UNIVERSITY OF THE PUNJAB

NOTIFICATION

It is hereby notified that the Syndicate at its meeting held on 27-07-2023 has approved the recommendations of the Academic Council made at its meeting dated 24-05-2023 regarding approval of the Revised Syllabi and Courses of Reading for Ph.D. in Geomatics under Semester System at the College of Earth and Environmental Sciences w.e.f. the Academic Session, 2021 and onward.

The Syllabi and Courses of Reading for Ph.D. in Geomatics under Semester System is attached herewith as Annexure 'A'.

Sd/-
REGISTRAR

Admin. Block,
Quaid-i-Azam Campus,
Lahore.

No. D/ 7662 /Acad. **Dated: 11- 10 /2023.**

Copy of the above is forwarded to the following for information and further necessary action: -

1. Dean, Faculty of Geo Sciences.
2. Principal, College of Earth and Environmental Sciences.
3. Controller of Examinations
4. Director, IT for placement at the website
5. Admin Officer (Statutes)
6. Secretary to the Vice-Chancellor.
7. PS to the Registrar.
8. Assistant Syllabus.

Assistant Registrar (Academic)
for Registrar

COLLEGE OF EARTH AND ENVIRONMENTAL SCIENCES
UNIVERSITY OF THE PUNJAB, LAHORE

Approval of Revised Courses & Syllabi for PhD in Geomatics

The curriculum and courses for PhD in Geomatics were approved from various statutory bodies of the University of the Punjab. Presently College of Earth and Environmental Sciences intends to revise the courses & syllabi keeping in view the advancements in the field of Geomatics. Most of the courses have been designed according the latest trends of the subject that can provide an interest to the students and later help them for competing in the job market.

Program Title: **PhD in Geomatics**

Department: **College of Earth and Environmental Sciences**

Faculty: **Geosciences**

1. Department Mission

Our mission is to address the issues regarding environmental sciences using modern Geospatial techniques. The basic goal is to develop new technologies related to Geomatics and Environmental Sciences. As Geomatics, Environmental sciences, Occupational health and safety Hydrology and Tourism & Hotel Management are professional degrees, the College seeks to provide education and training in the multiple dimensions of contemporary Environmental issues toward developing solution for a more sustainable future.

2. Introduction

Keeping in view the importance and the growing demands for training manpower in the emerging discipline, the College of Earth and Environmental Sciences has been established in the University of the Punjab in 2005. The new building of the College was completed in November 2008, featuring spacious rooms, moderately equipped laboratories, a library and large grounds.

College of Earth and Environmental Sciences provides a learning educational environment to students with the opportunities to acquire knowledge and skill to build a successful career and become an integral part of the community. Students will study different subjects related to Geomatics i.e., cartography, advanced spatial analysis, applications of geomatics in environmental sciences, geospatial applications for climate change, environmental

management, air pollution modelling, population dynamics, ecosystems, urbanization etc. Provision of high-quality education is the integral part of the college to produce graduate s of international standard. Furthermore, ethical and moral standards developing leadership capabilities and professionalism are the main goals of the college.

3. Program Introduction

As PhD. Geomatics is a professional degree; the degree is expected to provide education and training in the multiple dimensions of contemporary geospatial sciences toward developing solution for a more sustainable future. Our overriding objective is to provide the next generation of national and international leaders with the knowledge, skills and experience needed to advance policy and decision making, formulate effective solution to enhance Geomatics goals, and meet the challenges and opportunities of Geomatics applications in various fields, in way that provide broad, sustainable, resilient and equitable advances for human well-being in a complex and interdependent world,

4. Program Objectives

1. To establish the foundations and concepts of modern Geomatics techniques and their applications in various physical and social fields.
2. To equip students with professional skills to be demonstrated in teaching, research and Geospatial industry.
3. Graduates will be capable to cultivate and present client-driven Geomatics solutions and demands.
4. To train the students in problem solving skills that employ their understanding of theories, ideas, and concepts as well as their mastery of geospatial information science software and hardware.

In order for our program to remain preeminent our key goals are:

5. Market Need / Rationale of the Program

As Geomatics degree equips you with skills and knowledge for a variety of jobs in many areas including forest management, urban development, irrigation monitoring & management, agriculture resource estimation, flood monitoring & management, DAM sites selection, mineral resource assessment etc.

Moreover, urbanization, climate change, habitat loss assessment, water and air pollution modelling, species distribution assessment, water resources monitoring & management, and the availability of data are among the many major dilemmas our society faces each day. These complex problems cause environmental limits against economic development, diverse cultures, ethics, values, and social stability, and therefore require an understanding of science, policy, society, history, and economics in order to address problems realistically and effectively. Geomaticians must use integrated and holistic approaches to understand and find sustainable solutions to these problems. Graduates of the Geomatics degree are well prepared for a variety of sustainable careers including consulting, research, policy, and outreach, or further graduate work in a doctoral program.

Potential Employer:

- Space and Upper Atmosphere Research Commission (SUPARCO)
- National Engineering Services Pakistan (NESPAK)
- Ministry of Climate Change
- Pakistan Army, Air force and Navy
- Worldwide Fund for Nature (WWF)
- The Urban Unit
- Planning & Development Department of Provinces
- Mines & Minerals Department
- Agriculture Department
- Irrigation Department
- Forest Conservation Department
- MM Pakistan
- Transport Department
- Lahore Development Authority
- Water & Sanitation Authority (WASA)
- Lahore Waste Management Company (LWMC)
- Survey of Pakistan (SoP)
- PTCL, WARID, TELENOR and other Telecom sectors
- WAPDA

6. Admission Eligibility Criteria

- The Applicants having degree of MS / M. Phil.in Geomatics and Allied Sciences with 18 years of education or equivalent are eligible for admission in PhD in Geomatics degree program

- No third division in the whole career.

- CGPA on a scale other than 4.00 will be converted accordingly.

