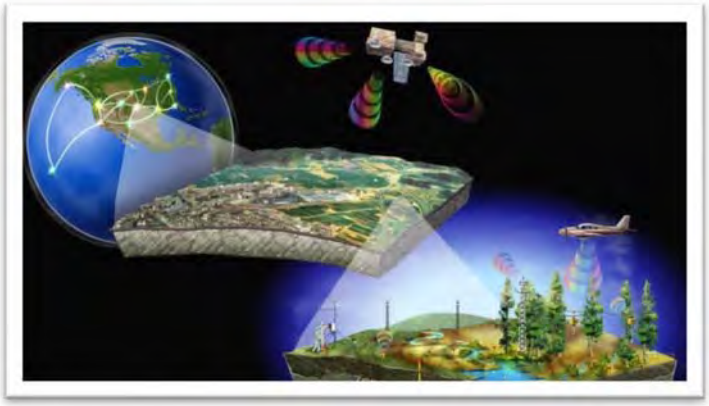
Learning Outcomes-based Curriculum Framework (LOCF) for Post Graduate Diploma Programme



POST GRADUATE DIPLOMA IN GEOINFORMATION SCIENCE AND TECHNOLOGY

Programme Code : 891

(Syllabus effective from 2021 Admission onwards)

Inter University Centre for Geospatial Information Science and Technology
University of Kerala
Karyavattom Campus
Thiruvananthapuram

Preamble

Education is the process of imparting or gaining knowledge, developing the powers of reasoning, logic, rationality and judgement, and generally of preparing oneself or others intellectually for a mature life. Learning is the process of acquiring new, or modifying existing, knowledge, behaviours, skills, abilities, values or preferences. A high priority task in the context of future education development agenda in India is fostering quality higher education. Further improvement of quality of higher education is considered critical for enabling effective participation of young people in knowledge production and participation in the knowledge economy, improving national competitiveness in a globalized world and for equipping young people with skills relevant for global and national standards and enhancing the opportunities or social mobility. Sustained initiatives are required for institutionalizing an outcome-oriented higher education system and enhancing employability of graduates through curriculum reform based on a learning outcomes-based curriculum framework, improving/upgrading academic resources and learning environment, raising the quality of teaching and research across all higher education institutions;

As an initiative to make the teaching-learning framework better and enhance the student learning outcomes, the University Grants Commission has taken a thoughtful step by introducing the concept of **LOCF - Learning Outcome Based Curriculum Framework.** The idea behind the implementation of LOCF in Indian institutions & universities is to pre-determine what outcomes need to be achieved by planning, mapping & measuring the student outcomes. The ultimate aim of LOCF lies in enhancing the quality of higher education in India and encouraging the students to gain the best skills & knowledge during their student journey. Learning outcomes are determined in sync with what students are expected to understand at the end of their study program. There is no single specified style of teaching or assessment in LOCF, instead, classes, opportunities, and assessments should all help students achieve the specified outcomes. The role of the faculty adapts into instructor, trainer, facilitator, and/or mentor based on the outcomes targeted. Accordingly, the University of Kerala has decided to implement the LOCF in all its departments under the auspices of Internal Quality Assurance Cell (IQAC). A series of teacher training workshops were organised by IQAC and the office of the Credit and Semester System (CSS), and the departments have revised the syllabus accordingly, through workshops and in consultation with academic experts in the field.

Graduate Attributes (GAs)

The graduate attributes reflect the particular quality and feature or characteristics of an individual, including the knowledge, skills, attitudes and values that are expected to be acquired by a graduate through studies at the higher education institution (HEI) such as a college or university. The graduate attributes include capabilities that help strengthen one's abilities for widening current knowledge base and skills, gaining new knowledge and skills, undertaking future studies, performing well in a chosen career and playing a

constructive role as a responsible citizen in the society. The graduate attributes reflect both disciplinary knowledge and understanding, generic skills, including global competencies, that all students in different academic fields of study should acquire/attain and demonstrate. Some of the characteristic attributes that a graduate should demonstrate are as follows: Disciplinary knowledge, Communication skills, Critical thinking, Problem solving, Analytical reasoning, Research-related skills, Teamwork and time management, Scientific reasoning, Reflective thinking, Self-directing learning, Digital literacy, Multicultural competence, Moral and ethical values, Leadership readiness, Life-long learning, etc.

The GAs of University of Kerala

- Continue life-long learning as an autonomous learner
- Continuously strive for excellence in education
- Apply and nurture critical and creative thinking
- Promote sustainable development practices
- Promote co-operation over competition
- Balance rights with responsibilities
- Understand and respect diversity & difference
- Not be prejudiced by gender, age, caste, religion, or nationality.
- Use education as a tool for emancipation and empowerment of humanity

About the Inter University Centre for Geospatial Information Science and Technology

The Inter University Centre for Geospatial Information Sciences and Technology (IUCGIST) was established in the University of Kerala jointly by Department of Science and Technology, Government of India; Kerala State Council for Science, Technology and Environment, Government of Kerala and the University of Kerala. The aim behind this joint venture was to generate trained manpower to manage digital geospatial data to meet the scientific, socio-economic and operational requirements of the state. The centre was inaugurated by the then Hon'ble Chief Minister of Kerala Sri. V. S. Achuthanandan on March 2008. To cater the need of trained people in the geo-information science and technology, the centre started a PG diploma course in Geo-Information Science and Technology (PGDGIST) on October 2008 under the UGC innovative programme. The centre is well equipped with state-of-the art GIS, image processing and photogrammetric softwares, DGPS and different types of spatial data sets including satellite images and SoI toposheets.

