

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

BSc DEGREE EXAMINATION MAY 2026
(First Semester)

Branch- **MATHEMATICS**

ANALYTICAL GEOMETRY OF 3D AND TRIGONOMETRY

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	Angle between the plane $ax + by + cz + d = 0$ and the line $\frac{x-x_1}{l} = \frac{y-y_1}{m} = \frac{z-z_1}{n}$, is parallel to the plane if $\theta =$ _____ a) $al + bm + cn = 0$ b) $al + bm + cn = 1$ c) $al + bm - cn = 1$ d) $al - bm - cn = 0$	K1	CO1
	2	The equation of any plane containing the line $\frac{x-x_1}{l} = \frac{y-y_1}{m} = \frac{z-z_1}{n}$ is _____ a) $a(x + x_1) + b(y + y_1) + c(z + z_1) = 0$ b) $a(x - x_1) + b(y - y_1) + c(z - z_1) = 0$ c) $a(x - x_1) - b(y - y_1) - c(z - z_1) = 0$ d) $a(x + x_1) - b(y + y_1) - c(z + z_1) = 0$	K2	CO1
2	3	The equation of the sphere with center $(-1, 2, -3)$ and radius 3 units a) $x^2 + y^2 - z^2 + 2x + 4y + 6z - 9 = 0$ b) $x^2 + y^2 + z^2 + 2x - 4y + 6z + 5 = 0$ c) $x^2 + y^2 + z^2 + 2x - 4y + 6z = 9$ d) $x^2 - y^2 - z^2 - 2x - 4y - 6z - 5 = 0$	K1	CO2
	4	The equation of the tangent plane to the sphere $x^2 + y^2 + z^2 = r^2$ at the point (x_1, y_1, z_1) is _____ a) $xx_1 + yy_1 + zz_1 = -(r^2)$ b) $xx_1 - yy_1 - zz_1 = r^2$ c) $xx_1 - yy_1 + zz_1 = r^2$ d) $xx_1 + yy_1 + zz_1 = r^2$	K2	CO2
3	5	The equation $\frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$ represents an _____ with axis along OX. a) vertical angle b) constant angle c) cylinder d) elliptic cylinder	K1	CO3
	6	The equation of the cone of the second degree which passes through the axes _____ a) $fyx - gzx + hyx = 0$ b) $fyx + gzx + hyx = 0$ c) $fyx + gzx + hyx = 1$ d) $fyx - gzx - hyx = 0$	K2	CO3
4	7	The locus of a line which is parallel to a given line which touches a given surface is called _____ a) an elliptic cylinder b) A cylinder c) an enveloping cylinder d) a circle	K1	CO4
	8	There are two tangent planes to a conicoid parallel to the plane $lx + my + nz = 0$ and their equations are _____ a) $lx + my + nz = \pm \left(\frac{l^2}{a} + \frac{m^2}{b} + \frac{n^2}{c} \right)^{1/3}$ b) $lx - my - nz = \pm \left(\frac{l^2}{a} - \frac{m^2}{b} - \frac{n^2}{c} \right)^{1/2}$ c) $lx + my + nz = \pm \left(\frac{l^2}{a} + \frac{m^2}{b} + \frac{n^2}{c} \right)^{1/2}$ d) $lx - my - nz = \pm \left(\frac{l^2}{a} + \frac{m^2}{b} + \frac{n^2}{c} \right)^{1/2}$	K2	CO4
5	9	Coefficient of $\cos^{n-1}\theta$ in the expansion of _____ a) $nc_1 - nc_3 - nc_4 + \dots = 2^{n-1}$ b) $nc_1 + nc_3 + nc_5 + \dots = 2^{n-1}$ c) $nc_1 - nc_3 + nc_5 + \dots = 2^n$ d) $nc_0 + nc_3 - nc_5 + \dots = 2^n$	K1	CO5
	10	Coefficient of $\cos^n\theta$ in the expansion of _____ a) $nc_0 + nc_2 + nc_4 + \dots = 2^{n-1}$ b) $nc_0 + nc_1 + nc_2 + \dots = 2^n$ c) $nc_0 - nc_2 - nc_4 - \dots = 2^{n-1}$ d) $nc_0 - nc_1 - nc_2 + \dots = 2^n$	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 image of the point (1,-2,3) in the plane $2x - 3y + 2z + 3 = 0$.	K2	CO1
		(OR)		
	11.b.	Find the perpendicular distance from P(3,9,-1) to the line $\frac{x+8}{-8} = \frac{y-31}{1} = \frac{z-13}{5}$		
2	12.a.	Find the equation to the sphere through the four points (2,3,1), (5,-1,2), (4,3,-1) and (2,5,3).	K2	CO2
		(OR)		
	12.b.	Show that the plane $2x-y-2z=16$ touches the sphere $x^2 + y^2 + z^2 - 4x + 2y + 2z - 3 = 0$ and find the point of contact.		
3	13.a.	Find the general equation to a cone which touches the coordinate planes.	K3	CO3
		(OR)		
	13.b.	Find the equation of the cone with vertex O and base curve, the conic in which the surface $ax^2 + by^2 + cz^2 = 1$ is cut by the plane $l_1x + m_1y + n_1z = p$.		
4	14.a.	Find the condition for the plane $lx+my+nz=p$ to touch the conicoid $ax^2 + by^2 + cz^2 = 1$.	K3	CO4
		(OR)		
	14.b.	If OD is the diameter parallel to a secant APQ through A meeting the conicoid at P and Q show that $\frac{AP \cdot AQ}{OD^2}$ is constant.		
5	15.a.	Express $\cos 8\theta$ in terms of $\sin \theta$.	K3	CO5
		(OR)		
	15.b.	Expand $\sin^7 \theta$ in a series of sines of multiples of θ .		

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	The straight lines $\frac{x-\alpha}{l} = \frac{y-\beta}{m} = \frac{z-\gamma}{n}$, $\frac{x-\alpha_1}{l_1} = \frac{y-\beta_1}{m_1} = \frac{z-\gamma_1}{n_1}$ are cut by a third whose direction cosines are λ, μ, ϑ . Show that the length intercepted on the third line is given by $\begin{vmatrix} \alpha - \alpha_1 & \beta - \beta_1 & \gamma - \gamma_1 \\ l & m & n \\ l_1 & m_1 & n_1 \end{vmatrix} = \begin{vmatrix} l & m & n \\ l_1 & m_1 & n_1 \\ \lambda & \mu & \vartheta \end{vmatrix}$ and deduce the length of S.D.	K3	CO1
2	17	Find the condition that the line $\frac{x-a}{l} = \frac{y-b}{m} = \frac{z-c}{n}$ where $l^2 + m^2 + n^2 = 1$ should touch the sphere $x^2 + y^2 + z^2 + 2ux + 2vy + 2wz + d = 0$.	K4	CO2
3	18	Find the angle between the lines in which the plane $ux + vy + wz = 0$ cuts the cone.	K3	CO3
4	19	Find the locus of the point of intersection of three mutually perpendicular tangent planes to the central conicoid $ax^2 + by^2 + cz^2 = 1$.	K4	CO4
5	20	Expand $\sin^3 \theta \cos^5 \theta$ in series of sines of multiples of θ .	K3	CO5

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