OUR VISION:

Department of Civil Engineering, Anna University, shall strive hard to develop and impart technical knowledge and professional skills required for Civil Engineering and Geoinformatics Engineering practice through excellence in teaching, research and consultancy to address sustainable infrastructure development needs at local, national and International levels.

OUR MISSION:

Department of Civil Engineering, Anna University shall contribute to technological and development by

1. Providing a firm scientific and technological base in Civil Engineering and Geoinformatics Engineering to achieve self-reliance.
2. Providing quality education through innovation in teaching practices at par with global standards.
3. Nurturing leadership and entrepreneurship qualities with ethical values.
4. Developing and disseminating latest knowledge and technologies in emerging areas of Civil Engineering and Geoinformatics Engineering.
5. Sharing intellectual resources and infrastructure facilities through collaborative partnership.
6. Ensuring supporting conditions for enhancing the employability skills.
PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

Graduates of the programme M.E Remote Sensing and Geomatics will

PEO1 Gain knowledge and skills in Remote Sensing and Geomatics which will enable them to have a career and professional accomplishment in the public or private sector Organizations

PEO2 Become consultants in Remote Sensing and Geomatics and solve complex real life issues related to data collection, analysis and synthesis for solving real world problems.

PEO3 Contribute to the enhancement of knowledge in Remote Sensing and Geomatics by performing quality research in institutions of international repute or in Research organizations or Academia.

PEO4 Practice their profession with good communication, leadership, ethics and social responsibility and formulate solutions that are technically sound, economically feasible, and socially acceptable.

PEO5 Graduates will function in multi-disciplinary teams and adapt to evolving technologies through life-long learning and innovation

PROGRAMME OUTCOMES (POs):
After going through the two years of study, our Remote Sensing and Geomatics Graduates will exhibit ability to:

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<tr>
<th>PO#</th>
<th>Graduate Attribute</th>
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<tr>
<td>PO1</td>
<td>Research Aptitude</td>
<td>An ability to independently carry out research/investigation and development work to solve practical problems.</td>
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<td>PO2</td>
<td>Technical Documentations</td>
<td>An ability to write and present a substantial technical report/document.</td>
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<td>PO3</td>
<td>Technical Competence</td>
<td>Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.</td>
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<td>PO4</td>
<td>Knowledge of Remote Sensing and Geomatics Engineering discipline</td>
<td>Demonstrate in-depth knowledge of Remote Sensing and Geomatics engineering discipline with an ability to evaluate, analyse and synthesise existing and new knowledge.</td>
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<td>PO5</td>
<td>Critical analysis of Remote Sensing and Geomatics Engineering issues and innovation</td>
<td>Critically analyse complex Remote Sensing and Geomatics problems, apply independent judgment for synthesizing information, and make innovative advances in a theoretical, practical, and policy context.</td>
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<td>PO6</td>
<td>Conceptualization and evaluation of Design Solutions</td>
<td>Conceptualize and solve Remote Sensing and Geomatics problems, evaluate potential solutions, and arrive at technically feasible, economically viable, and environmentally sound solutions with due consideration of health, safety, and sociocultural factors.</td>
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PEO / PO Mapping:

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1-Low, 2-Medium, 3-High
### MAPPING FOR PROFESSIONAL ELECTIVE COURSES

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1-Low, 2-Medium, 3-High
## ANNA UNIVERSITY, CHENNAI
### UNIVERSITY DEPARTMENTS
### M.E REMOTE SENSING AND GEOMATICS (FULL-TIME)
### REGULATIONS 2023
### CHOICE BASED CREDIT SYSTEM
### CURRICULA AND SYLLABI FOR I TO IV SEMESTERS

### SEMESTER I

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**SUMMARY**

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MA3160 PROBABILITY AND STATISTICAL METHODS

UNIT I ONE DIMENSIONAL RANDOM VARIABLES
Random variables - Probability function – Moments – Moment generating functions and their properties – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions – Functions of a Random Variable.

UNIT II TWO DIMENSIONAL RANDOM VARIABLES
Joint distributions – Marginal and Conditional distributions – Functions of two dimensional random variables – Regression Curve – Correlation.

