

MTE-05

ASSIGNMENT BOOKLET

Bachelor's Degree Programme

ANALYTICAL GEOMETRY

(Valid from 1st January, 2026 to 31st December, 2026)



**School of Sciences
Indira Gandhi National Open University
Maidan Garhi
New Delhi-110068
(For January 2026 cycle)**

Dear Student,

Please read the section on assignments in the Programme Guide for Elective courses that we sent you after your enrolment. A weightage of 30 per cent, as you are aware, has been earmarked for continuous evaluation, **which would consist of one tutor-marked assignment** for this course. The assignment is in this booklet.

Instructions for Formatting Your Assignments

Before attempting the assignment please read the following instructions carefully.

- 1) On top of the first page of your answer sheet, please write the details exactly in the following format:

ROLL NO.:

NAME:

ADDRESS:

.....

.....

COURSE CODE :

COURSE TITLE :

ASSIGNMENT NO. :

STUDY CENTRE : **DATE:**

PLEASE FOLLOW THE ABOVE FORMAT STRICTLY TO FACILITATE EVALUATION AND TO AVOID DELAY.

- 2) Use only foolscap size writing paper (but not of very thin variety) for writing your answers.
- 3) Leave 4 cm margin on the left, top and bottom of your answer sheet.
- 4) Your answers should be precise.
- 5) While solving problems, clearly indicate which part of which question is being solved.
- 6) This assignment is to be submitted to the Study Centre as per the schedule made by the study centre. Answer sheets received after the due date shall not be accepted.

We strongly suggest that you retain a copy of your answer sheets.

- 7) This assignment is valid only upto 31st **December, 2026**. If you have failed in this assignment or fail to submit it by 31st **December, 2026**, then you need to get the assignment for 2027 cycle and submit it as per the instructions given in that assignment booklet.
- 8) **You cannot fill the exam form for this course** till you have submitted this assignment. So solve it and **submit it to your study centre at the earliest**.

We wish you good luck.

Assignment

(To be done **after** reading all the material)

Course Code: MTE-05

Assignment Code: MTE-05/TMA/2026

Maximum Marks: 100

1. Check whether the following statements are **true** or **false**. Justify your answer with a short explanation or a counter example. (2 × 10 = 20)
 - (i) Any line through the origin cuts the sphere $x^2 + y^2 + z^2 = 4$ at exactly two points.
 - (ii) The plane making intercept at the z-axis and parallel to the xy-plane intersects the cone $x^2 + y^2 = z^2 \tan^2 \theta$ in a circle.
 - (iii) There exists no line with $\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{2}}, \frac{1}{\sqrt{6}}$ as direction cosines.
 - (iv) The tangent planes at the extremities of any axis of an ellipsoid are perpendicular.
 - (v) A section of an elliptic paraboloid by a plane is always an ellipse.
 - (vi) The curve $xy^2 + yx^2 = 0$ is symmetric about the origin.
 - (vii) There exists a unique line which is perpendicular to the lines $x = y = \frac{z}{2}$ and $x = y = -z$.
 - (viii) The plane $3x + 4y + 2z = 1$ touches the conicoid $3x^2 + 2y^2 = z^2 = 1$.
 - (ix) The xy- plane intersects the sphere $x^2 + y^2 + z^2 + 2x - z = 2$ in a great circle.
 - (x) Non degenerate conics are non-central.

2.
 - (a) Identify the conic $x^2 + xy + 2y^2 - 2x - 5 = 0$. Also trace it. (4)
 - (b) Find the point of intersection of the line $\frac{x}{4} = y = z - 1$ and the plane $2x + y + z = 5$. Also find the angle between them. (4)
 - (c) Find the new equation of the conicoid $2x^2 + 3y^2 + 5z^2 - xy + z = 1$ when the coordinate system is transformed into a new system with the origin and with the coordinate axes having direction ratios 2, 1, 0; -1, 2, 5; 1, -2, 1 with respect to the old system. (3)
 - (d) Find the path traced by the centre of the sphere which touches the lines $\frac{x}{y} = \frac{y}{-1} = \frac{z}{2}$ and $2x = y, y - z = 0$. (4)

