Course Title: Analytic Geometry **Full marks:** 60
Course number: Math. Ed. 446 (Minor) **Pass marks:** 30
Nature of course: Theory **Chr:** 3
Level: Bachelor Degree 4th semester **Total Period:** 48

1. Course Description

Analytic geometry deals the properties of geometric figures using coordinate system of two or three dimensions in which students will be able to generalize the nature and properties of geometric shapes using algebraic properties. It also defines and represents geometrical shapes in a numerical way. This geometry creates the foundation of most modern fields of geometry including algebraic, differential, discrete and computational geometry.

2. General objectives

The general objectives of this course are as follows:

- To familiarize the students with transformation of coordinates in two dimensions.
- To enable students to derived the equation of parabola and its related terms of a conic section.
- To familiarize students with the nature of ellipse as a conic section.
- To enable students to explain the nature of hyperbola and its asymptotes as a conic section.
- To let students explain the nature of the structure of space and coordinatize a point in different forms.
- To have students derive the equations of the planes, straight lines and spheres.

3 .Specific Objectives and Contents

Specific Objectives	Contents
• Describe the transformation of coordinates of axes • Derive transformation of coordinates of axes through translation and rotation. • Define invariants in orthogonal transformations.	**Unit-I Transformation of Co-ordinates (4)** 1.1 Translation of axes 1.2 Rotation of axes 1.3 Combination of translation and rotation of axes 1.4 Invariants in orthogonal transformation
• Derive equation of parabola • Determine equations of tangents and normal to parabola. • Derive equation of pair of tangents from an external point.	**Unit-II Parabola (5)** 2.1 Definition of Parabola 2.2 Equation of parabola in standard form 2.3 General equation of parabola 2.4 Equation of tangent and normal 2.5 Condition of tangency 2.6 Pair of tangents from an external point
• Derive equation of ellipse. • Identify position of a point with respect to an ellipse. • Find the coordinates of a point on the ellipse in terms of eccentric angle.	**Unit-III Ellipse (6)** 3.1 Definition of ellipse. 3.2 Standard form of ellipse 3.3 Nature of the curve given by: $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$

• Find the equation of the chord joining two points on the ellipse whose eccentric angles are given. • Find the equations of tangent and normal to an ellipse. • Find the equation of tangent from an external point. • Find the equation of a pair of tangents from an external point	3.4 Position of a point with respect to an ellipse 3.5 Auxiliary circle of the ellipse 3.6 Eccentric angle 3.7 Chord joining two points 3.8 Tangent and normal 3.9 Equation of tangent from an external point 3.10 Pair of tangents from an external point
• Derive the equation of hyperbola. • Find the equation of rectangular hyperbola referred to its asymptotes as axes. • Find the equation of asymptotes of hyperbola.	**Unit: IV Hyperbola (4)** 4.1 Definition 4.2 Equation of hyperbola 4.3Nature of the curve $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$ 4.4 Rectangular hyperbola 4.5 Asymptotes of hyperbola and its equations
• Identify the position of a point in space • Find the distance between two points. • Find the coordinates of a point that divides the join of two points in the given ratio. • Determine direction cosines and direction ratios of a line	**Unit-V Coordinates in space (6)** 5.1 Coordinates of a point in space 5.2 Distance between two points 5.3 Section formula 5.4 Angle between two lines 5.5 Direction cosines of a line

• Find the angle between two lines. • Find the projections of a point and a line segment on a line. • Convert Cartesian, spherical and cylindrical coordinates to one another.	5.6 Direction ratios of a line 5.7 Angle between two lines 5.8 Projections 5.9 Cylindrical and spherical coordinates
• Define plane in 3D and establish linear equation representing a plane. • Find equation of plane in intercept form, normal form and reduce general equation of plane in normal form. • Determine plane through three points, plane through the intersection of two planes. • Determine angle between two planes and plane bisecting the angle between two planes. • Establish condition for homogeneous equation to represent a pair of planes	**Unit-VI Plane (8)** 6.1 Linear equation of a plane 6.2 Equation of plane in intercept form and the equation of normal 6.3 Angle between two planes 6.4 Angle between a line and a plane 6.5 Plane through three points 6.6 Plane through the intersection of two planes 6.7 Two sides of a plane 6.8 Length of perpendicular from a point to a plane 6.9 Bisectors of angles between two planes 6.10 Pair of planes 6.11 Conditions for homogeneous second degree equation to represent a pair of planes