The Inter University Centre for Geospatial Information Sciences and Technology offers a Post Graduate Diploma in Geo Information Science & Technology. The course aims to provide conceptual knowledge on spatial and non-spatial data, their methods of acquisition, management, analysis, display, and dissemination. The course curriculum is designed in coherence with the emerging trends in the field of Geo-spatial information science and the increasing needs of skilled manpower within the country and abroad. It

is expected to make the students competitive to meet the geospatial demands of the public and private sectors as well as to build a career in the academic world. The students would be trained both in the fundamental and in the advanced fields of the spatial data management.

Name of the Programme

Post Graduate Diploma in Geo-Information Science and Technology (PGDGIST)

Duration : One Year (2 semesters)

Eligibility : Post graduate Degree in Geology (or any branch of Earth Science)/ Geography/Environmental Science/Physics/Computer Science with not less than 55% marks.

Number of seats: : 10

Admission : Through entrance test (Objective types containing 100 questions)

PROGRAMME SPECIFIC OUTCOMES (PSO) of PGDGIST	
PSO 1	To create a broad base of knowledge regarding various geo spatial technologies and its applications
PSO 2	To understand the technical and scientific aspects of various geo spatial technologies
PSO 3	To nurture students to use geo spatial technologies in the real time world. To expose the students to various geospatial softwares (ARC GIS) and remote sensing analysis softwares (ERDAS imagine) and various other open source softwares.
PSO 4	To create necessary skills by means of various geo spatial softwares, interpretation of various satellite imageries, GPS, DGPS & Total station hands on training, field trips to tackle the issues in various geographies effectively.
PSO 5	To enable the students to understand the basic aspects of data management and statistical techniques
PSO 6	To equip the students professionally competent in the field of geoinformatics
PSO 7	To help students to prepare for a successful career in the area of Remote Sensing & GIS techniques

LIST AND TYPES OF COURSES

Semester. No.	Course Code	Name of the Course	Type of Courses				Credits/Hours load
			Core Courses (CC)	Discipline Specific Elective (DE)	Skill enhancement Elective (SE)	Generic Course (GC)	
I	GST-CC-611	Fundamentals of Remote Sensing	√				3
	GST-CC-612	Digital Image Processing	√				3
	GST-CC-613	Geographic Information System	√				3
	GST-CC-614	Digital Image Processing Practical	√				2
	GST-CC-615	GIS Practical	√				3
	GST-DE-616	Introduction to Earth System Sciences		√			3
II	GST-CC-621	Applications of Geoinformatics	√				2
	GST-CC-622	Dissertation	√				8
	GST-DE-623	Data Management and Statistical Analysis		√			2
	GST-DE-624	Aerial Photography and Digital Photogrammetry		√			3
	GST-SE-625	Air photo Interpretation Practical			√		2

SEMESTER -1

COURSE CODE : GST-CC-611
COURSE TITLE: FUNDAMENTALS OF REMOTE SENSING
CREDITS: 3

INTRODUCTION

This Course aims to provide knowledge on various remote sensing techniques and satellite image interpretation methods. It is expected to provide an in depth understanding of the fundamental principles of Remote Sensing, Principles of satellite Missions and advanced Remote Sensing technologies.

COURSE OUTCOMES:

Sl. No.:	Course outcome (CO) *At the end of the course, the student will be able to:*
1	**CO1:** Understand the definition, concepts and types of remote sensing;
2	**CO2:** Develop knowledge on fundamental principles of Remote Sensing
3	**CO3**: Understand various data capturing methods
4	**CO4: U**nderstand remote sensing **s**ensors and its types
5	**CO5:** Develop knowledge on Principles of satellite Missions
6	**CO6:** Fundamentals of satellite image interpretation
7	**CO7:** Gain knowledge on advanced Remote Sensing technologies

COURSE CONTENT

MODULE 1: Definition of terms, Concepts and types of remote sensing; evolution of remote sensing technology, stages in remote sensing technology, spatial data acquisition, interdisciplinary nature and relation with other disciplines, applications of remote sensing, advantages of RS over conventional methods of survey and inventorying.

MODULE 2: Basic Principles of Remote Sensing - Electromagnetic spectrum: Characteristics of electro-magnetic radiation; Interactions between matter and electro-magnetic radiation; Types of remote sensing with respect to wavelength regions; Definition of radiometry; Black body radiation; Spectral characteristics of solar radiation; EMR Interaction with Earth materials; Spectral signature concepts, spectral reflectance and emittance, specular reflection and non- specular reflectance, Albedo of materials, EMR interaction with rocks, minerals, vegetation and water -Factors affecting spectral reflectance of materials. Spectral response patterns of Vegetation, Rocks, Soil and Water bodies, Their Spectral properties and characteristics.

MODULE 3 : Data acquisition – Procedure, Reflectance and Digital numbers- Reference data , Ground truth, Analog to digital conversion, Spectroradiometer-Ideal remote sensing system – Characters of real and successful remote sensing system-

MODULE 4: Sensors – Various Platforms with respect to the altitude, Types of sensors- passive sensors and active sensors; imaging systems, photographic sensors; Sensor resolution- spectral, spatial, radiometric and temporal; Imaging sensors and non-imaging radiometers; photograph v/s image, Panchromatic, Multispectral, hyperspectral, stereo images, Optical mechanical line scanner; Pushbroom scanner; Imaging spectrometer; spaceborne imaging sensors, active and passive microwave sensors; Thermal sensors; Atmospheric sensors; Sonar; Laser, Radar, hyperspectral sensors.