UNIT III ESTIMATION THEORY

UNIT IV TESTING OF HYPOTHESES
Sampling distributions - Type I and Type II errors - Tests based on Normal, t, Chi-Square and F distributions for testing of mean, variance and proportions – Tests for Independence of attributes and Goodness of fit.

UNIT V MULTIVARIATE ANALYSIS

TOTAL: 60 PERIODS

COURSE OUTCOMES:
At the end of the course, students will be able to

CO1 Use the appropriate and relevant, fundamental and applied mathematical and statistics knowledge and methodologies in solving practical problem.

CO2 Bring together and flexibly apply knowledge to characterize, analyse and solve a wide range of problems.

CO3 Understand the balance between the complexity/accuracy of the mathematical/statistical models used and the timeliness of the delivery of the solution.

CO4 Steeped in research methods and rigor.

CO5 Develop critical thinking based on empirical evidence and the scientific approach to knowledge development.

REFERENCES:

Attested

DIRECTOR
CO-PO MAPPING

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1-Low, 2-Medium, 3-High

RG3101 REMOTE SENSING AND DATA PRODUCTS

UNIT I PHYSICS OF REMOTE SENSING

UNIT II PLATFORMS
Orbit elements - Types of orbits - Motions of planets and satellites - Launch of space vehicle - Orbit perturbations and maneuvers - Escape velocity - Types and characteristics of different remote sensing platforms - Sun synchronous and geosynchronous satellites.

UNIT III OPTICAL SENSORS
Classification of remote sensors - Selection of sensor parameters - Resolution concept - Spectral, radiometric and temporal resolution - Quality of images in optical systems - Imaging mode - Photographic camera - Opto-mechanical scanners - Pushbroom and whiskbroom cameras - Panchromatic, multi spectral, hyperspectral scanners - Geometric characteristics of scanner imagery - Earth resource satellites operating with optical sensors - Landsat, SPOT, IRS, WorldView.

UNIT IV DATA RECEPTION AND DATA PRODUCTS
Ground segment organization - Data product generation - Sources of errors in received data - referencing scheme - Data product output medium - Digital products - Super structure, Fast, GeoTIFF, Hierarchical and HDF formats - Indian and International satellite data products - Ordering of data - Open sources for satellite imagery - USGS Earth Explorer - NASA Earth data Search - NOAA data access viewer - Bhuvan Indian Geo-Platform of ISRO - Google Earth Engine - Copernicus Open Access Hub - Upscaling and downscaling - Sample data download and appraisal.

UNIT V DATA ANALYSIS
Data products and their characteristics - Elements of visual interpretation - Interpretation keys - Digital image processing - Preprocessing - Image rectification - Image enhancement techniques - Image classification - Supervised and unsupervised classification algorithms for multispectral and hyperspectral images - Accuracy assessment.

LABORATORY EXCERCISES
1. Spectral reflectance observation of the following using handheld spectroradiometer.
   i) Vegetation. ii) Soil iii) Water iv) Built-up
3. Base Map preparation from SOI

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4. Visual image interpretation keys for different land cover types on different satellite data
5. Land use/land cover map
6. Soil Map
7. Geology and geomorphology maps.
8. Watershed delineation

TOTAL: 105 PERIODS (45 (THEORY) + 60 (PRACTICAL))

COURSE OUTCOMES:
- On completion of the course the student is expected to be able to
  CO1: Understand the concepts and laws related to remote sensing.
  CO2: Acquire knowledge about various remote sensing platforms.
  CO3: Understand the characteristics of different types of remote sensors.
  CO4: Gain knowledge about reception, product generation, storage and ordering of satellite data.
  CO5: Understand the concept of different image processing techniques and interpretation of Satellite data.

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1-Low, 2-Medium, 3-High

RG3102 GEOGRAPHICAL INFORMATION SYSTEM

UNIT I CARTOGRAPHY
Definition of map - Mapping organization in India - Classification based on function, scale, characteristics - Ellipsoid and geoid - Coordinate systems - Rectangular and geographic coordinates - UTM and UPS - Projection - Function - Types of map projections - Transformations - Function - Affine transformation - Choice of map projection - Evolution of cartography - Geospatial, spatial and non spatial data - Definition of GIS - Evolution of GIS - Components of GIS.

