Course Type	Course Code	Name of the Course	L	T	P	Credits
DC	NMNC525	Geodesy and GNSS Survey	3	1	0	4

Course Objective

- The course will provide an understanding the concept of Geodesy and precise point positioning using GNSS observations, Theoretical and practical basics of satellite positioning by the global systems.

Learning outcomes

- Students will learn the concepts of geodesy, Geodesy Observation techniques, GNSS, data processing techniques of GNSS.

Units	Course Content	L+T	Learning Outcomes
Unit 1	**Geodesy:** Shape of the earth, geoid, spheroid and ellipsoid of revolution, use of gravity in geodesy, coordinate system, geodetic reference systems	3L+1T	Student will learn about geodesy, coordinate system, spheroid and ellipsoid
Unit 2	Calculations on the ellipsoid, astronomical and geodetic coordinates, optometric, dynamic and normal heights, geopotential number	5L+1T	Student will learn about dynamic and normal height calculations.
Unit 3	**Geodesy Observation techniques:** Geometric techniques – total stations, strain meters, tide gauges, global navigation satellite systems, satellite laser ranging, very long baseline interferometry, satellite altimetry (radar and laser), interferometric SAR; gravimetric techniques – absolute gravimetry, relative gravimetry, satellite gravimetry.	6L+3T	Student will learn about geodesy observation techniques.
Unit 4	**GNSS:** Principles of GNSS: Introduction to GNSS, Time and Reference Systems, Satellite Orbits and Attitude, Signals and Modulation, Clocks, Atmospheric Signal Propagation, Satellite Navigation Systems: The Global Positioning System (GPS), GLONASS, Galileo, Chinese navigation satellite system, regional systems	5L+2T	Student will learn about principals of GNSS, satellite orbit, Satellite Navigation Systems and Regional systems
Unit 5	GNSS Receivers and Antennas: Receiver architecture, Signal processing, Multipath, Interference, Antennas, Simulator and test equipment, GNSS Algorithm and Models: Basic observation equations, combinations of observations, positioning model, least-squares estimation and kalman filtering, carrier phase integer ambiguity resolution, batch and recursive model validation	8L+3T	Student will learn about Receivers and Antennas and GNSS Algorithm and Models.
Unit 6	Positioning and Navigation: precise point positioning, differential positioning, attitude determination, GNSS/INS integration, land and maritime applications, aviation applications, ground-based augmentation system, space applications	4L+2T	Student will learn about point positioning of GNSS data.

Unit 7	Surveying, Geodesy and Geodynamics: the international GNSS service, orbit and clock product generation, surveying, geodesy, geodynamics	4L+1T	Student will learn about international GNSS service and orbit and clock product generation.
Unit 8	GNSS Remote Sensing and Timing: monitoring of the neutral atmosphere, Ionosphere monitoring, reflectometry, GNSS time and frequency transfer	7L+1T	Student will learn about monitoring of the neutral atmosphere.
	Total	**42L+14T**	

Textbooks:

1) Torge, Wolfgang / Müller, Jürgen (2012) "Geodesy"

2) Lu, Zhiping, Qu, Yunying, Qiao, Shubo (2014) "Geodesy: Introduction to Geodetic Datum and Geodetic Systems"

Reference books

1. J. Sanz Subirana, J.M. Juan Zornoza and M. Hernández-Pajares (2013)
2. Clement A. Ogaja (2022) "Introduction to GNSS Geodesy: Foundations of Precise Positioning Using Global Navigation Satellite Systems"