MODULE 5: Platforms - Principles of satellite Missions; Types of platforms- airborne remote sensing, space borne remote sensing; Orbital elements of satellites; satellites for Land, Ocean, and atmospheric studies - IRS, Landsat, SPOT, Radarsat, quick bird, Ikonos and ESA satellite series. Weather/Meteorological satellites, INSAT series, NOAA, GOES, NIMBUS Applications, Marine observation satellites- OCEANSAT.

MODULE 6: Image Interpretation and Analysis - Fundamentals of satellite image interpretation; Types of imaging, elements of interpretation; Techniques of visual interpretation; Generation of Thematic maps

MODULE 7: Introduction to advanced Remote Sensing Technologies: Synthetic Aperture Radar; Side Looking Airborne Radar; Hyper spectral Imaging Spectrometer; Lidar; Thermal Imaging System; Advanced Laser Terrain Mapping..

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1. Behr F.J., Ngigi M., Pradeepkumar A.P. and Zimmermann M. (2011) Geoinformation
   for a better world, Applied Geoinformatics for Society and Environment, Karlsruhe,.
2. Campbell J. B. and Wynne R. H. (2008) Introduction to Remote Sensing, Fifth Edition, The Guilford Press, New York, 718p.
3. Falkne, E. and Morgan D. (2002) Aerial Mapping: Methods and Application. Lewis Publishers, Boca Raton, 192p.
4. Lillesand T.M., Kiefer R.W. and Chipman J.W. (2004) Remote sensing and image interpretation, Fifth Edition, Wiley, NJ, 812p.
5. Mather P.M. and Koch M. (2011) Computer Processing of Remotely-Sensed Images –
   An Introduction. Fourth Edition, John Wiley, New York, 462p.
6. McCoy R.M. (2005) Field methods in remote sensing. Guilford Press, New York,.
7. Barrett, E.C. And L.R.Curits, 1976: Introduction To Environmental Remote Sensing, Halstged Press, Wiley, New York
8. Drury S.A, 1990: A Guide to Remote Sensing - Interpreting Images Of Earth, Oxford Science Publications, Oxford

9. Hord R.Michel, 1986: Remote Sensing Methods And Application, John Wiley And Sons.
10. Lintz, J. And L.S.Simonett (Eds), 1976: Remote Sensing Of Environment, Addition-Wesley, Readings, Mass.
11. Sabins, F.F.Jr., 1978: Remote Sensing Principles And Interpretation, Freeman, Sanfrancisco.
12. Schanda,E. (Ed), 1976 : Remote Sensing For Environmental Science, Springerverlag.

COURSE CODE: GST-CC-612
COURSE TITLE: DIGITAL IMAGE PROCESSING
CREDITS : 3

INTRODUCTION

Aim of the course is to familiarize students about various digital image processing techniques. This course will provide an in depth understanding in the field of satellite data acquisition, various image correction and enhancement techniques, digital image classification and GIS integration.

COURSE OUTCOMES:

Sl. No.:	**Course outcome (CO)** *At the end of the course, the student will be able to:*
1	**CO1:** Understand the basics of satellite data acquisition and its data formats
2	**CO2:** Develop knowledge on various image correction and enhancement techniques in digital image processing
3	**CO3: U**nderstand the digital image classification and accuracy assessment
4	**CO4:** Develop knowledge on data merging and GIS integration

COURSE CONTENT

MODULE 1: Introduction- Satellite data acquisition, Storage and retrieval, Data Formats , Satellite System , Data products .

MODULE 2: Image manipulation : Geometric distortion, sources and causes for distortion, rectification, Geometric correction- Radiometric correction Noise removal. GCP, Resampling, Image registration, transformation. Image Enhancement- Contrast Manipulation Gray-Level, Thresh holding-Level Slicing-Contrast Stretching, Convolution Low pass, high pass, Edge Enhancement Spatial feature manipulation, edge detection, Fourier Analysis.

MODULE 3: Information Extraction - Classification techniques, feature extraction, Digital Image interpretation , Pattern recognition, shape analysis, Textural analysis,

Decision concepts, fuzzy sets and Evidential reasoning, Change detection. Multispectral Classification- Supervised Classification Stage- Minimum distance to means classifier, parallelepiped classifier, Gaussian maximum likelihood classifier. Training Stage: Graphical representation of the spectral response patterns, unsupervised classification- Hybrid Classification of Mixed Pixels. Data output -Graphic Products tabular data, Accuracy Assessment. Error matrix.

MODULE 4: Data Merging and GIS Integration - Multitemporal Data merging Pattern recognition - Change detection procedures- Multisensor image merging, Merging of image data with Ancillary data- Incorporating GIS Data in automated land cover classification. Artificial Neural Network.