7. Duration of the Program

The CEES is following the HEC guidelines and PhD degree is awarded by the university after a minimum of three (3) years period. The general timeline followed by the CEES is three to five years. Number of courses taught in PhD Environmental sciences degree program will be 6 with each course having 3 credit hours. A total of 9 credit hours of course are taught in each semester (3 credit hours of core course and 6 credit hours of elective courses). After successful completion of course work, students' haves to appear in the comprehensive exam before the start of their PhD research work. The college designated competent authority (DDPC) to determine whether the delay is caused by circumstances beyond the student's control and if so, grant an extension for two in such exceptional circumstances. The date of notification of the award of the Ph.D. degree after the Ph.D. defence is considered to be the date of the completion of Ph.D. studies.

8. Categorization of Courses as per HEC Recommendation and Difference

Semester	Courses	Category (Credit Hours)					
		Core Courses	Basic Courses	Major Electives	Minor Electives	Any Other/Thesis	Semester Load
1st	6	1	--	5	--	--	9
2nd	7	1		6	--	--	9
3rd and 4th	--	--	--	--	--	--	--
HEC Guidelines	--	--	--	--	--	--	--
Difference HEC & PU	NIL	NIL	NIL	NIL	NIL	NIL	NIL

9. Scheme of Studies / Semester –Wise Workload

FIRST SEMESTER*:* **(*09 Credit Hours)***

Sr. No.	Course Code	Course Title	Course type	Pre-requisite	Credit Hours
CORE-COURSES ***(06 credit hours core-courses will be offered in 1st semester)***					
1.	GMT-701	INTRODUCTORY GEOMATICS (CORE-COURSE)	Core-Course	As per the eligibility requirement of the program	03
ELECTIVE COURSES ***(02 Elective courses of 06 credit hours will be offered in 1st semester)***					
2.	GMT-702	INTEGRATION OF GEOMATICS TECHNOLOGIES	Elective Course	As per the eligibility requirement of the program	03
3.	GMT-703	SATELLITE AND AERIAL IMAGE PROCESSING	Elective Course	As per the eligibility requirement of the program	03
4.	GMT704	SPATIAL MODELING AND SIMULATION	Elective Course	As per the eligibility requirement of the program	03
5.	GMT-705	ADVANCE SURVEYING TECHNIQUES	Elective Course	As per the eligibility requirement of the program	03
6.	GMT-706	ADVANCED COMPUTER CARTOGRAPHY	Elective Course	As per the eligibility requirement of the program	03

SECOND SEMESTER **(*09 Credit Hours)***

Sr. No.	Course Code	Course Title	Course type	Pre-requisite	Credit Hours
CORE-COURSES ***(06 credit hours core-courses will be offered in 2nd Semester)***					
1.	GMT-707	ADVANCED RESEARCH METHODOLOGY AND TECHNICAL WRITING IN GEOMATICS (CORE-COURSE)	Core-Course	As per the eligibility requirement of the program	03
ELECTIVE COURSES (02 Elective courses of 06 credit hours will be offered in 2nd Semester)					
2.	GMT-708	SATELLITE SENSORS AND INSTRUMENTATION	Elective Course	As per the eligibility requirement of the program	03
3.	GMT-709	ADVANCED REMOTE SENSING AND ITS APPLICATIONS	Elective Course	As per the eligibility requirement of the program	03
4.	GMT-710	ADVANCED SPATIAL MODELLING TECHNIQUES	Elective Course	As per the eligibility requirement of the program	03
5.	GMT-711	APPLICATIONS OF REMOTE SENSING AND GIS IN EARTH SCIENCES	Elective Course	As per the eligibility requirement of the program	03
6.	GMT-712	WEB GIS AND SOFTWARE APPLICATIONS IN GEOMATICS	Elective Course	As per the eligibility requirement of the program	03
7.	GMT-713	ADVANCE IMAGE INTERPRETATION AND PHOTOGRAMMETRY	Elective Course	As per the eligibility requirement of the program	03

10. Award of Degree

Degree awarding criteria stating:

As a requirement, the 18 credit hours are offered in the first year of the doctoral degree. Each student is required to achieve 3 CGPA in the course work. According to university policy and HEC guidelines following the completion of coursework, every Ph.D. student is required to pass a comprehensive examination to be granted candidacy as Ph.D. researcher; provided that if the student fails to pass the comprehensive test, he or she shall be allowed one more attempt to take the test. After qualifying for the comprehensive examination, the student is officially allowed to start the research and DPCC evaluates the projects and refers to the advanced research board.

Each Ph.D. researcher is required to write a doctoral dissertation that meets the HEC defined criteria. The Ph.D. dissertation is supervised by a full-time faculty member who holds a Ph.D. (or equivalent) degree and is an HEC approved supervisor. The Ph.D. thesis is evaluated by the committee member and by at least two external experts. Further, a plagiarism test following the HEC's Plagiarism Policy is conducted on the dissertation before its submission to the external experts. An open defence of the dissertation is required after a positive evaluation of the dissertation by the committee members. According to university and HEC guidelines, each Ph.D. researcher is required to publish at least one research paper as the first author during his or her doctoral studies in an HEC approved Y category (or above) journal for the award of Ph.D. degree.

11. NOC from Professional Councils (if applicable)

Not Applicable

12. Faculty Strength

Degree	Area / Specialization	Total
PhD	1. Prof. Dr. Sajid Rashid Ahmad 2. Prof. Dr. Irfan Ahmad Shaikh 3. Prof. Dr. Nadia Jamil 4. Dr. Abdul Qadir 5. Dr. Yumna Sadef 6. Dr. Muhammad Kamran 7. Dr. Muzaffar Majid Ch. 8. Dr. Azhar Ali 9. Dr. Sana Ashraf 10. Dr. Muhammad Bilal Shakoor 11. Dr. Naeem Akhtar Abbasi 12. Dr. Mehwish Mumtaz 13. Dr. Muhammad Awais 14. Dr. Rizwan Aziz 15. Dr. Muhammad Asif Javed	**15**

13. Present Student Teacher Ration in the Department

12:15 1:1

14. Course Outlines separately for each course

FIRST SEMESTER

GMT-701 INTRODUCTORY GEOMATICS (THEORY) (03 Credit Hrs)

PRE-REQUISITE: MS/M.Phil. in allied disciplines

Learning Outcomes

- It is expected that the students will be able to understand the basic concepts of Remote sensing and Geographical information systems
- Students will get the knowledge about the different freely available online spatial data platforms
- Student will be able to use the specialized software's to handle geospatial data

Contents

Definition and Domain of Geomatics, Geodesy Fundaments, spatial data sources, Geomatics Computer Fundamentals, Applications of Geomatics, Global and regional reference frames and geo-referencing, Remote sensing & Concepts of Remotely Sensed Data, Data acquisition Theory, Remote Sensing Satellites, Implementation of GIS techniques & tools for spatial data, spatial analysis, spatial interpolation methods, Computer-aided visualization, communication, and use of geospatial information.

