Application of GIS and GPS in Civil Engineering

01CI0714

Objective of the Course:

- To introduce students to the principles, techniques, and applications of Geographic Information Systems (GIS) and Global Positioning Systems (GPS) in the field of Civil Engineering
- Students will learn about the fundamental concepts of GIS and GPS technologies.
- Student will learn how they can be effectively utilized in various civil engineering applications such as urban planning, transportation, environmental engineering, and infrastructure management
- Students will learn how to apply GIS and GPS technologies to analyze spatial data

Credit Earned: 04

Prerequisite: Basics Knowledge of GIS

Student's learning outcomes:

After successful completion of the course, it is expected that students will be able to,

1. Describe the basic concepts and functionalities of GIS and GPS systems.
2. Apply principles of various data collection methods and remote sensing techniques.
3. Analyze GIS data models and GPS applications in civil engineering.
4. Utilize GIS software and assess emerging trends in GIS and GPS technologies.

Teaching and Examination Scheme

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE (E)	IA (M)	CSE (I)	Viva (V)	Term Work (TW)	
03	00	02	04	50	30	20	25	25	150

Detailed Syllabus

Sr. No	Topic name	Hours
1	**Introduction to GIS and GPS**	**04**
	1.1 Definition and basic concepts	1
	1.2 Historical development	1
	1.3 Components and functionalities of GIS and GPS systems	2
2	**GPS & Spatial Data Acquisition**	**05**
	2.1 Principles of spatial data collection	1
	2.2 GPS data collection methods (static, kinematic, differential)	2
	2.3 Remote sensing techniques and data sources	2
3	**GIS Data Models and Data Analysis**	**12**
	3.1 Vector data model, Raster data model and Attribute data	4
	3.2 Common GIS data formats (shapefiles, geodatabases, etc.)	2
	3.3 Data storage and organization	2
	3.4 Spatial analysis techniques (buffering, overlay, proximity analysis)	2
	3.5 Geoprocessing operations	2
5	**GPS Applications in Civil Engineering**	**08**
	4.1 Surveying and mapping	2
	4.2 Construction site layout and monitoring	2
	4.3 Geotechnical investigations	2
	3.4 Transportation planning and traffic management	**2**
6.	**Introduction of GIS Software**	**07**
	6.1 Introduction to GIS software (e.g., ArcGIS, QGIS)	4
	6.2 GIS data analysis and visualization projects	3
7.	**Emerging Trends and Future Directions**	**06**
	7.1 Advanced GIS and GPS technologies	2
	7.2 Integration with Building Information Modeling (BIM)	2
	7.3 Smart cities and Internet of Things (IoT) applications	2
	TOTAL	**42**

List of Activities

Sr. No	Topic name
1	Geodatabase creation
2	Spatial data Integration (Digitization) – point, line, polygon.
3	Determination of Latitude, Longitude, and height by GPS.
4	Tracking through GPS
5	Non-Spatial Data Integration.
6	Handling of GPS, data collection and integration of GPS data
7	Area calculation by GPS
8	Familiarization with ARC GIS software

9	Georeferencing in ARC GIS
10	Data input, data editing and topology creation
11	Digitization and layer creation
12	Linking spatial and non-spatial data
13	Buffer analysis and quarry analysis (selection by location and selection by attributes)
14	Network analysis: finding the shortest route between two places, finding the optimum path etc.

Suggested Theory Distribution

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve an effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember	Understand	Apply	Analyze	Evaluate	Create
5%	10%	30%	30%	15%	10%

Instructional Method and Pedagogy:

1 Prerequisite of the course and its pattern shall be discussed on the commencement of the course.
2 Lectures shall be conducted in class room using various teaching aids.
3 Presence in all academic sessions is mandatory which shall carry 5% marks of the total internal evaluation.
4 At the end of each unit/topic an assignment based on the course content shall be given to the students which shall carry 5% weightage for timely completion and submission of the assigned work.

Recommended Study Material

1. Introduction Longley, P. A., Goodchild, M. F., Maguire, D. J., & Rhind, D. W. (2015). Geographic Information Science and Systems. John Wiley & Sons.
2. Kang-tsung Chang. (2015). Introduction to Geographic Information Systems. McGraw-Hill Education.
3. Davis, P., & Fonstad, M. (2013). GIS for Landscape Architects. ESRI Press.
4. Arsanjani, J. J., Zipf, A., Mooney, P., & Helbich, M. (Eds.). (2019). OpenStreetMap in GIScience: Experiences, Research, and Applications. Springer.
5. Li, S., Dragicevic, S., Castro, F. A., & Sester, M. (Eds.). (2018). Geospatial Data Science: Techniques and Applications. CRC Press.

Web Links

1. https://www.youtube.com/watch?v=2kvT93QlFto&list=PLX17kXRvcmbEYwA1ZGlqHDCMXhkYjR2Rk
2. https://www.youtube.com/watch?v=ZNKOWP8qAMY&list=PL8ZbncaV3f_anQs_DoyKUxmNDApxM0HT8
3. https://www.youtube.com/watch?v=vs4KSiwDO1M&list=PLpgQWSI_ty3YIvugFyVI4d8wl21pbETcb