PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

MSc(SS) DEGREE EXAMINATION MAY 2024
(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 × 1 = 10)

Module No.	Question No.	Question	K Level	CO
1	1	A function $y = f(x)$ is an odd 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	The function whose value at any number x is the greatest integer less than or equal to x is called _____function. (a) absolute value (b) integer floor (c) integer ceiling (d) increasing	K1	CO1
2	3	$\lim_{n\to\infty} \frac{\ln n}{n} =$ _____ (a) 0 (b) 1 (c) n (d) 1/n	K1	CO2
	4	A sequence $\{a_n\}$ is said to be_____ if $a_n \geq a_{n+1}$ (a) Nondecreasing (b) Nonincreasing (c) Monotonically increasing (d) Monotonically decreasing	K2	CO2
3	5	A region is _____ if it contains all its boundary points. (a) open (b) closed (c) bounded (d) unbounded	K1	CO3
	6	The expression $f_{xx}f_{yy} - f_{xy}^2$ is called the _____of f. (a) interior point (b) boundary point (c) discriminant (d) critical point	K2	CO3
4	7	The ODE $y' + p(x)y = r(x)$ becomes $y' + p(x)y = 0$, then H is called _____ (a) linear (b) nonlinear (c) standard (d) homogeneous	K1	CO4
	8	An ODE may sometimes have an additional solution that cannot be obtained from the general solution and is called a ____ solution. (a) particular (b) complete (c) nonsingular (d) singular	K1	CO4
5	9	An equilibrium solution is called _____ if solutions close to it for some t remain close to it for all further t. (a) stable (b) unstable (c) orthogonal (d) periodic	K1	CO5
	10	An _____set $y_1, y_2, y_3, \ldots$ on an interval $a \leqq x \leqq b$ is complete in a set of functions defined on $a \leqq x \leqq b$. (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.	Find the slope of the parabola $y = x^2$ at the point $P(2,4)$. Write an equation for the tangent to the parabola at this point.	K2	CO1
		(OR)		
	11.b.	Consider the function $y = 2x - 1$ near $x_0 = 4$. Intuitively it appears that y is close to 7 when x is close to 4, so $\lim_{x\to 4} 2x - 1 = 7$. However, how close to $x_0 = 4$ does x have to be so that $y = 2x - 1$ differs from 7 by, say, less than 2 units?		
2	12.a.	Show that the sequence $\{1, -1, 1, -1, \ldots (-1)^{n+1}, \ldots\}$ diverges.	K2	CO2
		(OR)		
	12.b.	Find the sum of the series $\sum_{n=1}^{\infty} \frac{1}{n(n+1)}$.		
3	13.a.	Show that the function $f(x,y) = \frac{2x^2y}{x^4+y^2}$ has no limit as (x,y) approaches (0,0).	K2	CO3
		(OR)		
	13.b.	Find f_x, f_y as functions if $f(x,y) = \frac{2y}{y+\cos x}$.		
4	14.a.	Solve the IVP $(\cos y \sinh x + 1)dx - \sin y \cosh x\, dy = 0, y(1) = 2.$	K3	CO4
		(OR)		
	14.b.	Solve IVP $y' + y \tan x = \sin 2x, y(0) = 1.$		
5	15.a.	Find the Fourier series of the function $f(x) = \begin{cases} 0, & if -2 < x < -1 \\ k, & if -1 < x < 1 \\ 0, & if\ 1 < x < 2 \end{cases}$, P=2L=4,L=2	K3	CO5
		(OR)		
	15.b.	Compute the minimum square error E* of F(x) with N = 1,2,… 100& 1000 relation to $f(x) = x + \pi, -\pi < x < \pi$ on the interval $-\pi \leqq x \leqq \pi$.		

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	Prove that $\lim_{\theta\to 0} \frac{\sin\theta}{\theta} = 1$.	K3	CO1
2	17	Find the Taylor series and Taylor's polynomials generated by $f(x) = \cos x$ at $x = 0$.	K2	CO2
3	18	Find the local extreme values of the function $f(x,y) = xy - x^2 - y^2 - 2x - 2y + 4$.	K3	CO3
4	19	Mixing problem occur quite frequently in chemical industry. The tank contains 1000gal of water in which initially 100 lb of salt is dissolved. Brine runs in at a gallon contains 5 lb of dissolvent salt. The mixture in the tank is kept uniform by stirring. Brine runs out of 10 gal/min. Find the amount of salt in the tank at any time *t*.	K3	CO4
5	20	Find the two half-range expansions of the function $f(x) = \begin{cases} \frac{2k}{L}x, & if\ 0 < x < \frac{L}{2} \\ \frac{2k}{L}(L - x), & if\ \frac{L}{2} < x < L \end{cases}$	K2	CO5

Z-Z-Z END