Unit-1 Geodesy

1.1 Fundamentals of Geodesy
1.2 Geodetic survey techniques
1.3 Survey data collection and processing
1.4 Data rectification and databases development

Unit-2 Spatial Data sources

2.1 Freely Available Spatial Data Platforms
2.2 Online sources Data Acquisition
2.3 Data standardization
2.4 Data integration from other sources

Unit-3 Spatial Analysis

3.1 Interpolation techniques
3.2 Overlay analysis
3.3 Network analysis

Unit-4 Data Visualization

4.1 Computer aided visualization
4.2 Cartographic techniques
4.3 Digital cartography
4.5 Large- and small-scale maps

Unit-5 Remote sensing

5.1 Fundamentals of Earth observation satellites
5.2 Satellite orbits and sensors
5.3 Satellite data acquisition and processing
5.4 Satellite image analysis

Unit-6 Applications of Geomatics

6.1 Geomatics in Environment
6.2 Geomatics in Earth sciences
6.3 Applications in Hydrology

TEACHING – LEARNING STRATEGIES

- Lecture based examination
- Presentation/seminars
- Class discussion

- Quizzes

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes:

- classroom participation,
- attendance, assignments and presentation,
- homework
- attitude and behavior,
- hands-on-activities,
- Short tests, quizzes etc.

ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXTBOOKS / SUGGESTED READINGS

1. Kang-tsung Chang (2018), Introduction to Geographic Information Systems, 9th Edition, McGraw-Hill Education
2. Maribeth Price (2018), Mastering ArcGIS, 8th Edition, McGraw-Hill Education
3. Joyce GosataMaphanyane, Read Brown MthanganyikaMapeo and Modupe O. Akinola, (2018), Handbook of Research on Geospatial Science and Technologies, IGI Global, ISBN 9781522534402
4. DomenicoSolimini (2016), Understanding Earth Observation: The Electromagnetic Foundation of Remote Sensing (Remote Sensing and Digital Image Processing), 1st Edition, Springer
5. Charles D. Ghilani(2017),Elementary Surveying: An Introduction to Geomatics, 15th Edition, Pearson Education, ISBN 9780134604657
6. Paul Bolstad (2016), GIS Fundamentals: A first text on Geographic Information Systems, 5th Edition. White Bear Lake, MN: Eider Press.
7. Lawrence Fox (2015), Essential Earth Imaging for GIS, Esri Press, ISBN: 9781589483453
8. Thomas Lillesand, Ralph W. Kiefer and Jonathan Chipman (2015), Remote Sensing and Image Interpretation, 7th Edition, Wiley, ISBN: 978-1-118-34328-9

GMT-702 **INTEGRATION OF GEOMATICS TECHNOLOGIES (THEORY)**
(03 Credit Hrs)

PRE-REQUISITE: MS/M.Phil. in allied disciplines

Learning Outcomes

- It is expected that the students after the completion of this course would become independent in terms of geospatial data handling
- Students will get the knowledge about integration of spatial datasets from different platforms
- Students will be capable enough to use different remote sensing and geographical information system software's

Contents

Introduction to Geomatics, Integration of Geomatics with GIS & Remote sensing, the art and science of technologies used in the determination of positions above, on, or beneath the earth's surface, making measurements and collect data for determining horizontal distances; differences in elevation and direction; angular differences; determining locations on the earth's surface; and calculating areas and volumes, science of geodesy and the art of cartography; traverse and control surveys; Global Navigation Satellite Systems; surveying technology and methods; land surveys and deed descriptions; and using maps and geographic information systems to turn survey data into useful information, spatial interpolation methods.

Unit-1 Integration of Spatial Datasets

1.1 Difference about GIS, Remote sensing and GPS datasets
1.2 Standardization of Different datasets
1.3 Integration of datasets

Unit-2 Spatial Measurements

2.1 Measurement techniques
2.2 Above and below the surface measurement
2.3 Differences in elevation, direction and angular distances
2.4 Calculating area and volumes

Unit-3 Cartography

3.1 Science of Geodesy
3.2 Fundamentals of Cartography
3.3 Cartographic techniques

Unit-4 Surveying Equipment

4.1 Global Positioning system
4.2 Total station
4.3 Differential GPS
4.5 Drone/Aerial data collection

Unit-5 Surveying Techniques

5.1 Traverse and control surveys
5.2 Global Navigation Satellite Systems
5.3 Land Surveys
5.4 Data correction methods

Unit-6 Applications of Geomatics

6.1 Geomatics applications in Environment
6.2 Geomatics in Earth sciences
6.3 Applications in Hydrology

TEACHING – LEARNING STRATEGIES

- Lecture based examination
- Presentation/seminars
- Class discussion
- Quizzes

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes:

- classroom participation,
- attendance, assignments and presentation,
- homework
- attitude and behavior,
- hands-on-activities,
- Short tests, quizzes etc.

ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXTBOOKS / SUGGESTED READINGS

1. Joyce GosataMaphanyane, Read Brown MthanganyikaMapeo and Modupe O. Akinola, (2018), Handbook of Research on Geospatial Science and Technologies, IGI Global, ISBN 9781522534402
2. Kang-tsung Chang (2018), Introduction to Geographic Information Systems, 9th Edition, McGraw-Hill Education
3. Charles D. Ghilani(2017),Elementary Surveying: An Introduction to Geomatics, 15th Edition, Pearson Education, ISBN 9780134604657
4. DomenicoSolimini (2016), Understanding Earth Observation: The Electromagnetic Foundation of Remote Sensing (Remote Sensing and Digital Image Processing), 1st Edition, Springer
5. Paul Bolstad (2016), GIS Fundamentals: A first text on Geographic Information Systems, 5th Edition. White Bear Lake, MN: Eider Press

GMT-703 SATELLITE AND AERIAL IMAGE PROCESSING (THEORY) (03 Credit Hrs)

PRE-REQUISITE: MS/M.Phil in allied disciplines

Learning Outcomes

- Students will get the knowledge about different platforms being in operation for aerial and space imagery acquit ion
- Students will get detail knowledge about different techniques regarding satellite and aerial images acquisition, processing images interpretation.

