PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

MSc (SS) DEGREE EXAMINATION MAY 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)

Question No.	Question	K Level	CO
1	Given $sin^2\theta = \frac{3}{4}$, then the angle θ is (a) $\frac{\pi}{2}$ (b) $\frac{\pi}{3}$ (c) $\frac{\pi}{4}$ (d) $\frac{\pi}{6}$	K1	CO1
2	Given f is continuous at c and g is continuous at f(c), ten $g \circ f$ is continuous at (a) c (b) f(c) (c) g(c) (d) f(g(c))	K2	CO1
3	$\lim_{n\to\infty}\left(1+\frac{x}{n}\right)^n$ is (a) e^x (b) e^{-x} (c) e^{nx} (d) e^{-nx}	K1	CO2
4	$\sum_{n=0}^{\infty}\frac{4}{2^n}$ is (a) 2 (b) 4 (c) 8 (d) 16	K2	CO2
5	Given $f(x,y,z) = \frac{x-y}{y^2+z^2}$, then $f(0,-1/3,0)$ is (a) 0 (b)1 (c) 1/3 (d) 3	K1	CO3
6	Given $f(x,y) = x\cos y + ye^x$, then $\frac{\partial^2 f}{\partial x\,\partial y}$ is (a) ye^x (b) $-x\cos y$ (c) $-\sin y + e^x$ (d) none of these	K2	CO3
7	Given $y' = 1 + y^2$ (a) $y = sin(x+c)$ (b) $y = cos(x+c)$ (c) $y = tan(x+c)$ (d) $y = cot(x+c)$	K1	CO4
8	Given $y' = -2xy, y(0) = 1.8$ (a) $y = ce^{-x^2}$ (b) $y = ce^{-x^4}$ (c) $y = cx^2$ (d) $y = cx^4$	K2	CO4
9	The period for $\cos 2x$ is (a) π (b) $\frac{\pi}{2}$ (c) 2π (d) none of these	K1	CO5
10	Given f(x) is an odd function with period 2π, then (a) $f(x) = a_0 + \sum_{n=1}^{\infty} a_n \cos nx$ (b) $f(x) = \sum_{n=1}^{\infty} a_n \cos nx$ (c) $f(x) = a_0 + \sum_{n=1}^{\infty} b_n \cos nx$ (d) $f(x) = \sum_{n=1}^{\infty} b_n \cos nx$	K2	CO5

SECTION - B (35 Marks)
Answer **ALL** questions
ALL questions carry **EQUAL** Marks (5 × 7 = 35)

Question No.	Question	K Level	CO
11.a.	Given $f(x) = 3x+4, g(x) = 2x-1$and $h(x) = x^2$. Then find (i) $(f \circ g)$(x) (ii) $(g \circ f)$(x) (iii) $(f \circ f)(x)$ (iv) $(g \circ g)$(x) (v) $(f \circ g \circ h)$(x)	K1	CO1
	(OR)		
11.b.	Find the value of (i) $\lim_{x\to c}(x^3+4x^2-3)$ (ii) $\lim_{x\to c}(\frac{x^4+x^2-1}{x^2+5})$ (iii) $\lim_{x\to -2}\sqrt{4x^2-3}$		

Cont...

12.a.	Investigate the convergent of the following series (i) $\sum_{n=0}^{\infty} \frac{2^n+5}{3^n}$ (ii) $\sum_{n=1}^{\infty} \frac{4^n n! n!}{(2n)!}$	K2	CO2
	(OR)		
12.b.	Find the Taylor series and Taylor polynomial generated by $f(x) = \cos x$ at x = 0		
13.a.	Show that $f(x,y) = \begin{cases} \frac{2xy}{x^2+y^2}, & (x,y) \neq (0,0) \\ 0 & (x,y) = (0,0) \end{cases}$ is continous at every point except the origin.	K2	CO3
	(OR)		
13.b.	If $f(x,y) = \frac{2y}{y+\cos x}$, then find f_x and f_y as functions. Given resistors of R_1, R_2 and R_3 ohms are connected in parallelto make an R - ohms resisitor, the value of R can be found from the equation $\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$. Find the value of $\frac{\partial R}{\partial R_2}$ when R_1=30, $R_2 = 45$ and $R_3 = 90$ ohms.		
14.a.	Test the exactness of $\cos(x+y)\,dx + (3y^2 + 2y + \cos(x+y))\,dy = 0$.If exact solve.	K3	CO4
	(OR)		
14.b.	Solve the Bernoulli equation $y' = Ay - By^2$		
15.a.	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 $f(x+2\pi)=f(x)$. Functions of this kind occur as external forces acting on mechanical systems, electromotive forces in electric circuits, etc. (The value of at a single point does not affect the integral; hence we can leave undefined at and .)	K3	CO5
	(OR)		
15.b.	Find the Fourier series of the function. $f(x) = \begin{cases} 0 & if \quad -2 < x < -1 \\ k & if \quad -1 < x < 1 \\ 0 & if \quad 1 < x < 2 \end{cases}$ p=2L=4, L=2		

SECTION -C (30 Marks)

Answer **ANY THREE** questions

ALL questions carry **EQUAL** Marks (3 × 10 = 30)

Question No.	Question	K Level	CO
16	Prove that $\lim_{\theta \to 0} \frac{\sin\theta}{\theta} = 1$	K2	CO1
17	Given $\sum a_n$ be a series with positive terms and $\lim_{n\to\infty} \frac{a_{n+1}}{a_n} = \rho$, then prove that (i) the series converges if $\rho < 1$ (ii) the series diverges if $\rho > 1$ or ρ is infinite , (iii) the test is in conclusive if ρ = 1	K2	CO2
18	Find the point $P(x,y,z)$ on the plane $2x + y - z - 5 = 0$ that is closest to the origin.	K2	CO3
19	Suppose that in winter daytime temperature in a certain ofice building in maintained at 70°F . The heating in shut off at 10. P. M. and turned on again at 6 A. M. On a certain day the temperature inside the building at 2 A.M. was found to be 65°F. The outside temperature was 50°F at 10 P. M. and had dropped to 40°F by 6 A. M. What was the temperature inside the building when the heat was turned on at 6 A. M ?	K3	CO4
20	Find the two half - range expansions of the function $f(x) = \begin{cases} \frac{2k}{L}x & if \quad 0 < x < \frac{L}{2} \\ \frac{2k}{L}(L-x) & if \quad \frac{L}{2} < x < L \end{cases}$	K3	CO5

Z-Z-Z END