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Anna University, Chennai 600 025
UNIT II GIS DATA MODELS AND DATA INPUT
Point, line polygon / area, elevation and surface - Tessellations - Attributes and levels of measurement - Data sources - Ground and remote sensing survey - Collateral data collection - Input: Map scanning and digitization, registration and georeferencing - Concepts of RDBMS - Raster data model - Grid - Data encoding - Data compression - Vector data model - Topological properties - Arc node data structure - Raster vs. vector comparison - File formats for raster and vector - Data conversion between raster and vector.

UNIT III RASTER AND VECTOR DATA ANALYSIS
Raster data analysis: Local, neighborhood and regional operations - Map algebra - Vector data analysis: Topological analysis, point-in-polygon, line-in-polygon, polygon-in-polygon - Proximity analysis: Buffering, thiessen polygon - Non topological analysis: Attribute data analysis - Concepts of SQL - ODBC.

UNIT IV NETWORK ANALYSIS AND SURFACE ANALYSIS
Network - Creating network data - Origin, destination, stops, barriers - Closest facility analysis, service area analysis, OD cost matrix analysis, shortest path analysis - Address geocoding - Surface analysis - DEM, DTM - Point data to surface interpolation - DEM representation - Applications.

UNIT V DATA OUTPUT AND WEB BASED GIS
Map compilation - Cartographic functionalities for map design - Symbolization - Conventional signs and symbols - Spatial data quality - Lineage, positional accuracy, attribute accuracy, completeness, logical consistency - Metadata - Web based GIS: Definition, merits - Architecture - Map server - Spatial data infrastructure - Spatial data standards - Free and open source - Proprietary GIS software.

LABORATORY EXERCISES
1. Rectification and Spatial Referencing of Digital Map.
2. Onscreen Digitization and Database Creation.
3. Projection and Reprojection of spatial data.
4. Data Conversion – Vector to Raster, Raster to Vector.
5. Populating Attribute database and querying on attribute data.
   Mini Project: Optimal Siting and Routing using DEM and Viewshed Analysis.
7. Vector Analysis – Buffering, Overlay and Network analysis, flood mapping.
   Mini Project: Development of Flood Insurance Maps for a part of City.
10. Map compilation.
11. Modelling spatial variability.
12. Weighted thiessen polygon and proximity analysis.
   Mini Project: Visualisation of Temporal Variation of Climatic Parameters with Charts and Symbols.
13. Customisation and scripting.

TOTAL: 105 PERIODS (45 (THEORY) + 60 (PRACTICAL))

COURSE OUTCOMES:
- On completion of the course the student is expected to be able to
  CO1: Understand the Characteristics and Components of Maps and GIS.
  CO2: Perform input of Spatial and Non-spatial data into GIS.
  CO3: Analyze Spatial Relationship between Elements using GIS tools.
  CO4: Evaluate Network and Surface Data for Decision Making.
  CO5: Present the Spatial Information and Access the Quality against Standards.
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1-Low, 2-Medium, 3-High

RG3103 PROGRAMMING FOR SPATIAL DATA PROCESSING

UNIT I CONCEPTS OF OBJECT ORIENTED PROGRAMMING 6+6
Principles - Abstract Data types - Inheritance - Polymorphism - Object Identity - Object Modeling - Object Oriented Programming Languages - Object Oriented Databases - Object Oriented user Interfaces - Object Oriented GIS - Object Oriented Analysis - Object Oriented Design - Examples.

UNIT II C++ PROGRAMMING FUNDAMENTALS 6+6
Introduction to C++ - Keywords, identifiers - Data types - Variables - Operators - Manipulators - Operator Overloading - Operator Precedence - Control Statements - Functions - Call by Reference - Arguments - Function Overloading - Exercises.

UNIT III CLASSES AND OBJECT 6+6
Classes and Objects - Member Functions - Nesting of Member Functions Constructors Destructors - Type Conversions - Inheritance - Base class - Derived Class - Visibility modes - Single Inheritance - Multilevel Inheritance - Multiple Inheritance - Nesting - Polymorphism - File - Opening and Closing - Exercises.