Contents

This course provides an introduction to the principles and techniques of air photo interpretation and satellite image interpretation. This course also provides comprehensive information about satellite and aerial images processing and interpretation. Stereoscopic viewing, parallax, flight line planning, and mapping from air photos. Introduction to various remote sensing platforms for spatial data collection, working methodologies of aerial and satellite-based platforms, advantages of aerial and satellites-based data collection methods will be covered in this course

Unit-1 Satellite and Aerial Imagery

1.1 Satellite orbits
1.2 Satellite image acquisition
1.3 Aerial imagery platforms

Unit-2 Concepts of Image acquisition

2.1 Stereoscopic viewing
2.2 flight line planning
2.3 parallax

Unit-3 Sensor Types

3.1 Active and Passive sensors
3.2 Various optical sensors
3.3 Synthetic Aperture RADAR

Unit-4 Image processing

4.1 High- and low-resolution imagery comparison
4.2 Satellite and aerial imagery processing and rectification
4.3Comparison of Satellite and aerial imagery

Unit-5 DEM Generation using Ortho-imagery

5.1 Ortho-imagery
5.2 1m DEM Generation using Aerial ortho-imagery
5.3 Applications of high-resolution DEM

Unit-6 Photogrammetry Techniques

6.1 Aerial and terrestrial Photogrammetry
6.2 Aerial Triangulation
6.3 dimensions and position of objects

TEACHING – LEARNING STRATEGIES

- Lecture based examination
- Presentation/seminars
- Class discussion
- Quizzes

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is a continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes:

- classroom participation,
- attendance, assignments and presentation,
- homework
- attitude and behavior,
- hands-on-activities,
- Short tests, quizzes etc.

ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXTBOOKS / SUGGESTED READINGS

1. Avtar, R., & Watanabe, T. (Eds.). (2020). *Unmanned aerial vehicle: Applications in agriculture and environment*. Springer International Publishing.
2. Valavanis, K. P., & Vachtsevanos, G. J. (Eds.). (2015). *Handbook of unmanned aerial vehicles* (Vol. 2077). Dordrecht: Springer Netherlands.
3. Morgan, D., & Falkner, E. (2001). *Aerial mapping: methods and applications*. CRC press.
4. Paine, D. P., & Kiser, J. D. (2012). *Aerial photography and image interpretation*. John Wiley & Sons.
5. Aber, J. S., Marzolff, I., & Ries, J. (2010). *Small-format aerial photography: Principles, techniques and geoscience applications*. Elsevier.

GMT704 SPATIAL MODELING AND SIMULATION (THEORY) (03 Credit Hrs)

PRE-REQUISITE: MS/M.Phil in allied disciplines

Course Learning Outcomes

- To acquaint the students, with the understanding of spatial modeling techniques for GIS problem solving.
- The students will be trained to understand spatial modeling and its application in environment and different fields.

Contents

The modelling process; integrating environmental models and GIS; spatial heterogeneity and representative areal units; measurement scales vs. process scales; sensitivity and uncertainty analysis; model complexity; effects of input data quality; simulation model experiments; technical and conceptual limits of environmental modelling, various spatial interpolation methods. Students will complete a small research project.

Unit-1 Spatial Analysis

1.1 Spatial analyst tools
1.2 Conversion tools
1.3 Data management tools

Unit-2 Spatial Modelling

2.1 Model conceptualization
2.2 Model design
2.3 Model implementation

Unit-3 ArcGIS Model Builder

3.1 ArcGIS Model Builder
3.2 Validation of a model
3.3 Running a model

Unit-4 Erdas Imagine Model Builder

4.1 Erdas Model Builder
4.2 Validation of a model
4.3 Running a model

Unit-5 Hydrological Models

5.1 Watershed
5.2 Flood Hazard
5.3 Groundwater

Unit-6 Environmental Models

6.1 Specie Distribution
6.2 Forest Change Detection

TEACHING – LEARNING STRATEGIES

- Lecture based examination
- Presentation/seminars
- Class discussion
- Quizzes

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes:

- classroom participation,
- attendance, assignments and presentation,

- homework
- attitude and behavior,
- hands-on-activities,
- short tests, quizzes etc.

ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behaviors, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXTBOOKS / SUGGESTED READINGS

1. David L. Verbyla., (2002). Practical GIS Analysis, Taylor & Francis, London
2. Donald P. Albert & Wilbert M. Gesler., (2000). Spatial Analysis, GIS and Remote Sensing Application in Health Sciences, Ann Arbor Press, Michigan, USA.1-57504-101-4
3. Hall, G. Brent and Yeung, A., (2007), Spatial Database Systems: design, implementation and project management, Springer: Dordecht, The Netherlands.
4. John R, L, Stern, F. and Clarke, F.,(2016). Applied Spatial Modelling and Planning, Taylor & Francis, London, ISBN:1317406737, 9781317406730.
5. Stillwell, S. and Clarke, G., (2004). Applied GIS and Spatial Analysis, John Wiley & Sons, UK. ISBN: 1-57504-101-4
6. Obermeyer, N. and Pinto., J. (2008). Managing Geographic Information Systems, 2nd Ed., Guilford: New York.