REFERENCES

1. Campbell J. B. and Wynne R. H. (2008) Introduction to Remote Sensing, Fifth Edition, The Guilford Press, New York, 718p.
2. Falkne, E. and Morgan D. (2002) Aerial Mapping: Methods and Application. Lewis Publishers, Boca Raton, 192p.
3. Lillesand T.M., Kiefer R.W. and Chipman J.W. (2004) Remote sensing and image interpretation, Fifth Edition, Wiley, NJ, 812p.
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   An Introduction. Fourth Edition, John Wiley, New York, 462p.
5. McCoy R.M. (2005) Field methods in remote sensing. Guilford Press, New York,.
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7. Drury S.A, 1990: A Guide to Remote Sensing - Interpreting Images Of Earth, Oxford Science Publications, Oxford
8. Hord R.Michel, 1986: Remote Sensing Methods And Application, John Wiley And Sons.
9. Drury S.A, 1990: A Guide to Remote Sensing - Interpreting Images Of Earth, Oxford Science Publications, Oxford
10. Freeman, H and GG.Pieroni 1980: Map Data Processing, Academic Press, New York.
11. Lillisand, T.M. And P.W.Kiefer, 1986: Remote Sensing And Image Interpretation,John Wiley & Sons, New York.
12. Sabins, F.F.Jr., 1978: Remote Sensing Principles And Interpretation, Freeman, Sanfrancisco.

COURSE CODE : GST-CC-613
COURSE TITLE: GEOGRAPHIC INFORMATION SYSTEM
CREDITS: 3

INTRODUCTION

This Course aims to provide knowledge on spatial data concepts and various data analysis techniques. The students will get an idea about the concepts of spatial data input, editing, data analysis techniques, GPS and its applications.

COURSE OUTCOMES:

Sl. No.:	**Course outcome (CO)** *At the end of the course, the student will be able to:*
1	**CO1:** Understand the fundamentals of Fundamentals of GIS,its principles and concepts
2	**CO2:** Develop knowledge on spatial data Input , Editing and map projections
3	**CO3: U**nderstand the Data Structures in GIS
4	**CO4:** Develop knowledge on various Data Analysis techniques in GIS
5	**CO5**: Checking of data quality and error correction
6	**CO6:** Understand the overview of GPS and its applications.

COURSE CONTENT

MODULE 1: Fundamentals of GIS : Basic concepts, Principles, Techniques, Procedures, Terminology, etc. Overview of GIS. Data in GIS : Temporal, thematic and spatial data. Main characteristics of spatial data. Basic spatial entity types. Attribute data. Various file formats.

MODULE 2: The interface of remote sensing and geographic information systems , data encoding- data management, data manipulation, data output. Data Input and Editing : Map Projections. Coordinate Conversion. Data Sources, Digitizing, data encoding, re-projection and transformation.

Data input - Data verification, Correction and Storage. Data output – Data output format – Thematic maps, Charts and Graphs – User Interfaces. Methods of Data Analysis and Spatial Modeling.

MODULE 3: Data Structures in GIS : Various Raster and Vector data structures. Attribute data management. Data modelling : Points, lines, areas, networks and surfaces. Raster and Vector Spatial data models.

MODULE 4: Data Analysis : GIS Data Analysis – Simple Data Retrieval. Map overlay – Cartographic modeling using natural language commands. Linking command sequences into cartographic models – advantages and disadvantages of cartographic model in land evaluation and planning. Proximity, neighbourhood and reclassification functions. Vector and Raster data analysis. Interpolation and overlay techniques. Query analysis.

Combining attributes from overlaid maps – Classification methods: Classification – Multivariate analysis and Classification – Allocating individuals to existing classes. Classification methods in Geographical Information Systems – Expert systems for Geographical Information Systems

MODULE 5 : Data Quality : Errors and Natural Variation: Sources of error – Errors resulting from natural variation and original measurements. Errors arise through processing – Problems and Errors arising from overlay and boundary intersections – Errors resulting in raster and vector map – Errors associated with overlaying two or more polygon networks. The nature of boundaries – The statistical nature of boundaries.

MODULE 6: Global Positioning System : Overview of GPS and its applications. Cartographic communication process, including commercial and management aspects - map type, symbol and typographic design and use of colours in maps.

REFERENCES

1. Behr F.J., Ngigi M., Pradeepkumar A.P. and Zimmermann M. (2011) Geoinformation
   for a better world, Applied Geoinformatics for Society and Environment, Karlsruhe,.
2. Falkne, E. and Morgan D. (2002) Aerial Mapping: Methods and Application. Lewis Publishers, Boca Raton, 192p.
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   Geoinformatics for Society and Environment, Karlsruhe, 293p.
4. DeMers M. N. (2009) GIS for dummies. Wiley, NJ, 388p.
5. Iliffe J. (2000) Datums and Map Projections for remote sensing, GIS, and surveying.
   Whittles Publishing, Scotland, 159p.
6. Konecny G. (2003) Geoinformation: Remote sensing, photogrammetry and geographic information systems. Taylor& Francis, London, 266p.
7. Shekar, S., Xiong, H. (Eds) (2008). Encyclopedia of GIS, Springer-Verlag, New York, 1392p.
8. Sickle J.V. (2010) Basic GIS Coordinates. CRC Press, FL, 190p.
9. Sutton T., Dassau O. and Sutton M. (2009) A Gentle Introduction to GIS Department
   of Land Affairs. Eastern Cape, 113p.
10. Verbyla D. L. (2003) Practical GIS analysis. Taylor & Francis, London, 305
11. Burrough, P.A 1986: Principles of Geographical Information Systems for Land Resources Assessment, Clarandone Press, Oxford.

