COURSE CODE	**GIE-312**
COURSE NAME	**GEODESY AND MAP PROJECTIONS**
CREDIT HOURS	Theory: 02
	Practical: 01
	Total: 03
CONTACT HOURS	Theory: 32
	Practical: 48
	Total: 80
PREREQUISITE	Nil

MODE OF TEACHING:

Instruction:	Two hours of lecture per week	67%
Practical:	Three hours of Lab work per week	33%

COURSE DESCRIPTION:

The course involves: the fundamentals and modern concerns of geodesy, recent developments, and applications of global and satellite geodesy; the gravity field of the earth and how it affects observations; the geometry of the ellipsoid; determination of geographical and map projection coordinates from geodetic observations; and the concept of a geodetic datum and how to transform coordinates from one datum to another.

COURSE OBJECTIVES:

This course targets the development of skills and concepts related to the geodetic parameters behind any GIS project. This course would also remove some of the mystery surrounding the subject and to show its clear link to the other Geo-Science disciplines.

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students achieve following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐

2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

COURSE LEARNING OUTCOMES (CLOs):

Upon successful completion of the course, students will be able to:

No.	CLO	Domain	Taxonomy Level	PLO
1	Comprehend the basics of geodesy and map projections	Cognitive	2	1
2	Compare and analyze different map projection and geodetic reference systems	Cognitive	4	2

PRACTICAL APPLICATIONS:

This course will enable student to understand the basics and modern geodesy along with map projections and their usage in surveying and Geoinformatics engineering through usage of modern tools and techniques.

TOPICS COVERED:

Theory:

Week	Topics
1	An Introduction to Geodesy
2	Historical perspective on Geodesy
3	Functions, Branches and Observation Techniques of Geodesy
4	Earth as a sphere, Geodesy in the current world
5-6	Coordinate Reference Systems, Reference Frames and Datums- Definition

	of a Terrestrial Reference System (TRS), Satellite Laser Ranging, Very Long Baseline Interferometry
7	Terrestrial Reference Frame and its related issues (Polar Motion, Position of Zero Meridian, Dynamics of Earth)
8	Geometric Geodesy-Spherical Geometry and Coordinates, Distance along great and small circle arc
9	Properties of Spherical Triangle, Spherical Excess, Legendre Theorem
10	Ellipsoidal Geometry and Ellipsoidal Sections (Equator, Parallel, Meridian), Geodetic Coordinates, Prime Vertical Section, Normal Section
11	Derivation of a relationship between geodetic latitude, geocentric latitude & reduced latitude
12	Physical Geodesy-Gravity Field of the Earth, Geopotential, Units of Gravity and Geopotential, Gravimetry, Gravity Anomalies
13	Isostasy
14	Space Geodesy- Satellite Geodetic Measurement Techniques (Earth to Space Methods, Space to Earth Methods, Space to Space Methods, Kepler's Law).
15	Map Projections -Classification of Projections, Distortions of Projections
16	Quantification of Distortion and rectification, Datum Transformations, Examples of Modern Projects
17-18	**ESE**

Practicals:

No.	**Topic**
1	Development of different ellipsoidal models for datum creation with various ellipsoidal parameters i.e., major axis, minor axis, transformation units.
2	Creation of Fishnet for a particular area which must be projected using Various Spatial Software.
3	Convert a dataset from coordinate systems to different projections along with

	statistical measurement of types of distortion.
4	Test the data conversion and understanding of various distortion effects.
5	Draping a map over a globe and comparison of different map projections along with their effects of 1 and 2 standard parallel.
6	Optimizing the globe's orientation, positioning the light source, examine perspective along with aspect and selection of appropriate parameters.
7	Development and Analysis of Map Projection Distortions with Scale Factor and Tissot's Indicatrix. Development of Universal Transverse Mercator map projection and Analysis of Tissot's Indicatrix. Development of Lambert Conformal Conic map projection with two standard parallels and Analysis of Tissot's Indicatrix.
8	Development of Stereographic azimuthal map projection and Analysis of Tissot's Indicatrix.
9	Mapping the Features of Earth on Google Earth using Different Map Projection and Coordinate Systems.
10	Prepare a set of three layouts showing how the world, the Pakistan and Islamabad look in geographic coordinates and in various map projections.
11	Integrating data with different coordinate systems and the use of data with different coordinate systems in the same map.

TEXT AND MATERIAL:

Textbook (s):

a. Smith, J. (1996). Introduction to geodesy. New York: Wiley. ISBN: 978-0471166603

References Material:

a. Melluish, R. (2014). Introduction to the mathematics of map projections. [Place of publication not identified]: Cambridge Univ Press. ISBN: 978-1107658486
b. Torge, W., &Müller, J. (2012). Geodesy. Berlin: De Gruyter. ISBN: 978-3110207187

c. Maling, D. (1992). Coordinate systems and map projections. Oxford: Pergamon Press. ISBN: 978-0080372334

ASSESMENT SYSTEM:

1. CLOs Assessment

Cognitive	**Psychomotor**	**Affective**
Spreadsheet	-	-

2. Relative Grading

Theoretical / Instruction			67%
	Assignments 10%		
	Quizzes 10%		
	Mid Exams 30%		
	End Semester Exam 50%		
Practical Work			33%
Laboratory Work		*70%*	
	Laboratory Attendance 20%		
	Laboratory Report 20%		
	Laboratory Quiz 30%		
Viva/Quiz		*30%*	
Total			**100%**