GMT-705 ADVANCE SURVEYING TECHNIQUES (THEORY) (03 Credit Hrs)

PRE-REQUISITE: MS/M.Phil in allied disciplines

Learning Outcomes

It is expected that after the completion of this course the students will be able to;

- Use and handle the different survey equipment
- Data collection by using different surveying techniques
- Process and rectify collected data

Contents

Introduction to Geomatics, Introduction of Geodesy, Coordinate and Projection Systems, Geodetic and plan survey, Leveling (Theory, methods and equipment, field procedures and calculations), Distance Measurements (Methods, EDM and total station), Azimuths, Angles and Bearings, Establishment of Survey Control Network (horizontal control, vertical control, Traverse introduction, types, Theory of errors in measurements (Types of errors, precision and accuracy, error propagation), Topographic survey (methods, applications), Survey data Processing, various spatial interpolation methods.

Unit-1 Introduction to Geodesy

1.1 Foundations of geodesy
1.2 Coordinate systems
1.3 Projections

Unit-2 Geodetic surveys

2.1 Surveys theory
2.2 Survey methods
2.3 Survey equipment

Unit-3 Survey Data processing

3.1 Field data procedures
3.2 Data calculations
3.3 Distance and angle measurements

Unit-4 Establishment of Survey Control Network

4.1 horizontal and vertical control
4.2 Traverse introduction

Unit-5 Topographic surveys

5.1 Types of Errors
5.2 Precision and Accuracy
5.3 Error Propagation

Unit-6 Environmental Models

6.1 Methods and application
6.2 Survey data Processing
6.3 Various spatial interpolation methods

TEACHING – LEARNING STRATEGIES

- Lecture based examination
- Presentation/seminars
- Class discussion
- Quizzes

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes:

- classroom participation,
- attendance, assignments and presentation,
- homework
- attitude and behavior,
- hands-on-activities,
- short tests, quizzes etc.

ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behaviors, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXTBOOKS / SUGGESTED READINGS

1. Konecny, G. (2019). *Geoinformation: remote sensing, photogrammetry and geographical information systems*. cRc Press.
2. Solimini, D. (2016). *Understanding Earth Observation*. Springer
3. Ogundare, J. O. (2015). *Precision surveying: the principles and geomatics practice*. John Wiley & Sons.
4. Taniguchi, E., & Thompson, R. G. (Eds.). (2014). *City logistics: Mapping the future*. CRC Press.
5. Ghilani, C. D., Wolf, P. R., & Gidudu, A. (2008). *Elementary surveying: An introduction to geomatics*. Upper Saddle River: Pearson Prentice Hall.
6. Richards, J. A. (2009). *Remote sensing with imaging radar* (Vol. 1). Berlin: Springer.

GMT-706 ADVANCED COMPUTER CARTOGRAPHY (THEORY) (03 Credit Hrs)

PRE-REQUISITE: MS/M.Phil. in allied disciplines

Learning Outcomes

- This course provides the understanding about the advancements in cartography and digital cartography.
- This course also includes the practical exposure about the digital cartography and its applications.

Contents

Students will get the knowledge about the modern era techniques used in digital cartography.

Unit-1 Cartographic Data

1.1 Compilation of cartographic data
1.2 Displaying cartographic data
1.3 Spatial referencing of cartographic data

Unit-2 Coordinate Systems and Projections

2.1 Introduction to Geographic coordinate system
2.2 Introduction to Map Projections
2.3 Introduction to Projected coordinate system

Unit-3 Quantitative Data

3.1 Managing quantitative data
3.2 Classifying quantitative data
3.3 Mapping quantitative data

Unit-4 Elevation Data Representation

4.1 Introduction to 3D data
4.2 Contour and other terrain analysis
4.3 Displaying 3D data

Unit-5 Cartographic Data Compilation

5.1 Sources of cartographic data
5.2 Accessing and downloading data from various sources
5.3 Compiling and ordering retrieved data

Unit-6 Map Production

6.1 Principles of cartographic design
6.2 Production of effective maps
6.3 Exporting principles of maps

TEACHING – LEARNING STRATEGIES

- Lecture based examination
- Presentation/seminars
- Class discussion
- Quizzes

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes:

- classroom participation,
- attendance, assignments and presentation,
- homework
- attitude and behavior,
- hands-on-activities,
- Short tests, quizzes etc.

ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXTBOOKS / SUGGESTED READINGS

1. Field, K., (2018), The Definitive Guide to Making Maps, Esri Press. ISBN: 1589484398, 9781589484399.
2. Field, K., (2018). Cartography, ISBN: 9781589485020, ESRI Press Books.
3. Kang-tsung Chang (2018), Introduction to Geographic Information Systems, 9th Edition, McGraw-Hill Education
4. Maribeth Price (2018), Mastering ArcGIS, 8th Edition, McGraw-Hill Education
5. Price, M., (2018). Mastering ArcGIS, 8th Ed. McGraw-Hill Education.
6. Wilson, M, W., (2017).New Lines: Critical GIS and the Trouble of the Map, University of Minnesota Press, ISBN: 0816698538, 9780816698530.
7. Rankin, W., (2016).After the Map: Cartography, Navigation, and the Transformation of Territory in the Twentieth Century, University of Chicago Press. ISBN: 022633936X, 9780226339368.
8. Foody, G., See, L., Fritz, S., Mooney, P., Olteanu-Raimond, A.,Fonte, C, C.Antoniou, Y., (2017), Mapping and the Citizen Sensor, Ubiquity press, ISBN 978-1-911529-16-3.
9. Thomas Lillesand, Ralph W. Kiefer and Jonathan Chipman (2015), Remote Sensing and Image Interpretation, 7th Edition, Wiley, ISBN: 978-1-118-34328-9

SECOND SEMESTER

GMT- 707 ADVANCED RESEARCH METHODOLOGY AND TECHNICAL WRITING IN GEOMATICS (Theory) (03 Credit Hrs)

PRE-REQUISITE: MS/ M.Phil. in allied disciplines

Course Learning Outcomes

- The student will be able to identify a research problem, collect data, and interpret it in a scientific manner in the form of a thesis.
- The course will provide participants with an introduction to the knowledge and skills necessary to develop a research proposal and subsequently to conduct a research study using Geomatics tools.
- It will help to develop research abilities in the activities of research design and practice to develop skills reading research papers and in writing reviews with critical thinking skills and to evaluate a range of available literature.