12. Freeman, H and GG.Pieroni 1980: Map Data Processing, Academic Press, New York.
13. Graeme F. and Bonham Carter; Geographic Information Systems for Geoscientists; Modelling with GIS, Pergamon.
14. Ian Heywood, Sarah Cornelius and Steve Varver, Geographical Information Systems , Longman Limited, England.
15. Kang-tsung Chang, Geographic Information System, Tata McGraw-Hill Edition, New Delhi.
16. Tomlinson, R.F Calkins, H.S and D.F.Marble 1976: Computer Handling Of Geographic Data, UNESCO, Geneva.

COURSE CODE : GST-CC-614
COURSE TITLE: DIGITAL IMAGE PROCESSING PRACTICAL
CREDITS : 2

INTRODUCTION

This Course aims to provide knowledge on Satellite image processing using various softwares. This course will equip the students to use different Satellite images and it's processing in the real time world with the help of softwares.

COURSE OUTCOMES:

Sl. No.:	**Course outcome (CO)** *At the end of the course, the student will be able to:*
1	**CO1:** Understand the Satellite image processing using various softwares.
2	**CO2:** Evaluate and apply the techniques for satellite image enhancement and image restoration
3	**CO3:** Understanding of various image classification schemes

COURSE CONTENT

MODULE 1: DIGITAL IMAGE PROCESSING: Importing Satellite Image, Geometric Correction, Georeferencing , Image to image rectification, Subset, Projection conversion. Introduction to ERDAS Imagine and various open softwares for remote sensing data interpretation.

MODULE 2: IMAGE ENHANCEMENT TECHNIQUES: Noise Reduction, mosaic, resolution merge, Visual interpretation of multispectral and Panchromatic Image. Histogram stretching, linear, non linear stretching, histogram equalization. Image rectification.

MODULE 3 : DIGITAL ANALYSIS : Image classification-Supervised and Unsupervised, Image recoding, Accuracy assessment, Integration of GIS data. Image Fusion, Stitching of Images, Change Detection from Multi-Temporal imagery.

REFERENCES

1. Campbell J. B. and Wynne R. H. (2008) Introduction to Remote Sensing, Fifth Edition, The Guilford Press, New York, 718p.
2. Falkne, E. and Morgan D. (2002) Aerial Mapping: Methods and Application. Lewis Publishers, Boca Raton, 192p.
3. Lillesand T.M., Kiefer R.W. and Chipman J.W. (2004) Remote sensing and image interpretation, Fifth Edition, Wiley, NJ, 812p.
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7. Star, J.L., J.E. Estes, and K.C. McGwire,1997, Integration of GIS and Remote Sensing, Cambridge University Press.

COURSE CODE : GST-CC-615
COURSE TITLE: GIS PRACTICAL
CREDITS : 3

INTRODUCTION

This Course aims to provide practical knowledge to students in Geographic Information Systems (GIS), providing opportunities to analyze data, explore issues, problem solve, and evaluate situations in a geographic and spatial context using various GIS software platforms. It is expected to equip the students to perform basic and advanced GIS analysis concepts, techniques in real world applications.

COURSE OUTCOMES:

Sl. No.:	**Course outcome (CO)** ***At the end of the course, the student will be able to:***
1	**CO1:** Applyingy geo spatial technologies in the real time world using softwares for the production of various thematic maps
2	**CO2** : Understanding of topology
3	**CO3:** Analysis of spatial data, using GIS analysis tools

COURSE CONTENT

MODULE 1: CREATION OF SPATIAL DATA: Georeferencing, Image to Image rectification, Spatial data Integration (Digitization), Editing of Spatial & Non-Spatial data, Data Editing-Removal of errors – Overshoot & Undershoot, Snapping, Clipping, Intersection and Union, Buffering techniques, creation of shape file & geodatabase,

MODULE 2 : TOPOLOGY : Building Topology; Data Query, Importing Kml/Kmz data. Introduction to ARC GIS and various open source GIS softwares.

MODULE 3: ANALYSIS TOOLS -Buffer anlysis, Overlay analysis, network analysis, Raster data analysis, Terrain analysis, Hydrology tool analysis. Network analyses, Layout Generation and report.

REFERENCES

1. Falkne, E. and Morgan D. (2002) Aerial Mapping: Methods and Application. Lewis Publishers, Boca Raton, 192p.
2. Iliffe J. (2000) Datums and Map Projections for remote sensing, GIS, and surveying.
   Whittles Publishing, Scotland, 159p.
3. Sickle J.V. (2010) Basic GIS Coordinates. CRC Press, FL, 190p.
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7. Mitchell, Andy (2001). ESRI Guide to GIS Analysis, Volume 1. Geographic Patterns & Relationships. ESRI Press
8. Kang-tsung Chang, Geographic Information System, Tata McGraw-Hill Edition, New Delhi.
9. Tomlinson, R.F Calkins, H.S and D.F.Marble 1976: Computer Handling Of Geographic Data, UNESCO, Geneva.

COURSE CODE : GST-DE-616
COURSE TITLE: INTRODUCTION TO EARTH SYSTEM SCIENCES
CREDITS: 3

INTRODUCTION

This course aims at imparting the basic concepts of earth structure, its various processes and an overview of different landforms. This course will help the student to understand the fundamentals of Earth and its structure, various agents of earth processes, basics of water resources and to provide knowledge on various Landforms and landscapes in earth surface.

