

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

BSc DEGREE EXAMINATION DECEMBER 2024
(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	A force is given by a vector $F=3i+4j+5k$ and moves a particle from the point $P(2,1,0)$ to the point $Q(4,6,2)$. Find the work done a) 32 b) 30 c) 28 d) 36	K1	CO1
	2	The curvature of a circle of radius 'a' is a) a^2 b) 1 c) a d) $\frac{1}{a}$	K2	CO1
2	3	The value of $\lim_{(x,y) \rightarrow (1,2)} x^2y^3 - x^3y^2 + 3x + 2y$ a) 10 b) 11 c) 9 d) 0	K1	CO2
	4	If $f(x,y) = ye^{xy}$, then $f_y(0,1)$ is a) 0 b) -1 c) 1 d) 2	K2	CO2
3	5	Find the local maximum of $f(x,y)=x^4+y^4-4xy+1$ at (0,0) a) 10 b) -1 c) 1 d) No Maximum point	K1	CO3
	6	A rectangular box without a lid is to be made from 12 m ² of cardboard. Find the maximum volume a) 10 b) 4 c) 1 d) 8	K2	CO3
4	7	$\int_0^2 \int_1^2 x^2 y dy dx =$ _____ a) $\frac{27}{2}$ b) $-\frac{27}{2}$ c) $\frac{27}{4}$ d) 0	K1	CO4
	8	The moment of inertia is also called as a) First moment b) Second moment c) Polar coordinates d) Cartesian Coordinate	K2	CO4
5	9	The cylindrical coordinates of the point with rectangular coordinates (3, -3, -7) is a) (3, -3, -7) b) $(3\sqrt{2}, \pi/4, 7)$ c) $(3\sqrt{2}, \pi/4, -7)$ d) $(3\sqrt{2}, -\pi/4, -7)$	K1	CO5
	10	The Spherical coordinates of the point with rectangular coordinates $(0, 2\sqrt{3}, -2)$ is a) (2, -3, -7) b) $(4, -\pi/2, \pi/3)$ c) $(4, \pi/2, 2\pi/3)$ d) $(3\sqrt{2}, -\pi/4, -7)$	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 a vector perpendicular to the plane passes through the points P(1,4,6), Q(-2,5,1) and R(1,-1,1)	K2	CO1
		(OR)		
	11.b.	Find the derivative of $\vec{r}(t) = (1 + t^3)\vec{i} + te^{-t}\vec{j} + \sin 2t\vec{k}$ and find the unit tangent vector at the point where $t = 0$.		
2	12.a.	If $f(x, y) = \frac{xy}{x^2 + y^2}$, find $\lim_{(x,y) \rightarrow (0,0)} f(x, y)$ if it exists.	K3	CO2
		(OR)		
	12.b.	Find the tangent plane to the elliptic paraboloid $z = 2x^2 + y^2$ at the point (1,1,3).		
3	13.a.	If $u = x^4y + y^2z^3$, where $x = rse^t$, $y = rs^2e^{-t}$ and $z = r^2s \sin t$ find the value of $\frac{\partial u}{\partial s}$ when $r = 2$, $s = 1$, $t = 0$.	K3	CO3
		(OR)		
	13.b.	Find the gradient and directional derivative of the function $f(x, y, z) = x \sin(yz)$ at the point (1,3,0) in the direction of the vector $\mathbf{v} = \mathbf{i} + 2\mathbf{j} - \mathbf{k}$		
4	14.a.	Use a double integral to find the area enclosed by one loop of the four leaved rose $r = \cos 2\theta$.	K3	CO4
		(OR)		
	14.b.	Find the mass and center of mass of a triangular lamina with vertices (0,0), (1,0) and (0,2) if the density function is $1 + 3x + y$		
5	15.a.	Use a triple integral to find the volume of the Tetrahedron T bounded by the planes $x + 2y + z = 2$, $x = 2y$, $x = 0$ and $z = 0$	K4	CO5
		(OR)		
	15.b.	Evaluate $\iiint_B e^{(x^2 + y^2 + z^2)^{3/2}} dV$, where $B = \{(x, y, z) \mid x^2 + y^2 + z^2 \leq 1\}$		

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	(i) Find the angle between the planes $x + y + z = 1$ and $x - 2y + 3z = 1$ (ii) Find symmetric equations for the line of intersection L of these two planes	K3	CO1
2	17	(i) Calculate f_{xyz} if $f(x, y, z) = \sin(3x + yz)$ (ii) Verify the function $u(x, t) = \sin(x - at)$ satisfies the wave equation	K4	CO2
3	18	Find the shortest distance from the point (1, 0, -2) to the plane $x + 2y + z = 4$.	K4	CO3
4	19	Find the volume of the solid that lies under the paraboloid $x^2 + 2y^2 + z = 16$, the planes $x = 2$ and $y = 2$ and the three coordinate planes.	K4	CO4
5	20	Derive the formula for triple integration in spherical coordinates.	K5	CO5

Z-Z-Z END