23MCU205

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

BSc DEGREE EXAMINATION MAY 2024
(Second Semester)

Branch - **MATHEMATICS WITH COMPUTER APPLICATIONS**

ANALYTICAL GEOMETRY OF 3D AND VECTOR 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	The length of the perpendicular from the origin to the plane $x+y+z=1$ is _____ (a) 1 (b) $\sqrt{3}$ (c) $\frac{1}{\sqrt{3}}$ (d) 0	K2	CO 1
	2	Compare and find the angle between the planes $2x+4y-6z=11$ & $3x+6y+5z=-4$ from the following (a) $\frac{\pi}{3}$ (b) $\frac{\pi}{2}$ (c) $\frac{\pi}{4}$ (d) $\frac{\pi}{6}$	K2	CO 1
2	3	The straight lines in space which are not coplanar are called_____. (a) parallel lines (b) skew lines (c) perpendicular lines (d) intersecting lines	K2	CO 2
	4	Infer the condition that is true when a line is parallel to a plane. (a) al+bm+cn=0 (b) ax+by+cz=0 (c) al-bm-cn=0 (d) ax-by-cz=0	K1	CO 2
3	5	Find the equation of the sphere which has the centre at (1,-2,3) and passing through (2,1,2) (a) $(x-1)^2+(y+2)^2+(z-3)^2=11$ (b) $(x-2)^2+(y-1)^2+(z-2)^2=11$ (c) $(x-2)^2+(y-1)^2+(z-2)^2=121$ (d) $(x-1)^2+(y+2)^2+(z-3)^2=121$	K2	CO 3
	6	Which of the following conditions is true? (a) Intersection of two sphere is sphere (b) Intersection of two sphere is plane (c) Intersection of two sphere is circle (d) Intersection of two sphere is line	K1	CO 3
4	7	If C is the straight line joining (0,0,0) and (1,1,1) then $\int_C \boldsymbol{r}.d\boldsymbol{r}$ is _____ (a) $\frac{1}{2}$ (b) 1 (c) $\frac{3}{2}$ (d) 2	K2	CO 4
	8	The area enclosed by the ellipse is (a) πab (b) π^2ab (c) πa^2b (d) πab^2	K1	CO 4
5	9	Gauss' divergence theorem connects (a) line integral and double integral (b) line integral and surface integral (c) double integral and surface integral (d) surface integral and volume integral	K1	CO 5
	10	If the integral $\int_c F.dr = \iint_s Curl\ F.ds$ then it is called as (a) Surface integral (b) Greens theorem (c) Stokes theorem (d) divergence theorem	K1	CO 5

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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 distance between the parallel planes $2x - 2y - z + 3 = 0$ & $4x - 4y + 2z + 5 = 0$.	K2	CO 1
		(OR)		
	11.b.	Find the equation of the plane passing through the points (3,1,2), (3,4,4) and perpendicular to the plane $5x + y + 4z = 0$.		
2	12.a.	Find the perpendicular distance from $P(3,9,-1)$ to the line $\frac{x+8}{-8} = \frac{y-31}{1} = \frac{z-13}{5}$.	K2	CO 2
		(OR)		
	12.b.	Show that the shortest distance between the lines $\frac{x-3}{-1} = \frac{y-4}{2} = \frac{z+2}{1}$; $\frac{x-1}{1} = \frac{y+7}{3} = \frac{z+2}{2}$ is $\sqrt{35}$.		
3	13.a.	Interpret and find the equation of the sphere having the circle $x^2 + y^2 + z^2 - 2x + 4y - 6z + 7 = 0, 2x - y + 2z = 5$ as a great circle.	K3	CO 3
		(OR)		
	13.b.	Show that the planes $2x - y - 2z = 16$ touches the sphere $x^2 + y^2 + z^2 - 4x + 2y + 2z = 3$ and find the point of contact.		
4	14.a.	Identify whether $F(x,y) = (3 + 2xy)\vec{i} + (x^2 - 3y^2)\vec{j}$ is a conservative field, or not	K3	CO 4
		(OR)		
	14.b.	Solve the line integral $\int_c F.dr$, where $F(x,y,z) = xyi + yzj + zxk$ and c is the twisted cubic given by $x = t, y = t^2, z = t^3, 0 \le t \le 1$.		
5	15.a.	Examine the surface area of sphere of radius a.	K4	CO 5
		(OR)		
	15.b.	Examine the surface integral $\iint_s x^2\, dS$, where S is the unit sphere $x^2 + y^2 + z^2 = 1$.		

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	Show that the origin lies in acute angle between the planes $x + 2y + 2z = 0$ & $4x - 3y + 12z + 13 = 0$. Find the planes bisecting the angles between them and point out which bisects the obtuse angle.	K3	CO 1
2	17	Show that the lines $\frac{x+1}{-3} = \frac{y+10}{8} = \frac{z-1}{2}$; $\frac{x+3}{-4} = \frac{y+1}{7} = \frac{z-4}{1}$ are coplanar. Find also their point of intersection and the plane through them.	K3	CO 2
3	18	Find the equation of the sphere, passing through the four points (2,3,1),(5,-1,2),(4,3,-1) and (2,5,3).	K3	CO 3
4	19	Solve $\oint_c x^4 dx + xydy$, where C is the triangular curve consisting of the line segments from (0,0) to (1,0), from (1,0) to (0,1), and from (0,1) to (0,0).	K4	CO 4
5	20	Evaluate $\iint_s F.ds$, where $F(x,y,z) = xyi + \left(y^2 + e^{xz^2}\right)j + sin(xy)\,k$ and S is the surface of the region E bounded by the parabolic cylinder $z = 1 - x^2$ and the planes $z = 0, y = 0$ *and* $y + z = 2$.	K4	CO 5

Z-Z-Z END