COURSE OUTCOMES:

Sl. No.:	**Course outcome (CO)** ***At the end of the course, the student will be able to:***
1	**CO1: U**nderstand the fundamentals of Earth and its structure,

	basics of Maps ,scale and projections, understanding topographical maps and geological maps.
2	**CO2:** Develop knowledge on various agents of Earth processes, overview of different types of rocks and its weathering process.
3	**CO3: U**nderstand the basics of Water resources , Surface water and ground water and Groundwater potential zones
4	**CO4** : Understanding of coastal geomorphology
5	**CO5:** Develop knowledge on various Landforms and landscapes in earth surface
6	**CO6:** Understand the Fundamental concepts of Natural and Bioresources and various types of Natural Hazards

COURSE CONTENT

MODULE 1: The Earth - Dimensions and structure. Mass movements. Spatial attributes - latitude and longitude. Maps - scale - projections. Topographical maps and geological maps and their preparation, conventional symbols. Reading a topographic map, symbols used in the topographic maps.

MODULE 2: Earth processes- agents of weathering, the rock cycle, Overview of rocks - Igneous, sedimentary and metamorphic rocks. Weathering Physical weathering and chemical weathering. Soils their formation, classification, types in India, a typical tropical soil profile.

MODULE 3: surface and subsurface Water resources - Surface water - Streams, rivers and lakes Types of streams. Drainage basins, patterns. Geological work of streams erosion, transportation, deposition long profile of stream.

Groundwater - Groundwater and it's sources. Hydrologic cycle. Sources of groundwater, Vertical distribution of subsurface water – soil water zone, and capillary zone, Zones of aeration and saturation, water table and potentiometric surfaces, Rock properties affecting groundwater - Porosity, Permeability, Interstices of rocks and their water bearing properties, Aquifer, Aquiclude, Aquitard, Aquifuge, Types of aquifers – confined and unconfinedGroundwater potential zones, artificial recharging of groundwater.

MODULE 4 : **Coastal geomorphology**: shorelines, tides, coastal currents, waves, marine erosion, beaches, landward and sea ward transport, beach transport along the shore, spits, bars, tombolo, offshore bars and barrier islands, retreating and advancing coasts. Beach profile and wave cut terraces.

MODULE 5: Landforms and landscapes - Igneous activity and landforms: Intrusive landforms - batholiths, laccoliths, dykes, Extrusive landforms - shield volcano, cinder cones, composite cones, plateau basalts, craters and calderas. Fluvial landforms. glacial landforms, aeolian landforms, coral reefs, coastal landforms. Overview of structural features Fold, fault, Joints, fractures.

MODULE 6: Natural Resources and Bioresources. Fundamental concepts of Environment management. Natural Hazards Earthquakes, Volcanoes, Floods, Tsunamis, coastal erosion, land subsidence, landslides. Disaster Management and mitigation plans.

REFERENCES

1. Billings, M.P. 2000. Structural geology (Third Edition), Prentice Hall of India Pvt.Ltd., New Delhi
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3. Thornbury, W.D. 2000 Principles of Geomorphology (Second Edition),New Age International Pvt Ltd, New Delhi
4. Todd, D.K. 1995 Groundwater Hydrology (Second Edition), John Wiley and Sons, Singapore.
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SEMESTER -2

COURSE CODE : GST-CC-621
COURSE TITLE: APPLICATIONS OF GEOINFORMATICS
CREDITS: 2

INTRODUCTION

This Course aims to provide wide applications of geoinformatics in different fields. This course will equip the students to understand the wide areas of geoinformatics application in various sectors of world including topographic mapping, remote sensing based mapping, use of geomatics in Natural resource management, Urban planning and Disaster management and webgis.

COURSE OUTCOMES:

Sl. No.:	**Course outcome (CO)** *At the end of the course, the student will be able to:*
1	**CO1:** Understand the concepts of topographic and thematic mapping
2	**CO2:** Develop knowledge on remote sensing based mapping
3	**CO3:** Explain the various application of GIS in the fields of Natural resource management, Urban planning and Disaster management
4	**CO4:** Develop knowledge on concept ad principles of Web GIS

COURSE CONTENT

MODULE 1: Topographic mapping- production of large-scale maps and its applications in various disaster management practices such as flood, drought, landslides, tsunami, and coastal erosion; visualisation of multimedia and web mapping.

MODULE 2: Remote sensing based mapping -application of remote sensing for water resources management, application of thermal and RADAR remote sensing in various fields.

MODULE 3: Applications of GIS: Applications of GIS in natural resource management, mapping and decision making; Urban planning and management; Water resources management; Disaster management- flood, drought, landslides, tsunami, and coastal erosion; Environmental management; Demography, health, business and humanities.

MODULE 4: Introduction to Web GIS: Definition, concept of Web GIS, History of Web GIS, components of web GIS, internet, web GIS v/s Internet GIS, Applications of web GIS, advantages and limitations of web GIS.