Contents

Background and philosophy of research: concept of research, types of research, elements of research. Types of data for research. Various stages of research, research methods and methodology. Research proposal, selection of a research topic and problems, literature survey, reference collection, hypothesis, mode of approach, actual investigation, results and conclusion, presenting an oral scientific seminar, writing a report, research paper and thesis, Layout of a research report, PhD thesis dissertation. Plagiarism and its professional consequences.

Unit-1 Research

1.1 Types of Research
1.2 Background and philosophy of research
1.3 Concept of research
1.4 Elements of research

Unit-2 Hypothesis

2.1 Null hypothesis
2.2 Alternate hypothesis
2.3 Problem statement

Unit-3 Data collection

3.1 Primary data collection
3.2 Secondary data collection
3.3 Surveying

Unit-4 Surveying Techniques

4.1 Introduction to different surveying Equipment
4.2 Surveying techniques
4.3 Survey Data collection methods
4.4 Processing of Survey Data

Unit-5 Data Analysis

5.1 Raster and Vector data analysis
5.2 Interpretation of data analysis
5.3 Discussion on research findings

Unit-6 Thesis writing

6.1 Abstract
6.2 Introduction
6.3 Materials and methods
6.4 Results and discussion
6.5 Conclusion
6.6 References

TEACHING – LEARNING STRATEGIES

- Lecture based examination
- Presentation/seminars
- Class discussion
- Quizzes

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

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- classroom participation,
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- homework
- attitude and behavior,
- hands-on-activities,
- Short tests, quizzes etc.

ASSESSMENT AND EXAMINATIONS:

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RECOMMENDED TEXTBOOKS / SUGGESTED READINGS

1. J.G. Maphanyane, R.B. Mthanganyika and M.O. Akinola (2018), Handbook of Research on Geospatial Science and Technologies, IGI Global, ISBN: 9781522534402.
2. F. Sami and M. Khaoula (2016), Handbook of Research on Geographic Information Systems Applications and Advancements. IGI Global, ISBN:1522509380, 9781522509387.
3. S. L. Steinberg and S. J. Steinberg (2015), GIS Research Methods: Incorporating Spatial Perspectives. Esri Press, ISBN:1589483782, 9781589483781.
4. B. Bhatta (2013), Research Methods in Remote Sensing. Springer Science & Business Media, ISBN:9400765940, 9789400765948.

GMT- 708 SATELLITE SENSORS AND INSTRUMENTATION (THEORY) (03 Credit Hrs)

PRE-REQUISITE: MS/ M. Phil in allied disciplines

Course Learning Outcomes

- The course will provide participants with a basic introduction in relation to errors induced in the satellite data due to improper mounting of satellite sensors.
- The student should have a clearer understanding of the error induced in the satellite data due to improper mounting of satellite sensors.

Contents

Theoretical and practical issues associated with airborne remote sensing technologies to precision mapping problems. Navigation, LANDSAT, SAR, and hyperspectral data. General principles and advance application of digital image processing techniques for analyzing remotely sensed satellite imagery using commercial image analysis software's.

Unit-1 Sensors

1.1 Sensor types
1.2 Air borne Sensors
1.3 Active sensors working Principles
1.4 Passive sensors working Principles

Unit-2 Satellites

2.1 Landsat Series
2.2 Sentinel Series

Unit-3 Synthetic Aperture Radar

3.1 fundamentals and working principles of SAR
3.2 fundamentals and working principles of Polsar
3.3 SAR Interferometry

Unit-4 GNSS

4.1 GLONASS
4.2 BeiDou
4.3 Galileo

Unit-5 GPS system

5.1 GPS constellation
5.2 Ground stations
5.3 Data Transmission
5.4 GPS receiver

Unit-6 Image Processing

6.1 Image pre-processing
6.2 Image post-processing
6.3 Image classification

TEACHING – LEARNING STRATEGIES

- Lecture based examination
- Presentation/seminars
- Class discussion
- Quizzes

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

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- classroom participation,
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RECOMMENDED TEXTBOOKS / SUGGESTED READINGS

1. Solimini, D. (2016). *Understanding Earth Observation*. Springer.
2. Liu, J. G., & Mason, P. J. (2016). *Image processing and GIS for remote sensing: techniques and applications*. John Wiley & Sons.
3. Campbell, J. B., & Wynne, R. H. (2011). *Introduction to remote sensing*. Guilford Press.
4. Lillesand, T., Kiefer, R. W., & Chipman, J. (2015). *Remote sensing and image interpretation*. John Wiley & Sons.
5. Schott, J. R. (2007). *Remote sensing: the image chain approach*. Oxford University Press on Demand.
6. Prost, G. L. (1994). *Remote sensing for geologists: a guide to image interpretation*. CRC Press.
7. Jensen, J. R. (2005). *Introductory digital image processinga remote sensing perspective* (No. 621.3678 J4/2005).

GMT- 709 ADVANCED REMOTE SENSING AND ITS APPLICATIONS (THEORY) (03 Credit Hrs)

PRE-REQUISITE: MS/ M. Phil. in allied disciplines

Course Learning Outcomes

- The aim of this course is to enable graduates to scientifically deal with remote sensing data and the processes involved in the data analysis and reporting the results.
- It is expected that after the completion of this course the students will be able to use remote sensing data in different fields.

Contents

An integrated course dealing with contemporary principles and applications of aerospace remote sensing. Emphasis will be placed on scanning systems; multispectral sensors; the identification and interpretation of spectral signatures; how the imagery obtained by sensors is analyzed optically or digitally to yield Earth resource information; and the manipulation and display of remotely-sensed data. Hands on practice on IDRISI, ERDAS, ENVI or ER MAPPER software.

Unit-1 Image Selection

1.1 Spatial resolution
1.2 Radiometric resolution
1.3 Temporal resolution
1.4 Spectral resolution

Unit-2 Multispectral scanners

2.1 Landsat imagery
2.2 Sentinel imagery
2.3 Air borne imagery

Unit-3 Synthetic Aperture Radar

3.1 C band
3.2 L band
3.3 SAR Interferometry

Unit-4 Spectral Signatures

4.1 Spectral reflectance curve for Vegetation
4.2 Spectral reflectance curve for Water
4.3 Spectral reflectance curve for Soil

Unit-5 Image Processing

5.1 Image pre-processing
5.2 Image post-processing
5.3 Image classification

Unit-6 Remote Sensing Applications

6.1 Applications for Vegetation
6.2 Applications for Water
6.3 Applications for Urban area

TEACHING – LEARNING STRATEGIES

- Lecture based examination
- Presentation/seminars
- Class discussion
- Quizzes

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

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- attendance, assignments and presentation,
- homework
- attitude and behavior,
- hands-on-activities,
- Short tests, quizzes etc.