14
UNIT IV PROGRAMMING USING IDL 6+6

UNIT V GIS CUSTOMISATION PROGRAMMING USING PYTHON 6+6

TOTAL: 60 PERIODS

COURSE OUTCOMES:
- On completion of the course the student is expected to be able to
  CO1: Acquainted with the concepts of OOPs technique.
  CO2: Implement procedures involved in programming with fundamental C++.
  CO3: Apply the tools and procedures involved in programming with C++ with Oops concept.
  CO4: Apply scientific programming language and graphic visualization of complex numerical data for the purpose of interpretation
  CO5: Implement the concepts of python scripting language for customization in GIS.

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RG3104 PHOTOGRAMMETRY L T P C 3 0 2 4

UNIT I PRINCIPLES OF PHOTOGRAMMETRY 9+6
Definition and applications of Photogrammetry - Types of photographs, classification - Photographic overlaps - Camera: metric vs non-metric, aerial cameras - Vertical photographs - Geometry, scale, parallax equations, planimetric mapping - Tilted photograph - Geometry - Flight planning - Crab and drift - Computation of flight plan - Photogrammetry project Planning.

UNIT II PHOTOGRAMMETRY CONCEPTS 9+6
Stereoscopes - Stereoscopic depth perception - Parallax concept - Parallax equation - Causes of Y Parallax - Viewing and measuring system - Principle of the floating mark - Coordinate systems for Photogrammetry - Collinearity and coplanarity condition - Space resection - Two-dimensional coordinate transformations: Congruence (euclidean), similarity (helmert), affine, projective, and polynomial - Three-dimensional coordinate transformation.

UNIT III STEREO PLOTTERS ORIENTATION AND MAPPING 9+6
Stereo plotters - Classification – Analog, semi-analytical, analytical, and digital plotting concepts - Cross ratio - Concepts of analog and analytical orientation: Interior, relative, and absolute orientation - GPS/INS based orientation - Elements and principles of aerotriangulation - Independent models - Strip adjustment - Simultaneous bundle adjustment rectified photo, orthophoto, and true orthophoto - Ortho mosaic - Mono plotting - Stereo plotting - Feature collection.
UNIT IV  DIGITAL PHOTOGRAMMETRY  

UNIT V  OTHER PHOTOGRAMMETRIC TECHNIQUES AND APPLICATIONS  
Concepts and working principles of close-range photogrammetry, Terrestrial photogrammetry, non-topographic photogrammetry, and satellite photogrammetry - UAS technology - Large scale mapping and 3D modelling - Recent trends and applications of photogrammetry with the case study.

TOTAL: 75 PERIODS

COURSE OUTCOMES:
- On completion of the course the student is expected to be able to
  
CO1: To understand and highlight the importance of photography for topographic mapping, the functional and physical elements of photography.
CO2: To comprehend various photogrammetric techniques and applications, including aerial, terrestrial, and satellite photogrammetry.
CO3: To develop analytical skills and problem-solving abilities in the context of photogrammetry.
CO5: To provide hands-on experience and practical training in photogrammetry through laboratory exercises, fieldwork, and real-world projects.

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UNIT I  RESEARCH PROBLEM FORMULATION  
Objectives of research, types of research, research process, approaches to research; conducting literature review-information sources, information retrieval, tools for identifying literature, Indexing and abstracting services, Citation indexes, summarizing the review, critical review, identifying research gap, conceptualizing and hypothesizing the research gap.

UNIT II  RESEARCH DESIGN AND DATA COLLECTION  
Statistical design of experiments- types and principles; data types & classification; data collection - methods and tools.

UNIT III  DATA ANALYSIS, INTERPRETATION AND REPORTING  
Sampling, sampling error, measures of central tendency and variation.; test of hypothesis- concepts; data presentation- types of tables and illustrations; guidelines for writing the abstract, introduction, methodology, results and discussion, conclusion sections of a manuscript; guidelines for writing thesis, research proposal; References – Styles and methods, Citation and listing system of documents; plagiarism, ethical considerations in research.