REFERENCES

1. Behr F.J., Ngigi M., Pradeepkumar A.P. and Zimmermann M. (2011) Geoinformation
   for a better world, Applied Geoinformatics for Society and Environment, Karlsruhe,.
2. Behr F.J., Rahman A.A., Zimmermann M. and Pradeepkumar A.P. (2012)
   Geoinformation – Catalyst for planning, development and good governance, Applied
   Geoinformatics for Society and Environment, Karlsruhe, 293p.
3. Shekar, S., Xiong, H. (Eds) (2008). Encyclopedia of GIS, Springer-Verlag, New York, 1392p.
4. Burrough, P.A 1986: Principles of Geographical Information Systems for Land Resources Assessment, Clarandone Press, Oxford.
5. Freeman, H and GG.Pieroni 1980: Map Data Processing, Academic Press, New York.
6. Graeme F. and Bonham Carter; Geographic Information Systems for Geoscientists; Modelling with GIS, Pergamon.
7. Ian Heywood, Sarah Cornelius and Steve Varver, Geographical Information Systems , Longman Limited, England.
8. Kang-tsung Chang, Geographic Information System, Tata McGraw-Hill Edition, New Delhi.

COURSE CODE : GST-CC-622
NAME OF THE COURSE: DISSERTATION
CREDITS : 8

INTRODUCTION

This course aims to provide production-oriented dissertation report. This course will equip the students to create a production-oriented project in which the students may apply the knowledge and skills acquired during the course. The dissertation will be done by using the facilities, equipment and data available at IUCGIST OR by collecting data from other sources OR by getting the analysis done at other labs/institutes/departments OR a combination of all above means.

COURSE OUTCOMES:

Sl. No.:	**Course outcome (CO)** *At the end of the course, the student will be able to:*
1	**CO1:** Develop a production-oriented dissertation work

COURSE CONTENT

Finding a problem of relevance, planning and design of the research work, data collection, analysis and processing of data, converting data into various formats, interpretation and preparing of the report.

COURSE CODE: GST-DE-623
COURSE TITLE: DATA MANAGEMENT AND STATISTICAL ANALYSIS
CREDITS : 2

INTRODUCTION

The aim of the course is to familiarize the students with the concept of spatial data concept and database management systems. This course will equip the students to understand the Spatial data concept, various geoportals, open source concepts ,basics of mark-up languages, database management systems and different types of Geo-statistics for spatial analysis

COURSE OUTCOMES:

Sl. No.:	**Course outcome (CO)** *At the end of the course, the student will be able to:*
1	**CO1:** Understand the Spatial data concept, geoportals and Spatial Data Infrastructure
2	**CO2:** Develop knowledge on Open Source Concepts and basics of mark up languages
3	**CO3: U**nderstand the various types of database management systems

4	**CO4**: Develop knowledge on different types of Geo-statistics for spatial analysis and modelling

COURSE CONTENT

MODULE 1: Spatial data concept- data types- database and data management , Hardwares and softwares ,Geoportals - Spatial Data Infrastructure - national and state SDIs.

MODULE 2: Open Source Concepts and Specifications: - Introduction to spatial data open source Software

MODULE 3: Database management systems - database management systems, types of DBMS hierarchical, network, relational data model- classification of database .

MODULE 4: Geo-statistics for spatial analysis and modeling: Mean, median and mode. Standard deviation. Neighborhood, Zonal and Distance measure operations; Spatial pattern analysis- concepts and techniques. Statistical Surfaces- Interpolation, Variogram, Krigging. Basic introduction to geostatistical models.

REFERENCES

1. A. Silberschats, Henry F. Korth (1998) "Database System Concepts", 3rd Edition, TMH,Bonham Carter G.F (1994) GIS for Geoscientists: Modeling with GIS Pergamon Publications.
2. Goodchild, M.F. (1978) - Statistical Aspects of the Polygon Overlay Problems, in Harvard papers on GIS, Ed. G. Dulton, Vol. 6, Addison Wesley and Reading Press.
2. Mary Summer, Computers: Concepts and Uses, Prentice Hall, Englewood Cliffs. New
   Jersey.

COURSE CODE: GST-DE-624
COURSE TITLE: AERIAL PHOTOGRAPHY AND DIGITAL PHOTOGRAMMETRY
CREDITS: 3

INTRODUCTION

The aim of the course is to familiarize the students in various concepts of photogrammetry. The students will be equipped to understand the principles of photogrammetry, Information from aerial photographs and knowledge on digital photogrammetric systems.

COURSE OUTCOMES:

Sl. No.:	**Course outcome (CO)** *At the end of the course, the student will be able to:*
1	**CO1:** Understand the historical development of Aerial

	Photography and the principles of photography
2	**CO2:** Understanding of cartographic principles and techniques.
3	**CO3:** Develop knowledge on Planimetric Information from aerial photographs
4	**CO4: U**nderstand the orthophotos and photogrammetric project planning
5	**CO5:** Develop knowledge on digital photogrammetric systems

COURSE CONTENT

MODULE 1: Historical development of Aerial Photography; Evolution of Photogrammetry, Definition and terms, concepts, principles and types of photogrammetry, types of aerial photographs, vertical photographs, tilted photographs, orthophotographs, aerial cameras, CCD Camera, CCD cameras with piezo shift, Time delay integration in CCD sensor - Spectral Sensitivity of CCD sensor, Geometric problems of CCD images, line scanners - SPOT, MOMS Data.

MODULE 2 : CARTOGRAPHY : History and development of Cartography, Definition, scope and concepts of cartography. Characteristics of Map. Categories of maps. Methods of mapping. Geodesy, Map projection-cylindrical, conical, azimuthal and globular projections. Properties & uses of projection. Map scale, and co-ordinate system. Plane coordinates in UTM system, projection used in Survey of India topographic sheets.