	6.12Angle between two planes represented by a second degree homogeneous equation.
• Derive the equation of straight line in symmetrical form and equation of straight line joining two points. • Transform general equation to symmetrical form. • Find angle between a line and a plane. • Derive the condition for a line to lie in a plane. • Derive the condition for co- planarity of lines. • Find the shortest distance between two lines.	**Unit-VII Straight Lines (8)** 7.1 Equation of a straight line in symmetrical form 7.2 Perpendicular distance of a line from a point 7.3 Two forms of the equation of a line 7.4 Angle between a line and a plane 7.5 Condition for a line to lie in a plane 7.6 Plane containing a line coplanar lines, 7.7 Shortest distance between two lines.
• Determine equation of a sphere in different conditions. • Determine the intersection of two spheres. • Discuss the intersection of a sphere and a time. • Find the equation of a tangent plane and determine the condition of tangency.	**Unit-VIII Sphere (7)** 8.1 Equation of a sphere 8.2 General equation of a sphere 8.3 Equation of a sphere through four points 8.4 Plane section of a sphere 8.5 Equation of a sphere with a given diameter

	8.6 Intersection of a two spheres 8.7 Spheres through the given circle 8.8 Intersection of a sphere and a line 8.9 Equation of tangent plane 8.10 Condition of tangency.

4. Instructional Techniques:

The nature of this course being theoretical, teacher-centred instructional techniques will be dominant in teaching-learning process. The teacher will adopt the following techniques :

4.1 General instructional techniques:

- Lecture with illustration
- Discussion
- Demonstration

4.2 Specific instructional techniques:

Unit	Specific Activity and Instructional Techniques
I	• Demonstration and discussion
II	• Assignment and presentation (for all units)
III	• Discussion and assignment
IV	• Assignment and presentation
V	• Individual and group work presentation

VI	• Discussion and assignment
VII	• Assignment and presentation
VIII	• Discussion and assignment

5. Evaluation:

5.1 Internal evaluation:

Internal evaluation will be conducted by course teacher based on following activities:

a. Attendance	5 points
b. Participation in learning activity	5 points
c. First assessment test	10 points
d. Second assessment test	10 points
e. Third assessment test	10 points
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Total	40 points

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5.2 External Evaluation :

Faculty of Education, Examination division will conduct final examination of weight 60

points at the end of semester. This 60 points is divided in final examination paper as

Objective question	(10x1)	10 points
Short answer question	(6x 5)	30 points
Long answer question	(2x 10)	20 points
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Total		60 points

6. Recommended and Reference Books

6.1 Recommended Books

Koirala S.P., Pandey U.N. & Pahari N.P. (2009), *Analytic geometry* Kathmandu; Vidyarthi Prakashan (P) Ltd. (Third revised ed. 2016). (For all units)

Joshi M.R. (1997); *Analytic geometry*, Kathmandu; Sukunda Pustak Bhandar

Loney S.L. (1984): *The elements of coordinate geometry*; New Delhi: S. Chand and company Pvt. Ltd.

6.2 **Reference Books**

Chatterjee,D. *Analytical solid geometry*,New Delhi :Prentice Hall of India Private limited.

Chatterjee,D.

Narayan S. and Mittal P.K. (2001), *Analytical Solid geometry*, New Delhi: S.Chand and Company Pvt. Ltd.

Prasad L.(1990), *Analytical Solid geometry*, Panta: Paramount Publication

Sthapit Y.R. & Bajracharya B.C. (1992), *A textbook of three dimensional geometry*; Kathmandu: Sukunda Pustak Bhandar.

Thomas G.B. & Finney R.L. (2004), *Calculus and analytic geometry* New Delhi: Pearson publication.

Mittal P.K.(2007), *Analytical geometry* ,Delhi:Vrinda publication (P)LTD