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RECOMMENDED TEXTBOOKS / SUGGESTED READINGS

1. Liu, J. G., & Mason, P. J. (2016). *Image processing and GIS for remote sensing: techniques and applications*. John Wiley & Sons.
2. Lillesand, T., Kiefer, R. W., & Chipman, J. (2015). *Remote sensing and image interpretation*. John Wiley & Sons.
3. Campbell, J. B., & Wynne, R. H. (2011). *Introduction to remote sensing*. Guilford Press.
4. Schott, J. R. (2007). *Remote sensing: the image chain approach*. Oxford University Press on Demand.
5. Jensen, J. R. (2005). *Introductory digital image processinga remote sensing perspective* (No. 621.3678 J4/2005).

GMT- 710 ADVANCED SPATIAL MODELLING TECHNIQUES (THEORY) (03 Credit Hrs)

PRE-REQUISITE: MS/ M. Phil. in allied disciplines

Learning Outcomes

- To acquaint the students, with the understanding of spatial modeling techniques for GIS problem solving.
- The students will be trained to understand spatial modeling and its application in different fields.

Contents

The modelling process; integrating environmental models and GIS; spatial heterogeneity and representative areal units; measurement scales vs. process scales; sensitivity and uncertainty analysis; model complexity; effects of input data quality; simulation model experiments; technical and conceptual limits of environmental modelling, various spatial interpolation methods. Students will complete a small research project.

Unit-1 Spatial Analysis

1.1 Spatial analyst tools
1.2 Conversion tools
1.3 Data management tools

Unit-2 Spatial Modelling

2.1 Model conceptualization
2.2 Model design
2.3 Model implementation

Unit-3 ArcGIS Model Builder

3.1 Making a model in ArcGIS Model Builder
3.2 Validation of a model in ArcGIS Model Builder
3.3 Running a model in ArcGIS Model Builder

Unit-4 Erdas Imagine Model Builder

4.1 Making a model in Erdas Model Builder
4.2 Validation of a model in Erdas Model Builder
4.3 Running a model in Erdas Model Builder

Unit-5 Spatial Interpolation

5.1 Concept of spatial interpolation
5.2 Stochastic spatial interpolation
5.3 deterministic spatial interpolation

Unit-6 Spatial Interpolation Techniques

6.1 IDW
6.2 RBF
6.3 Kriging

TEACHING – LEARNING STRATEGIES

- Lecture based examination
- Presentation/seminars
- Class discussion
- Quizzes

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- attendance, assignments and presentation,
- homework
- attitude and behavior,
- hands-on-activities,
- Short tests, quizzes etc.

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RECOMMENDED TEXTBOOKS / SUGGESTED READINGS

1. Kaplan, E., (2017). Understanding GPS/GNSS: Principles and Applications", Artech House
2. Lombard, J, R., Stern, E. and Clarke, G., (2017). Applied Spatial Modelling and Planning. Routledge Taylor & Francis Group, London and New York
3. Hall, G. Brent and Yeung, A., (2007). Spatial Database Systems: design, implementation and project management, Springer: Dordecht, The Netherlands.
4. Coburn C Timothy and Yarus M. Jeffrey., (2000). Geographic Information Systems in Petroleum Exploration and Development (AAPG Computer Applications in Geology, No. 4), American Association of Petroleum Geologists.
5. Aronoff, S., (1989). Geographic Information Systems: A management Perspective. WDL Publications, Ottawa.

GMT- 711 APPLICATIONS OF REMOTE SENSING AND GIS IN EARTH SCIENCES (THEORY) (03 Credit Hrs)

PRE-REQUISITE: MS/ M.Phil. in allied disciplines

Learning Outcomes

- The basic aim of this course is to broaden the vision of students in relation to earth sciences and give them practical exposure in solving a problem using remote sensing and geographical information systems.
- The student will be able to identify a research problem related to earth sciences and solve that problem using GIS and remote sensing.

Contents

Detailed investigation of advanced application areas of GIS and remote sensing. Topics may include Geo-hazards including landslides, earthquakes, floods, air pollution, various spatial interpolation methods, decision-support using analytical hierarchy process, geological, web-based, temporal, agricultural, land parcel, and natural resources applications. Students will be asked to complete application project during the semester.

Unit-1 Geo-hazards

1.1 Landslides
1.2 Earthquakes
1.3 Floods

Unit-2 Mapping techniques

2.1 Risk mapping
2.2 Hazard mapping
2.3 Vulnerability mapping

Unit-3 Geospatial Applications

3.1 Geospatial applications for agriculture
3.2 Geospatial applications for natural resources
3.3 Geospatial applications for geology

Unit-4 Remote Sensing Applications in Earth Sciences

4.1 Applications for Vegetation
4.2 Applications for Water
4.3 Applications for Urban area

Unit-5 Spatial Interpolation methods

5.1 Inverse distance weighting
5.2 Radial basis function
5.3 Kriging

Unit-6 GIS Applications in Earth Sciences

6.1 Applications for Vegetation
6.2 Applications for Water
6.3 Applications for Urban area

TEACHING – LEARNING STRATEGIES

- Lecture based examination
- Presentation/seminars
- Class discussion
- Quizzes

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- attendance, assignments and presentation,
- homework
- attitude and behavior,
- hands-on-activities,
- Short tests, quizzes etc.

