Kotebe University of Education
College of Natural and Computational Sciences
Department of Mathematics

Course Syllabus on 'Transformation Geometry'

Course Code: Math 3053

Credit Hours/ ECTS: 3,　**Contact hrs:** 3,　**Tutorial hrs:** 2

Length of time to complete the course: 16 weeks

Total number of load hours the student will carry to complete the course: 189 hrs

Prerequisite courses: Math 2042, Math 2052 **Course category:** Compulsory

Year: III　Semester: I

Program: B.SC. in Mathematics

Aims

The main theme of the course is to introduce to students the interplay between transformation and geometry. It rigorously treats various transformations in Affine space. It is a prerequisite for differential and projective geometries.

Course description

This course covers group of transformations, Affine Geometry, orthogonal transformations, orientation preserving transformations, representation of orthogonal transformations, similarity transformations, Affine transformations, and projective transformations.

Learning Outcomes

On completion of the course successful students will be able to:

- understand the basic properties of transformations,
- recognize the axioms and the associated theorems of affine geometry,
- understand the basic properties of orthogonal transformations,
- understand the basic similarity transformations and their representations,

- understand the basic properties of affine transformations,

- identify several classes of affine transformations,

- understand the relationship between affine transformations and linear mappings.

Mode of Delivery: This course will be offered in a semester based mode of delivery

Course Contents

1. **Group of transformations (6 hrs)**

    1.1 Definition of transformation

    1.2 Examples of group of transformations

2. **Affine geometry (12 hrs)**

    2.1 Axioms of an affine space

    2.2 Geometry in an affine space

    2.3 Lines and planes in an affine space

    2.4 Concurrency

    2.5 Classical theorems (Menelaus, Ceva, Desargues, and Papus.)

3. **Orthogonal transformations (12 hrs)**

    3.1 Properties of orthogonal transformations

    3.2 Orientation preserving and orientation reversing orthogonal transformations

    3.3 The fundamental types of orthogonal transformations of the plane (translations, reflections and rotation)

    3.4 Representation of orthogonal transformations as product of the fundamental orthogonal transformations

    3.5 Orthogonal transformations of the plane in coordinates

4. **Similarity transformations (9 hrs)**

    4.1 Properties of similarity transformations

    4.2 Homothetic transformations

    4.3 Representation of similarity transformations as the product of homothetic and an orthogonal transformations

    4.4 Similarity transformations of the plane in coordinates

5. **Affine transformations (9 hrs)**

    5.1 Definition and examples of affine transformations (orthogonal and Similarity transformations, Skew reflection, compressions, Shear)

    5.2 Properties of Affine transformations

    5.3 Affine transformations and linear mappings

Teaching-Learning Strategy/Methods

Lectures, Tutorial, Group Assignments

Assessment Strategy/Methods

- Assignment: 20%

- Tests: 30%

- Semester Examination: 50%

Course Policy

A student has to

- Attend at least 85% of the classes

- Take all continuous assessments

- Take final examination

- Respect all rules and regulations of the university

References

[1] Martin, G. E., Transformation geometry: An introduction to symmetry. Springer Science & Business Media, (2012).

[2] Modenov, P. S., and Parkhomenko, A. S. Geometric transformations (Vol. 1). Published in cooperation with the Survey of Recent East European Mathematical Literature [by] Academic Press, (1966).

[3] Cederberg, J. N. A course in modern geometries. Springer Science & Business Media, (2013).

[4] Thomas, D. A. Modern geometry. Brooks/Cole, (2002).

[5] Wallace, E. C., and West, S. F. Roads to geometry. Waveland Press, (2015).

[6] Musser, G, L., Trimpe, L., and Maurer, V. R. College geometry: A problem solving approach with applications. 2 nd ed., Pearson, (2008).