MODULE 3: Planimetric Information from aerial photographs - Overlapping of vertical photographs, Stereoscopy and Parallax, Stereoscopic viewing, Stereoscopes, Orientation for viewing, Vertical exaggeration, Floating mark. Triangulation, aerial mosaics.

MODULE 4:. **Orthophotography**- Classifications of orthophoto system, Strip rectification, orthophoto stereomate, Photogrammetric Project Planning, Flight Planning, Photographic scale, Relief displacement, Tilt, Crab and drift, Flying height, Ground control. Principles of aerial photo interpretation.

MODULE 5:. **Digital Photogrammetry**: Digital photogrammetric systems, Digital photogrammetric work station and its configuration, photogrammetric scanners; various formats of data inputs; 3D visualization in digital environment. Advantages and applications of digital photogrammetry and introduction to digital photogrammetric softwares.

REFERENCES

1. Francis H.Moffitt and Edward M. Mikhail, Photogrammetry, 2016: Harper & Row Publishres, New York.
2. Wolf P.R., Elements Of Photogrammetry (Paperback 2014) by Mc Graw Hill India, 2013.
3. Drury S.A, 1990: A Guide to Remote Sensing - Interpreting Images Of Earth, Oxford Science Publications, Oxford

4. Freeman, H and GG.Pieroni 1980: Map Data Processing, Academic Press, New York.
5. Lillisand, T.M. And P.W.Kiefer, 1986: Remote Sensing And Image Interpretation,John Wiley & Sons, New York.
6. Sabins, F.F.Jr., 1978: Remote Sensing Principles And Interpretation, Freeman, Sanfrancisco.

COURSE CODE : GST-SE-625
COURSE TITLE: AIR PHOTO INTERPRETATION PRACTICAL
CREDITS : 2

INTRODUCTION

This course aims to provide practical knowledge in visual and digital interpretation of aerial photographs. This course is designed to equip the students to apply and understand the principles of photogrammetry by visual and digital interpretation of aerial photographs using mirror and pocket stereoscopes

COURSE OUTCOMES:

Sl. No.:	**Course outcome (CO)** *At the end of the course, the student will be able to:*
1	**CO1:** Identification of landforms in aerial photos
2	**CO2:** Understand visual and digital interpretation of aerial photographs using mirror stereoscope

COURSE CONTENT

MODULE 1: Aerial Photography Interpretations; Visual interpretation of aerial photos, characteristics and identification of land features.

MODULE 2: Aerial Photography data extraction; Fundamentals of stereoscopes, mirror, pocket stereoscopic viewing

REFERENCES

1. Francis H.Moffitt and Edward M. Mikhail, Photogrammetry, 2016: Harper & Row Publishres, New York.
2. Wolf P.R., Elements Of Photogrammetry (Paperback 2014) by Mc Graw Hill India, 2013.
3. Drury S.A, 1990: A Guide to Remote Sensing - Interpreting Images Of Earth, Oxford Science Publications, Oxford
4. Freeman, H and GG.Pieroni 1980: Map Data Processing, Academic Press, New York.

5. Lillisand, T.M. And P.W.Kiefer, 1986: Remote Sensing And Image Interpretation,John Wiley & Sons, New York.
6. Sabins, F.F.Jr., 1978: Remote Sensing Principles And Interpretation, Freeman, Sanfrancisco.

SAMPLE QUESTION PAPER (2 CREDITS)

Reg.No: ……

Name : ……..

Post Graduate Diploma in Geoinformation Science and Technology
Second Semester Examination – 2022

GST-CC-621 APPLICATIONS OF GEOINFORMATICS

Time: 2 hours

Max.Marks-**60**

I. (a) Define thematic map. How do you prepare thematic maps with satellite data.

OR

(b) Evaluate the advantages and disadvantages of microwave remote sensing in water resources and other mapping.

(1x 20= 20 marks)

II. Write short notes on any **five** of the following:

(a) Discuss Web GIS.
(b) Evaluate the potential applications of thermal remote sensing in geo-environmental studies.
(c) Analyse the role of GIS in health sector.
(d) Write a note on Physical Environment Mapping
(e) Analyse the role of Remote sensing technology in Wetland Management.
(f) Explain the relevance of tourist maps.
(g) Discuss the process involved in socio-economic mapping.
(h) Write a note on the uses of RADAR mapping for the mitigation of landslide occurrences.

(5 x 8 = 40 marks)

SAMPLE QUESTION PAPER (3 CREDITS)

Reg.No: ……

Name : ……..

Post Graduate Diploma in Geoinformation Science and Technology

First Semester Examination – 2022

PAPER GST-CC-612 DIGITAL IMAGE PROCESSING

Time: **3** hours

Max.Marks-**60**

1. (a) Describe the Image pre-processing techniques in digital image processing

OR

(b) Explain the Resampling procedure in digital image processing

(1×15 = 15 marks)

2. (a) Compare various kinds of filters and its potential applications used in the processing of remotes sensing data.

OR

(b) Evaluate the procedures involved and the advantages of supervised classification

(1×15 = 15 marks)

3. Write short notes on any *six of the following:*

i. Analyse the concepts of NDVI and its applications in forestry
ii. Summarize the advantages and disadvantages of unsupervised classification
iii. Explain Pitch, Roll & Yaw
iv. Describe the regression method in atmospheric correction
v. Elaborate the applications of digital image processing in various fields
vi. What are the change detection techniques
vii. Differentiate between True and False colour images
viii. Define IDW

(6 × 5 = 30 marks)
