Category: Open Elective

Course Code: DPG101OE	**L**	**T**	**P**	**S**	**Credits**
Course Name: Geographic Information Systems (GIS) and Spatial Analysis	1	0	1	0	2

Course Description:

This course introduces the basic principles and practices of Geographic Information Systems (GIS). Students will explore the capabilities of GIS in capturing, analysing, and visualizing spatial data. Emphasis will be placed on learning key concepts, tools, and techniques, with practical applications and hands-on experience in GIS software. By the end of the course, students will be able to use GIS for spatial analysis and understand how GIS is used in various fields, such as environmental management, urban planning, and architecture.

Course Outcomes:

By the end of the course, students will be able to:

- Understand the basic concepts, definitions, and components of GIS.
- Explore different types of GIS data, including vector and raster data models.
- Develop skills in geospatial data acquisition, processing, and management.
- Apply spatial analysis techniques using GIS software.
- Interpret and present geospatial information effectively.

Course Contents:

Module 1: Introduction to GIS

Understanding GIS: Definition and Scope, History and Evolution of GIS, Key Applications of GIS in Various Fields (Environmental Science, Urban Planning, Agriculture, etc.); Components of GIS: Hardware, Software, Data, People, and Procedures; Overview of GIS Software Packages (ArcGIS, QGIS, etc.); Types of GIS: Desktop GIS, Web GIS, Mobile GIS, and Cloud GIS; Differences and Uses.

Module 2: Geospatial Data and Analysis

GIS Data Models: Vector Data Model (Points, Lines, Polygons), Raster Data Model (Grids, Images), Concept of Attribute Data, Geospatial Data Types and Sources: Primary vs. Secondary Data; Types of Geospatial Data: Satellite Imagery, Aerial Photography, GPS Data, and Sensor Data; Publicly Available Data Sources and Data Portals; Georeferencing and Map Projections: Concept of Georeferencing, Coordinate Systems and Projections, Spatial Data Analysis: Vector Analysis: Buffer, Overlay, and Network Analysis; Raster Analysis: Map Algebra, Terrain Analysis (Slope, Aspect); Working with Map Layouts in GIS; Spatial Querying and Data Retrieval: Attribute and Spatial Queries

Book/Resources

1. Concepts and Techniques of Geographic Information Systems. C. P. Lo, Albert K. W. Yeung
2. Remote Sensing and Image Interpretation, 7th Edition. Thomas Lillesand, Ralph W. Kiefer, Jonathan Chipman

Course Code: DPG104DCE	**L**	**T**	**P**	**S**	**Credits**
Course Name: Introduction to Remote Sensing	1	0	1	0	2

Course Description:

This course introduces the basic principles of Remote Sensing (RS) and Electromagnetic radiation. Students will gain basic knowledge about the interaction of electromagnetic radiation with different earth surface features, sensors used in earth observation, different areal and space born platforms and some key application areas of RS. Practical applications and hands-on experience in Digital image processing will be given to students. By the end of the course, students will be able to choose and apply application specific RS data, such as environmental management, urban planning, and architecture.

Course Outcomes:

By the end of the course, students will be able to:

- Understand the basic concepts, definitions, and components of RS.
- Explore various RS platforms and data, including.
- Develop skills in RS data acquisition, processing, and management.
- Basic Digital Image Processing and software's required.
- Basic satellite data interpretation.

Course Contents:

Module 1: Introduction to Remote Sensing

Overview of Remote Sensing Remote sensing: Definition, history and scope; Overview of a typical remote sensing system and its components; Electromagnetic radiation (EMR) and Electromagnetic Spectrum (EMS); Interactions of EMR with earth's surface features: vegetation, water, and soils.

Module 2: Sensors and Platforms

Sensors and Satellite systems; Sensor resolution (Spatial, spectral, temporal) and its importance; Characteristics of important satellite systems: LANDSAT and IRS; Applications of satellite data in earth observation; Elements of image interpretation; basic Image processing techniques

Book/Resources

3. Remote Sensing and Image Interpretation, 7th Edition. Thomas Lillesand, Ralph W. Kiefer, Jonathan Chipman
4. Fundamentals of Remote Sensing, S.C. Bhatia

Course Code: DPG102OE	**L**	**T**	**P**	**S**	**Credits**
Course Name: Fundamentals of Climate Science	1	0	1	0	2

Course Description:

This introductory course provides the students with essential concepts in climate science. It focuses on the fundamental components of the climate system, the mechanisms driving climate change, and the tools used to study climate. Each chapter includes a hands-on activity to reinforce learning.