3.
 - (a) Find the reciprocal cone of the cone $x^2 + z^2 - 2yz + 4zx = 0$. (3)
 - (b) Find the equation of the cylinder with base curve $x^2 + y^2 + z^2 - 2x - 4z + 1 = 0, 2x + y + z = 2$. (3)
 - (c) For what value(s) of α , the conicoid $x^2 + y^2 + \alpha z^2 + 2yz + xy + x + 2y + z + 3 = 0$ has a unique centre? Give reason for your answer. (3)
 - (d) Find the angle between the lines $x = 1, z - y = 0$ and $2x - y = -1, z = 1$. (3)
 - (e) Find the equation of the plane which passes through the line of intersection of the planes $2x + y - 2z = 6$ and $2x + 3y + 6z = 5$ and makes equal angles with these planes. (3)

4.
 - (a) Find the equation of the line which passes through $(1, \sqrt{3})$ and makes an angle 30° with the line $x - \sqrt{3}y + \sqrt{3} = 0$. (3)
 - (b) Find the distance of the line obtained in part (a), from the origin by expressing it in the normal form. Also find the intercepts made by this line on the coordinate axes. (3)

- (c) Obtain the equation of the plane passing through the line $\frac{x-1}{2} = \frac{-(y+1)}{1} = \frac{z-3}{4}$ and which is perpendicular to the plane $x + 2y + z = 4$. (3)
- (d) Find the vertices, eccentricity, foci and asymptotes of the hyperbola $\frac{x^2}{8} - \frac{y^2}{4} = 1$. Also trace it. Under what conditions on λ the line $x - \lambda y + 2 = 0$ will be tangent to this hyperbola? Explain geometrically. (6)
5. (a) Find the points of intersection of the conics $\frac{x^2}{4} - \frac{y^2}{9} = 1$ and $\frac{x^2}{6} + \frac{y^2}{9} = 1$. (2)
- (b) Let R be the point which divides the line segment joining $P(2, 1, 0)$ and $Q(-1, 3, 4)$ in the ratio 1:2 such that $PR < PQ$. Find the equation of the line passing through R and parallel to the line $\frac{x}{2} = \frac{y}{1} = \frac{z}{3}$. (3)
- (c) Under what conditions on α , the spheres $x^2 + y^2 + z^2 + \alpha x - y = 0$ and $x^2 + y^2 + z^2 + x + 2z + 1 = 0$ intersect each other at an angle of 45° . (3)
- (d) Find the centre and radius of the circle $x^2 + y^2 + z^2 + 2x + 2y + 4z = 3, 2x - y - z = 3$. (2)
6. (a) Show that the angle between the two lines in which the plane $x - y + 2z = 0$ intersects the cone $x^2 + y^2 - 4z^2 + 6yz = 0$ is $\tan^{-1} \frac{\sqrt{6}}{7}$. (4)
- (b) Using projection show that the line passing through $(-1, 8, 8)$ and $(6, 2, 0)$ is perpendicular to the line passing through $(4, 2, 3)$ and $(2, 1, 2)$. (2)
- (c) At what point the origin must be shifted so that linear terms in the conicoid $x^2 + 2y^2 - z^2 - 2yz + 2xz + x - 3y + z + 4 = 0$ vanish? Justify. (4)
7. (a) Find the new equation of the conicoid $9x^2 + 16y^2 - 36z^2 - 36x - 72z = 144$ when the coordinate system is changed into a new system with the same origin at $(-2, 0, 1)$ and direction ratios same as the old system. (4)
- (b) Find the new equation of the conicoid $184x^2 - 236xy + 88xz + 169y^2 - 14yz + 88z^2 = 324$ when the coordinate system xyz is transformed into another coordinate system $x'y'z'$ under the transformations given by the following table:

	x	y	z
x'	$\frac{2}{3}$	$-\frac{2}{3}$	$\frac{1}{3}$
y'	$\frac{1}{3}$	$\frac{2}{3}$	$\frac{2}{3}$
z'	$-\frac{2}{3}$	$-\frac{1}{3}$	$\frac{2}{3}$

What object does this new equation represents in the coordinates system $x'y'z'$?

Does the old equation represent the same object in the coordinate system xyz ?

Justify your answer. (6)

- (c) Trace the conicoid given by $x^2 + 2z^2 = 4y$. What are the sections of this conicoid by the planes $x + 2 = 0$ and $y = 1$? Describe geometrically. (5)