UNIT IV  INTELLECTUAL PROPERTY RIGHTS  
Concept of IPR, types of IPR – Patent, Designs, Trademarks and Trade secrets, Geographical indications, Copy rights, applicability of these IPR; IPR & biodiversity; IPR development process, role of WIPO and WTO in IPR establishments, common rules of IPR practices, types and features of IPR agreement, functions of UNESCO in IPR maintenance.

UNIT V  PATENTS  
Patents – objectives and benefits of patent, concept, features of patent, inventive steps, specifications, types of patent application; patenting process - patent filling, examination of patent, grant of patent, revocation; equitable assignments; Licenses, licensing of patents; patent agents, registration of patent agents.

TOTAL: 45 PERIODS

COURSE OUTCOMES
Upon completion of the course, the student can

CO1: Describe different types of research; identify, review and define the research problem

CO2: Select suitable design of experiment s; describe types of data and the tools for collection of data

CO3: Explain the process of data analysis; interpret and present the result in suitable form

CO4: Explain about Intellectual property rights, types and procedures

CO5: Execute patent filing and licensing

REFERENCES:
2. Soumitro Banerjee, “Research methodology for natural sciences”, IISc Press, Kolkata, 2022,
UNIT I  PHYSICS OF MICROWAVES  
Light theory, wave description of simple harmonic waves - Complex wave description, energy and power of waves - Brightness or intensity - Polarization property of microwaves - Wave equation for polarized waves, wave combination - Interference - Coherence, phase as a relative distance measure - Interference pattern - Fraunhofer criterion, microwave propagation - Maxwell equation - Signal loss through lossy media.

UNIT II  ACTIVE MICROWAVE REMOTE SENSING  
Radar basics - RADAR operation and measurements - Radar frequency bands - Antenna configuration, SLAR - Imaging geometry - Resolution concepts, SAR concepts - Doppler principle & processing system parameters and fading concepts - SAR focusing, geometric distortions, operational limitations, RADAR energy quantification, interaction with earth surface and vegetation, scattering models - Surface and volume scattering.

UNIT III  PASSIVE MICROWAVE REMOTE SENSING  

UNIT IV  PLATFORMS, SENSORS AND DATA PROCESSING  
Airborne, space borne and Indian missions, modes of acquisition, data products and selection procedure, SAR image processing software - Measurement and discrimination - Header extraction - Slant range to ground range - Multi-looking from SLC - Filtering technique - Geometric correction, factors affecting geometrical correction - Backscattering coefficient - Speckle processing - Image interpretation, SAR image fusion - Hybrid classification of optical microwave.

UNIT V  IMAGING, NON-IMAGING TECHNIQUES AND APPLICATIONS  
Polarimetry, interferometry, altimetry, scatterometry - Principles - Data & resource availability - Principle & applications in agriculture, forestry, ocean, geology, hydrology, cryospace studies, landuse mapping and ocean related studies.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
- On completion of the course the student is expected to be able to
  CO1: Understand the importance of Microwave Remote Sensing over other Remote Sensing techniques.
  CO2: Gain knowledge on SAR data acquisition and processing.
  CO3: Understand the physical fundamentals about wave theory related to Microwave Remote Sensing.
  CO4: Impart the skills required to analyze and understand polarimetric and Interferometric concepts.
  CO5: Knowledge about the oceanographic applications of scatterometry and altimetry and other active, passive microwave remote sensing applications over land and atmosphere.

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DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025

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RG3202 SATELLITE IMAGE PROCESSING

UNIT I FUNDAMENTALS
Satellite systems and data - Acquisition - Storage - Orbits - Data formats - Data products - Image processing system - Factors to be considered - Image display systems - Image sampling and quantization - Basic relationship between pixels.

UNIT II SENSOR AND DATA MODEL

UNIT III IMAGE ENHANCEMENTS
Spectral signatures - Image characteristics, feature space scatterogram - Point, local and regional operation - Contrast, spatial feature and multi image manipulation techniques - Fourier transform - Principle component analysis - Optimal Rotation Transformation - Scale-space transform, wavelet transform, multi-image fusion.