Course Outcomes:

By the end of the course, students will be able to:

- Differentiate between weather and climate, explaining the key components of the climate system and their interactions.
- Identify the natural and anthropogenic factors that contribute to climate change, demonstrating an understanding of the greenhouse effect.
- Utilize climate models and tools to analyze climate data, predicting potential changes in climate based on various scenarios.
- Engage in hands-on activities that reinforce theoretical concepts, fostering critical thinking and practical application in climate science.

Course Contents:

Module I: Introduction to the Climate System

Define climate and climate change; Climate and weather; Key climate variables (Temperature, Precipitation, wind, evaporation, ET, LST); Earth's Energy Budget**:** Solar radiation, reflection, and absorption; Components of the Climate System: Atmosphere, Hydrosphere, Lithosphere, Cryosphere and Biosphere; Climate System Feedbacks Positive (ice-albedo feedback) and negative (cloud feedback); climate extremes Group activity: Basic analysis of observed climate, plotting, analysis and basic interpretation of climate data using MS Excel.

Module II: Causes of Climate Variability and Change

Natural Causes of Climate**:** Solar radiation changes, Volcanic activity, Ocean-atmosphere interactions (e.g., El Niño and La Niña); Anthropogenic Climate Forcing: Greenhouse Gas Emissions, Greenhouse gas emissions (CO_2, Methane), deforestation, industrial activities; Radiative Forcing and the Greenhouse Effect; Group Activity: Analysis of a time series GHG data from reanalysis and satellite derived-data to determine trends

Book/Resources

5. Weather and Climate: An Introduction" by Greg O'Hare, John Sweeney, and Rob Wilby
6. Introduction to Modern Climate Change" by Andrew E. Dessler
7. Climate Science: A Very Short Introduction" by Mark Maslin
8. Climate Change: Causes, Effects, and Solutions" by Edward A. Bryant

Category: Multidisciplinary (FYUGP Semester-I)

Course Code: DPG101MD	**L**	**T**	**P**	**S**	**Credits**
Course Name: Exploring Neighbourhood with Space Technology	1	1	1	0	3

Course Objectives:

This course introduces students to the innovative use of space technology in exploring and understanding neighbourhoods. Through a combination of theoretical discussions, case studies, and hands-on projects, students will gain a comprehensive understanding of how space technology, including satellite imagery, remote sensing, and geographic information systems (GIS), can be leveraged to analyse, monitor, and improve neighbourhoods.

Course Outcomes:

By the end of the course, students will be able to:

- Understand the principles of space technology and its applications in analysing neighbourhoods.
- Analyse neighbourhood characteristics and dynamics using satellite imagery and remote sensing data.
- Apply Geographic Information Systems (GIS) techniques to map and visualize neighbourhood features and changes.
- Evaluate the role of space technology in urban planning, community development, and environmental monitoring.

Course Contents:

Module I: Introduction to Space Technology

Overview of space technology: remote sensing, satellites, GIS; remote sensing; Interpretation and analysis of satellite imagery for neighbourhood exploration; Introduce available satellite data for processing and analysis.

Module II: GIS for Neighbourhood Analysis

Mapping neighbourhood features and dynamics using GIS; Overview of GIS Softwares (QGIS); Google Earth and its capabilities; Mobile & WebGIS; Data collection using GPS; Introduce students to different case studies, identify gaps, challenges & opportunities.

Module III: Social Equity and Neighbourhood Analysis

Exploring social equity issues through space technology; Analysing spatial patterns of inequality and access to resources; Analysing demographic, socioeconomic, and environmental factors; Introduce available socioeconomic data for processing & analysis, identify gaps, challenges & opportunities.

Book/Resources

i. Concepts and Techniques of Geographic Information Systems. C. P. Lo, Albert K. W. Yeung
ii. Remote Sensing and Image Interpretation, 7th Edition. Thomas Lillesand, Ralph W. Kiefer, Jonathan Chipman