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**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. Themain 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](https://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor:%22Basudeb+Bhatta%22&source=gbs_metadata_r&cad=8), 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 Structuring of data | **D**iscuss the different types of spatial data generation techniques  **A**nalyze the spatial data for different applications | T1 , R1, Lecture 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 and analysis | **D**iscuss the different computational algorithms for triangulation and spatial analysis  **A**nalyze the performance of triangulation methods | T1, Lecture notes | (a), (b) |
| 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.

1. an ability to apply knowledge of mathematics, science and engineering
2. an ability to design and conduct experiments, as well as to analyze and interpret data
3. 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
4. an ability to function on multidisciplinary teams
5. an ability to identify, formulate, and solve engineering problems
6. an understanding of professional and ethical responsibility
7. an ability to communicate effectively
8. the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
9. a recognition of the need for, and an ability to engage in life-long learning
10. a knowledge of contemporary issues
11. 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**