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RECOMMENDED TEXTBOOKS / SUGGESTED READINGS

1. Bui, D. T., Do, A. N., Bui, H. B., & Hoang, N. D. (Eds.). (2017). *Advances and Applications in Geospatial Technology and Earth Resources: Proceedings of the International Conference on Geo-Spatial Technologies and Earth Resources 2017*. Springer.
2. Cefalo, R., Zieliński, J. B., & Barbarella, M. (2018). *New Advanced GNSS and 3D Spatial Techniques*. Springer.
3. Pirasteh, S., & Li, J. (Eds.). (2017). *Global changes and natural disaster management: geo-information technologies*. Springer International Publishing.
4. Jensen, J. R. (2009). *Remote sensing of the environment: An earth resource perspective 2/e*. Pearson Education India.
5. Ramasamy, S. (Ed.). (2006). *Geomatics in Tsunami*. New India Publishing.

GMT- 712 WEB GIS AND SOFTWARE APPLICATIONS IN GEOMATICS (THEORY)
(03 Credit Hrs)

PRE-REQUISITE: MS/ M.Phil. in allied disciplines

Course Learning Outcomes

- The course will provide participants with an introduction to the knowledge and skills regarding web applications using geographical information systems. It will help students to understand the development in the field of GIS.
- The students will be trained in terms of basic programming skills and the use of relational database management system that is an integral part of geographic information systems.

Contents

Cloud computing, parallel computing, machine learning, Web Design, HTML, WebGIS Basic Concepts, WebGIS, its Technology & Architecture, ArcGIS Server, GIS Services, Web API's (JavaScript), Microsoft SQL Server, Geodatabases, database management system, relational database management system, Google earth, Google earth engine, Web 2.0, Web 3.0, open-source GIS software's, Volunteered geographic information.

Unit-1 Geodatabase

1.1 Personal Geodatabase
1.2 File Geodatabase
1.3 Enterprise level Geodatabase

Unit-2 Web GIS

2.1 Basic concepts
2.2 Technology
2.3 Architecture

Unit-3 Advanced Computing Concepts

3.1 Parallel computing
3.2 Cloud computing
3.3 Machine learning

Unit-4 Basics of Programming

4.1 Python
4.2 Java
4.3 C++

Unit-5 Databases

5.1 Database Management System
5.2 Relational Database Management System
5.3 ERP

Unit-6 Google for spatial analysis

6.1 Google Earth
6.2 Google Earth Engine
6.3 Google Earth Engine Applications

TEACHING – LEARNING STRATEGIES

- Lecture based examination
- Presentation/seminars
- Class discussion
- Quizzes

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- attendance, assignments and presentation,
- homework
- attitude and behavior,
- hands-on-activities,
- Short tests, quizzes etc.

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RECOMMENDED TEXTBOOKS / SUGGESTED READINGS

1. Fu, P. (2018), Getting to Know Web GIS, 3rd Edition, Esri Press, ISBN 9781589485211
2. Costa Fonte, C., Fritz, S., Olteanu-Raimond, A. M., Antoniou, V., Foody, G., Mooney, P., & See, L. (2017). *Mapping and the citizen sensor* (p. 398). Ubiquity Press.
3. Tiwari, A., Jain, K. (2017), Concepts and Applications of Web GIS, Nova Science Publishers, ISBN 9781536127799
4. Longley, P. A., Goodchild, M. F., Maguire, D. J., & Rhind, D. W. (2005). *Geographic information systems and science*. John Wiley & Sons.

GMT- 713 ADVANCE IMAGE INTERPRETATION AND PHOTOGRAMMETRY (THEORY) (03 Credit hrs)

PRE-REQUISITE: MS/ M.Phil. in allied disciplines

Learning Outcomes

- This course will provide know how about remote sensing techniques of image enhancement, filtering, band ratioing and change detection using software.
- The students will be trained to understand spatial modeling using remote sensing data and its application in different fields.

Contents

Introduction to the principles and techniques of air photo interpretation and satellite image interpretation, Aerial photography as a tool for studying the Earth's environment, General principles and advance application of digital image processing techniques for analyzing remotely sensed satellite imagery using commercial image analysis software (IDRISI, IMAGINE ERDAS). Lab exercises will focus on specific applications in natural, rural and urban settings. Topics may also include NDVI, NDBI, image enhancement, filtering, band ratioing and change detection.

Unit-1 Image Preprocessing

1.1 Image enhancement
1.2 Band ratioing
1.3 Image stacking

Unit-2 Image classifications

2.1 Supervised classification
2.2 Unsupervised classification
2.3 Object based classification

Unit-3 Remote Sensing Indices

3.1 NDVI
3.2 NDBI
3.4 NDWI

Unit-4 Aerial Photography

4.1 Principles
4.2 Techniques
4.3 Problems

Unit-5 Aircraft principal axes

5.1 Roll
5.2 Pitch
5.3 Yaw

Unit-6 Remote Sensing Applications

6.1 Applications for Vegetation
6.2 Applications for Water
6.3 Applications for Urban area

TEACHING – LEARNING STRATEGIES

- Lecture based examination
- Presentation/seminars
- Class discussion
- Quizzes

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RECOMMENDED TEXTBOOKS / SUGGESTED READINGS

1. Konecny, G. (2019). *Geoinformation: remote sensing, photogrammetry and geographical information systems*. cRc Press.
2. Pelton, J. N., Madry, S., & Camacho-Lara, S. (Eds.). (2017). *Handbook of satellite applications*. New York: Springer.
3. Liu, J. G., & Mason, P. J. (2016). *Image processing and GIS for remote sensing: techniques and applications*. John Wiley & Sons.
4. Lillesand, T., Kiefer, R. W., & Chipman, J. (2015). *Remote sensing and image interpretation*. John Wiley & Sons.
5. Jensen, J. R. (2005). *Introductory digital image processinga remote sensing perspective* (No. 621.3678 J4/2005).

Checklist for a New Academic Program

Parameters	
1. Department Mission and Introduction	☐
2. Program Introduction	☐
3. Program Alignment with University Mission	☐
4. Program Objectives	☐
5. Market Need/ Rationale	☐
6. Admission Eligibility Criteria	☐
7. Duration of the Program	☐
8. Assessment Criteria	☐
9. Courses Categorization as per HEC Recommendation	☐
10. Curriculum Difference	☐
11. Study Scheme / Semester-wise Workload	☐
12. Award of Degree	☐
13. Faculty Strength	☐
14. NOC from Professional Councils (if applicable)	☐

Program Coordinator

Principal