Birla Institute of Technology & Science, Pilani
Hyderabad Campus

FIRST SEMESTER 2023-2024

Course Handout Part II

Date: 11-08-2023

In addition to part-I (General Handout for all courses appended to the timetable) this portion gives further specific details regarding the course.

Course No. : **CE F431**

Course Title : **PRINCIPLES OF GEOGRAPHICAL INFORMATION SYSTEMS**

Instructor – in – Charge : RAJITHA K

Scope & Objective: The course introduces the fundamentals of Geographic Information Systems. The main objective of the course is to promote a good foundation in GIS and working knowledge of fields strongly related to GIS in the computing perspective. Different algorithms for spatial analysis are discussed in the course illustrated with case studies. The course will also guide the students through projects and to apply concepts and ideas in various application areas and to establish a motivation towards research in thrust areas related to GIS.

Course Outcomes: At the end of the course, student will be able to

- Develop framework for analyzing the spatial data obtained from satellite platform and UAV platform
- Generate spatial datasets utilizing the primary data obtained from GPS , satellite images and ancillary datasets
- Solve spatial related problems related to Civil Engineering discipline utilizing satellite images and GIS software

Student Learning Outcomes (SLOs) assessed in this course: **(a), (b), (c), (d), (e), (h), (i), (j) and (k).**

Text Book:

T1: Kang-tsung Chang; “Introduction to Geographic Information Systems” , Tata

McGraw-Hill , 9 th ed. 2020.

Reference Books:

R1: Thomas M Lillesand, and Ralph W Kiefer; "Remote sensing and Image Interpretation", John Wiley & Sons,7th ed. 2015

R2: Basudeb Bhatta, Remote sensing and GIS, Oxford University Press, Third edition, 2021.

R3: Michael F. Worboys, "GIS: A Computing Perspective", Taylor & Francis Ltd; 1995, second edition. 2016

Course Plan:

Lecture No.	Topics to be covered	Learning objectives	Reference	SLO*
1-2	Introduction to GIS	**S**tudy the basic concepts of GIS, **L**ist the advantages and scope of applications in different field of Engineering and science	T1 , R1 ,Lecture notes	(a),(k)
3-5	GIS Functionality: Interface, Spatial data, Raster data model and vector data model	**S**tudy the different types of spatial datasets **A**nalyze the spatial datasets to solve real life problems	T1, R1	(a), (b)
6-12	Co-ordinate system and Geo-Referencing and map Projection	**D**iscuss the different types of coordinate system **E**valuate the performances for various cases	T1, R1,R2, Lecture notes	(a), (b)
13	Digitization, Encoding, and	**D**iscuss the different types of spatial data	T1 , R1, Lecture	

	Structuring of data	generation techniques **A**nalyze the spatial data for different applications	notes	(a), (b)
14-18	Remote sensing Fundamentals	**S**tudy the basics of remote sensing techniques, **D**iscuss the laws governing remote sensing process **E**xamine the utility of data for solving real world problems	T1 , R1, Lecture notes	(a), (j)
19-20	Basics of Global Navigation Satellite System (GNSS)	**S**tudy the Global Navigation Satellite System **D**iscuss trilateration, errors and advances in GNSS	Lecture notes	(a),(j), (k)
21-22	RADAR, TM and Multispectral sensing Radar: basics and application	**S**tudy on advanced remote sensing sensors **D**iscuss the real life applications focusing GIS utility	T1 ,R2, Lecture notes	(a),(j)
23-25	Deterministic and Statistical spatial interpolation	**S**tudy the different Spatial Interpolation techniques **E**xamine the performances of different techniques	T1, R1, Lecture notes	(a), (b)
26-28	Triangulation, DEM, TIN, terrain mapping	**D**iscuss the different computational algorithms for	T1, Lecture notes	(a), (b)

	and analysis	triangulation and spatial analysis **A**nalyze the performance of triangulation methods		
29-31	Network analysis, Geocoding, Path analysis and network applications	**D**iscuss the computational algorithms for network analysis and location – allocation problems **S**olve problems related to network analysis	R1, Lecture notes	(a), (e)
32-34	Advances in Geo-spatial technology, WebGIS	**D**iscuss the advances of cloud and web based geospatial techniques **D**esign of Web based **a**pplications	Lecture notes	(a), (b), (e)
35-40	Transportation, Environment, water resources and allied fields applications	**Di**scuss various current applications of GIS through case studies for multi-disciplinary engineering related applications	Lecture notes	(h),(i),(j), (k)

Details of lab classes:

1. Introduction to Geo-spatial related Open source software (QGIS/SNAP/Google Earth Engine)
2. Access to the open source dataset and understanding spatial datasets
3. Georeferencing of raster dataset
4. Spatial database creation and digitization of spatial datasets.
5. Attribute data integration to the vector data and Map composing
6. Spatial analysis tools, querying, joining data. Use of editing tools, buffer and overlay analysis and creation of thematic maps
7. Spatial data modelling using data obtained from UAV, DEM, TIN generation from point datasets and its applications

8. Watershed delineation and estimation of morphometric parameters
9. Network analysis and Location –allocation problems
10. Introduction to WebGIS related applications
11. Geo-spatial applications in the domain of transportation
12. Geo-spatial applications in the domain of Environmental Engineering

***Student Learning Outcomes (SLOs):**

SLOs are outcomes (a) through (k) plus any additional outcomes that may be articulated by the program.

(a) an ability to apply knowledge of mathematics, science and engineering
(b) an ability to design and conduct experiments, as well as to analyze and interpret data
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
(d) an ability to function on multidisciplinary teams
(e) an ability to identify, formulate, and solve engineering problems
(f) an understanding of professional and ethical responsibility
(g) an ability to communicate effectively
(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
(i) a recognition of the need for, and an ability to engage in life-long learning
(j) a knowledge of contemporary issues
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Evaluation Scheme:

Component	Duration	Weightage (%)	Date & Time	Nature of Component
Midsemester test	90 min	25	13/10 - 9.30 - 11.00AM	CB
Lab[1]	-	15	Continuous	OB
Project[2]	-	15	Continuous	OB

Lab test	30 min	5		CB
Comprehensive Exam.	180 min	40	18/12 FN	CB

[1] **All lab are evaluative**

[2] **The project is mandatory for the completion of the course**

Chamber Consultation Hour: Saturday 2-3 PM
Notices: Notices will be displayed on Google classroom.

Make-up Policy:
Only genuine cases will be granted make up.
Special Instructions for Lab sessions:

- The lab sessions targets to provide soft skill in the domain of advances in geo-spatial data processing. Only open source software will be utilized for the lab

Academic Honesty and Integrity Policy: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

Instructor-In-Charge
CE F431