATION DECEMBER 2023
(First Semester)

Branch – SOFTWARE SYSTEMS (Five Year Integrated)

CALCULUS AND ITS APPLICATIONS

Time: Three Hours

Maximum: 75 Marks

SECTION-A (10 Marks)

Answer ALL questions

ALL questions carry EQUAL marks

(10 x 1 = 10)

Module No.	Question No.	Question	K Level	CO
1	1	A function $y = f(x)$ is an even function if _____. (a) $f(-x) = f(x)$ (b) $f(x) = f(-x)$ (c) $f(x) = -f(x)$ (d) $f(-x) = -f(x)$	K1	CO1
	2	Let f be a function defined on the interval I and let x_1 and x_2 be any two points in I , if _____, then f is said to be increasing on I . (a) $f(x_1) < f(x_2)$ whenever $x_1 > x_2$ (b) $f(x_2) < f(x_1)$ whenever $x_1 < x_2$ (c) $f(x_1) > f(x_2)$ whenever $x_1 > x_2$ (d) $f(x_2) > f(x_1)$ whenever $x_1 < x_2$	K1	CO1
2	3	A sequence $\{a_n\}$ is said to be _____ to the number L if for every $\epsilon > 0$ there exists an integer N such that for all $n > N, a_n - L < \epsilon$. (a) Divergent (b) Convergent (c) Monotonically increasing (d) Monotonically decreasing	K1	CO2
	4	A sequence $\{a_n\}$ is said to be _____ if $a_n \leq a_{n+1}$ (a) Nondecreasing (b) Nonincreasing (c) Monotonically increasing (d) Monotonically decreasing	K2	CO2
3	5	A region in the plane is _____ if it lies inside a disk of fixed radius. (a) finite (b) infinite (c) bounded (d) unbounded	K1	CO3
	6	A region is _____ if it consists entirely of interior points. (a) bounded (b) open (c) closed (d) finite	K2	CO3
4	7	The general solution of initial value problem when $y' = 3y, y(0) = 5.7$ is _____? (a) 5.7 (b) $5.7e^x$ (c) $5.7e^{3x}$ (d) e^x	K1	CO4
	8	A first order ODE is said to be _____ if it can be brought into the form $y' + p(x)y = r(x)$. (a) linear (b) nonlinear (c) standard (d) homogeneous	K1	CO4
5	9	If function $f(x)$ is called a _____ if $f(x)$ is defined for all real x , except possibly at some points and if there is some positive number p , is called a period of $f(x)$, such that $f(x + p) = f(x)$. (a) trigonometric function (b) exponential function (c) orthogonal function (d) periodic function	K1	CO5
	10	The function y_1, y_2, y_3, \dots are called _____ on $a \leq x \leq b$ if they are orthogonal on this interval and all have norm 1. (a) orthonormal (b) norm (c) orthogonal (d) weight function	K2	CO5

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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.	Evaluate $\lim_{x \rightarrow 1} \frac{x^2+x-2}{x^2-x}$.	K2	CO1
		(OR)		
	11.b.	Prove that $\lim_{x \rightarrow 0^+} \sqrt{x} = 0$.		
2	12.a.	Does the sequence whose nth term is $a_n = \left(\frac{n+1}{n-1}\right)^n$ converge? If so, find the $\lim_{n \rightarrow \infty} a_n$.	K2	CO2
		(OR)		
	12.b.	Does $\sum_{n=1}^{\infty} \frac{\ln n}{n^{3/2}}$ converge?		
3	13.a.	Find the values of $\frac{\partial f}{\partial x}$ and $\frac{\partial f}{\partial y}$ at the point (4,-5) if $f(x,y) = x^2 + 3xy + y - 1$.	K2	CO3
		(OR)		
	13.b.	Find $\frac{\partial z}{\partial x}$ and $\frac{\partial z}{\partial y}$ at (0, 0, 0) if $x^3 + z^2ye^{xz} + z \cos y = 0$.		
4	14.a.	Solve $2xyy' = y^2 - x^2$.	K3	CO4
		(OR)		
	14.b.	Solve the following Bernoulli equation $y' = Ay - By^2$.		
5	15.a.	Find the Fourier series of the function $f(x) = \begin{cases} -k, & \text{if } -2 < x < 0 \\ k, & \text{if } 0 < x < 2 \end{cases}$, $P = 2L = 4, L = 2$	K3	CO5
		(OR)		
	15.b.	Find the Fourier series of the function $f(x) = x + \pi$, if $-\pi < x < \pi$ and $f(x + 2\pi) = f(x)$.		

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	Evaluate $\lim_{x \rightarrow 0} \frac{\sqrt{x^2+100}-10}{x^2}$.	K4	CO1
2	17	Find the Taylor series generated by $f(x) = \frac{1}{x}$ at $a = 2$. Where does the series converge to $1/x$?	K4	CO2
3	18	Solve $\lim_{(x,y) \rightarrow (0,0)} \frac{4xy^2}{x^2+y^2}$ if it exists.	K4	CO3
4	19	Solve $\cos(x+y) dx + (3y^2 + 2y + \cos(x+y)) dy = 0$.	K4	CO4
5	20	Find the Fourier coefficients of the periodic function $f(x) = \begin{cases} -k, & \text{if } -\pi < x < 0 \\ k, & \text{if } 0 < x < \pi \end{cases}$ and $f(x + 2\pi) = f(x)$.	K4	CO5

Z-Z-Z

END