UNIT IV THEMATIC CLASSIFICATION
Training sites - Supervised, Unsupervised and Hybrid classifiers - Baye’s Theorem - Parametric classification - Decision tree - Other Non-parametric classifiers - Sub-pixel and super-pixel classification - Hyper-spectral image analysis - Accuracy assessment.

UNIT V FEATURE EXTRACTION
LABORATORY EXCERCISES

1. Reading and Displaying satellite data from BIL, BSQ and BIP Formats.
2. Generating False Colour Composite (FCC).
3. Extracting area of Interest (AOI).
4. Generating Histogram of various bands.
5. Georeferencing the base image.
7. Enhancement using Band ratio and NDVI.
8. Enhancement using different Filtering techniques.
10. Principal Component Analysis (PCA).
11. Fourier analysis.
12. Unsupervised Classification.
13. Supervised Classification.
15. Accuracy Assessment and Change detection study.

TOTAL: 105 PERIODS (45 (THEORY) + 60 (PRACTICAL))

COURSE OUTCOMES:
- On completion of the course the student is expected to be able to

**CO1:** Gain knowledge about basic requirement of satellite image processing

**CO2:** Understand knowledge about the error in satellite image and also to restore it for further processing.

**CO3:** Perform various image Enhancement techniques to improve the visual Interpretability of the image

**CO4:** Gain knowledge about classification of the satellite image using various methods and also evaluate the accuracy of classification.

**CO5:** Implement the advanced image classification methods and conduct lifelong research in the field of image processing.

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DIRECTOR

Centre for Academic Courses
Anna University, Chennai-600 025
UNIT I  FUNDAMENTALS OF TOTAL STATION AND ELECTROMAGNETIC WAVES  9
Methods of Measuring Distance - Basic Principles of Total Station - Historical Development, Classifications, applications and comparison with conventional surveying. Classification - Applications of Electromagnetic waves, propagation properties, wave propagation at lower and higher frequencies.

UNIT II  DISTANCE AND ATMOSPHERIC CORRECTION  9
Refractive index (RI) - Factors affecting RI - Computation of group RI for light and near infrared waves at standard and ambient conditions - Computation of RI for microwaves at ambient condition - Reference refractive index - Real time application of first velocity correction. Measurement of atmospheric parameters - Mean refractive index - Second velocity correction - Total atmospheric correction - Use of temperature and pressure transducers.

UNIT III  ELECTRO OPTICAL AND MICROWAVE SYSTEM  9
Electro-optical system: Measuring principle, working principle, reflectors, sources of Error, Infrared and Laser Total Station instruments - Microwave system: Measuring principle, working principle, sources of Error, Microwave Total Station instruments. Comparison between Electro-optical and Microwave systems. Care and maintenance of Total Station instruments - Traversing and Trilateration - COGO functions, offsets and stake out - land survey applications.

UNIT IV  GNSS SATELLITE SYSTEM  9
Basic concepts of GPS - Historical perspective and development - applications - Geoid and Ellipsoid - satellite orbital motion - Keplerian motion - Kepler's Law - Perturbing forces - Geodetic satellite - Doppler effect - Positioning concept - GNSS - Galileo, BeiDou, GLONASS, IRNSS and GAGAN, QZSS - Different segments - Space, control and user segments - satellite configuration - Signal structure - Orbit determination and representation - Anti Spoofing and Selective Availability - Task of control segment - Receivers.

UNIT V  DATA PROCESSING  9
GPS observables - Code and carrier phase observation - Linear combination and derived observables - Concept of parameter estimation - Downloading the data RINEX format - Differential data processing - software modules - Solutions of cycle slips, ambiguities, Concepts of rapid, static methods with GPS - Semi Kinematic and pure Kinematic methods - Satellite geometry & accuracy measures - Applications - Long baseline processing - Use of different softwares.

