PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)
BSc DEGREE EXAMINATION DECEMBER 2025
(First Semester)

Branch- MATHEMATICS WITH COMPUTER APPLICATIONS
CALCULUS

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	If $\vec{a}$ and $\vec{b}$ are orthogonal, then___ a) $\vec{a}X\vec{b} = \vec{0}$ b) $\vec{a} \cdot \vec{b} = 0$ c) $\vec{a}X\vec{b} = \vec{\iota}$ d) $\vec{a} \cdot \vec{b} = 1$	K1	CO1
	2	$\vec{r}(t) = \cos t\,\vec{\iota} + \sin t\,\vec{j} + t\vec{k}$ is the vector equation of_____? a) helix b) ellipse c) circle d) straight line	K2	CO1
2	3	The function $\tan^{-1}\left(\frac{y}{x}\right)$ is discontinuous at___ a) x=0 b) y=0 c) $x = \infty$ d) $y = \infty$	K1	CO2
	4	The equation $u_{xx} + u_{yy} = 0$ is called ___ equation a) Laplace b) Wave c) Euler d) Lagrange	K2	CO2
3	5	If $f(x,y) = x\ln(y^2 - x)$ then $f(3,2) =$_____. a) $\frac{\sqrt{6}}{2}$ b) $\frac{\sqrt{3}}{2}$ c) 0 d) 1	K1	CO3
	6	If (a,b) is a saddle point of the function $f(x,y)$ then ____ a) $D > 0$ b) $D < 0$ c) $D = 0$ d) none	K2	CO3
4	7	$\int_1^2 \int_0^3 x^2 y\,dxdy =$_____. a) $\frac{27}{2}$ b) $-\frac{27}{2}$ c) $-\frac{27}{4}$ d) $\frac{27}{4}$	K1	CO4
	8	The mass of a triangular lamina with vertices $(0,0), (1,0)$ and $(0,2)$ is ___. a) $\frac{11}{16}$ b) $\frac{16}{11}$ c) $\frac{3}{8}$ d) $\frac{8}{3}$	K2	CO4
5	9	The rectangular coordinates of the point with spherical coordinates $\left(2, \frac{2\pi}{3}, 1\right)$ is _____. a) $\left(1, \sqrt{3}, 1\right)$ b) $\left(1, \sqrt{3}, -1\right)$ c) $\left(-1, \sqrt{3}, -1\right)$ d) $\left(-1, \sqrt{3}, 1\right)$	K1	CO5
	10	The Jacobian of the transformation T given by $x = g(u,v), y = h(u,v)$ is denoted by _____. a) $\frac{\partial(x,y)}{\partial(u,v)}$ b) $\frac{\partial(u,v)}{\partial(x,y)}$ c) $\frac{\partial(x,u)}{\partial(y,v)}$ d) $\frac{\partial(u,y)}{\partial(x,v)}$	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.	Find a vector perpendicular to the plane that passes through the points $P(1,4,6), Q(-2,5,-1)$ and R(1,-1,1) and also find the area of triangle PQR.	K3	CO1
		(OR)		

1	11.b.	Show that the curvature of the circle of radius a is $1/a$.	K3	CO1
2	12.a.	Determine $\frac{\partial z}{\partial x}$ and $\frac{\partial z}{\partial y}$ if z is defined implicitly as a function of x and y by the equation $x^3 + y^3 + z^3 + 6xyz = 1$.	K3	CO2
		(OR)		
	12.b.	Determine the tangent plane to the elliptic paraboloid $z = 2x^2 + y^2$ at the point $(1,1,3)$.		
3	13.a.	If $f(x,y,z) = x \sin yz$, construct the gradient of f and the directional derivative of f at $(1,3,0)$ in the direction of $\vec{v} = \vec{\iota} + 2\vec{\jmath} - \vec{k}$.	K4	CO3
		(OR)		
	13.b.	A rectangular box without a lid is to be made from 12sq.m of cardboard. Make use of the Lagrange multiplier to find the maximum volume of such a box.		
4	14.a.	Find the volume of the tetrahedron bounded by the planes $x + 2y + z = 2, x = 2y, x = 0, z = 0$.	K4	CO4
		(OR)		
	14.b.	Use double integrals to find the area enclosed by one loop of the four leaved rose $r = \cos 2\theta$		
5	15.a.	Evaluate $\iiint_E \sqrt{x^2 + z^2}\, dV$ where E is the region bounded by the paraboloid $y = x^2 + z^2$ and the plane $y = 4$.	K5	CO4
		(OR)		
	15.b.	Evaluate $\int_{-2}^{2} \int_{-\sqrt{4-x^2}}^{\sqrt{4-x^2}} \int_{\sqrt{x^2+y^2}}^{2} (x^2 + y^2)\, dz\, dy\, dx.$		

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	Find the angle between the planes $x + y + z = 1$ and $x - 2y + 3z = 1$ and also find the symmetric equations for the line of intersection L of these two planes.	K4	CO1
2	17	The dimensions of a rectangular box are measured to be 75cm, 60cm and 40cm and each measurement is correct to within 0.2cm. Use differentials to estimate the largest possible error when the volume of the box is calculated from these measurements.	K4	CO2
3	18	Estimate the maximum value of the function $f(x,y,z) = x + 2y + 3z$ on the curve of intersection of the plane $x - y + z = 1$ and the cylinder $x^2 + y^2 = 1$.	K5	CO3
4	19	The manager of a movie theatre determines that the average time movie-goers wait in line to buy ticket for the week's film is 10 minutes and the average time they wait to buy popcorn is 5 minutes. Assuming that the waiting times are independent find the probability that a movie-goer waits a total of less than 20 minutes before taking his or her seat.	K5	CO4
5	20	Evaluate $\iint_R e^{(x+y)(x-y)}\, dA$ where R is the trapezoidal region with vertices $(1,0), (2,0), (0,-2), (0,-1)$	K5	CO5

Z-Z-Z   END