LABORATORY EXERCISES  60
1. Study of Total station and measurement of Angle, Distance, and Coordinate measurement.
2. Establishment of Horizontal control point by Traversing and establishment of vertical control by Trigonometric levelling.
3. To determine the instrument station coordinate: Orientation by back site and Resection methods (Angles only and Distances only). To determine the height of the tower/column/power transmission line by REM method.
4. To determine the perimeter of a polygon by MLM / Inverse method and the area of a polygon (some points are inaccessible points, that are to be determined by different offset methods).
5. Topographic mapping and Preparation of Contour map using Total Station
6. Setting out of the structure and curve by Coordinates / Distance and angle.
7. Navigation and Feature collection using handheld GPS
8. GNSS Planning of points with and without obstructions.
9. Accuracy evaluation of baseline with different common observation times using GNSS.
11. Establishment of Ground Control Point using Static / Rapid Static differential GNSS survey by Lee Frog Method
12. Establishment of Ground Control Point using Static / Rapid Static differential GNSS survey by Trilateration method
13. Network Adjustment of GNSS observation
14. Preparation of Planimetric map using Post Processed Kinematic (PPK) method

TOTAL: 105 PERIODS (45 (THEORY) + 60 (PRACTICAL))

COURSE OUTCOMES:
- On completion of the course the student is expected to be able to
  CO1: Learn the fundamentals of Total station.
  CO2: Provides knowledge about electromagnetic waves and its usage in Total Station and GPS.
  CO3: Understand the measuring and working principle of electro optical and Microwave Total station.
  CO4: Learn the basic concepts of GNSS.
  CO5: Gains knowledge about GPS data downloading and processing.

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RG3211 SEMINAR L T P C
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SYLLABUS:
The students work on a specific technical topic in Geomatic Engineering. They will work for three hours per week, guided by a group of staff members. During this time, they will be asked to give a talk on a topic of their choice and engage in a dialogue with the audience. Additionally, they are required to submit a brief copy of their talk. Furthermore, the students will be expected to present a seminar lasting no more than fifteen minutes on the technical topic. The course delves into key theories, methodologies, and real-world examples, aiming to foster critical thinking and analysis. It also focuses on emerging trends, technologies, and advancements in the field of Geomatic Engineering. Moreover, the students are expected to answer queries related to the topic, and
interaction among the students and the audience is encouraged. The evaluation will be based on the overall quality of the presentation, both in terms of general and technical aspects, as well as the submitted report and the level of interaction displayed during the seminar.

**TOTAL: 30 PERIODS**

**COURSE OUTCOMES:**

- On completion of the course the student is expected to be able to

  **CO1:** Effectively communicate complex ideas, and deliver presentations with clarity and confidence.

  **CO2:** Evaluate scholarly articles, summarize key findings, and effectively incorporate relevant literature into their seminar presentations and reports.

  **CO3:** Gather relevant information, critically evaluate sources, and synthesize findings to make a presentation and present before the technical evaluation committee of the seminar topic.

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**RG3311**

**PRACTICAL TRAINING (4 WEEKS)**

**SYLLABUS:**

The students individually undertake training in reputed Industries during the summer vacation for a period of minimum four weeks. At the end of training, a detailed report on the work done should be submitted within ten days from the commencement of the semester. The students will be evaluated through Presentation and viva-voce examination by a team of internal staff.

**COURSE OUTCOMES:**

- On completion of the course the student is expected to be able to

  **CO1** Understand industry requirement for Geospatial technology.

  **CO2** To have hands on training on technical aspects.

  **CO3** To comprehend the use of geospatial for industrial requirement.

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SYLLABUS:
The student individually works on a specific topic approved by a faculty member who is familiar with this area of interest. The student can select any topic which is relevant to his/her specialization in the program. The topic may be experimental or analytical or case studies. At the end of the semester, a detailed report on the work done should be submitted which contains a clear definition of the identified problem, a detailed literature review related to the area of work, and methodology for carrying out the work. The students will be evaluated through a viva-voce examination by a panel of examiners including one external examiner.

TOTAL: 180 PERIODS

COURSE OUTCOMES:
- On completion of the course the student is expected to be able to
  
  CO1 Identify engineering challenges/problems, which require the use of the geomatics domain.
  
  CO2 Do the review of the literature and identify the gaps/weaknesses in existing solutions to the identified challenge/problem.
  
  CO3 Identify appropriate techniques to analyze complex engineering problems.

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RG3411 PROJECT WORK II

SYLLABUS:
The student should continue the Project Work I on the selected topic as per the formulated methodology. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report should be prepared and submitted to the head of the department. The students will be evaluated based on the report and the viva-voce examination by a panel of examiners including one external examiner.

TOTAL: 360 PERIODS

COURSE OUTCOMES:
- On completion of the course the student is expected to be able to
  
  CO1 Establish research skills, including the ability to identify relevant sources of data, collect data, analyze information, and draw meaningful conclusions.
  
  CO2 Apply the knowledge gained throughout their program and their expertise in their chosen area of research, including programming languages, data analysis tools, design software, or other specialized tools necessary to complete the project.
  
  CO3 Write a comprehensive project thesis, present their work to a panel of examiners, and effectively communicate the research outcomes.
PROFESSIONAL ELECTIVE COURSES

RG3001
GEODESY AND APPLICATIONS

UNIT I  INTRODUCTION  9
Definition, history, and importance of geodesy - Geodesy in various disciplines and applications - Earth's shape and size - Geoid, ellipsoid, and Earth's figure - Geodetic datums and their relationship to the Earth's shape - Classification of geodesy - Distance measurement techniques - Angle measurements and orientation - Height determination methods.

UNIT II  GEOMETRIC GEODESY  9
Definition, history, and importance of geometric geodesy - Overview of coordinate systems and geodetic datums - Mathematical foundations of geodesy - Geometry of the Earth and celestial reference systems - Spherical trigonometry and its applications in geodesy - Geodetic coordinate systems, cartesian, geocentric, geodetic, and local coordinate systems - Transformation between different coordinate systems - Geodetic datums - Definition and characteristics of geodetic datums - Datum transformations and datum shifts - Geometric geodetic measurements - Horizontal angle and azimuth measurements.

UNIT III  GEODETIC ASTRONOMY  9
Definition, history, and importance of geodesic astronomy - Celestial sphere and celestial coordinate systems - Equatorial, ecliptic, and galactic coordinate systems - Transformation between celestial and terrestrial coordinate systems - Celestial observations: Measurement of astronomical angles and azimuths - Astrometry and the reduction of observational data - Time determination - Universal Time (UT) and Coordinated Universal Time (UTC) - Earth's rotation and its variations.

UNIT IV  PHYSICAL GEODESY  9
Definition, history, and importance of physical geodesy - Geopotential theory - Mathematical representation of the Earth's gravitational potential - Earth's gravity field - Gravity anomaly and its interpretation - Determination of gravity anomalies using terrestrial and satellite measurements - Geoid determination - Methods for geoid determination (e.g., satellite altimetry, terrestrial gravity data) - Geoid modeling and its applications in geodesy - Satellite missions: GRACE, Jason, Cryosat missions.

UNIT V  APPLICATIONS OF GEODETIC MEASUREMENTS  9
Geodetic control networks and their use in surveying and mapping - Geodesy in geophysics, geodynamics, and plate tectonics - Geodetic applications of astronomical observations - Applications of satellite data in geodetic studies - Monitoring and modeling of crustal deformation and plate motion - Geodesy in navigation and positioning systems - Geodetic applications in climate change monitoring and environmental studies - Geodetic software and tools - Emerging topics in Geodesy.

TOTAL: 45 PERIODS
COURSE OUTCOMES:
- On completion of the course the student is expected to be able to
CO1: Understand the fundamental concepts, history, and importance of geodesy and its applications in various disciplines.
CO2: Apply mathematical foundations and concepts of coordinate systems and geodetic datums to solve geodetic problems and perform coordinate transformations.
CO3: Apply celestial coordinate systems, perform transformations between celestial and terrestrial coordinate systems, and utilize astronomical observations for geodetic purposes.
CO4: Analyze and interpret gravitational potential, gravity anomalies, and geoid models using terrestrial and satellite measurements.
CO5: Utilize geodetic measurements for surveying, mapping, geophysics, and environmental studies.

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RG3002 SOFT COMPUTING AND BIO-INSPIRED TECHNIQUES L T P C

UNIT I ARTIFICIAL NEURAL NETWORKS 9

UNIT II FUZZY SYSTEMS 9
UNIT III  NEURO-FUZZY MODELLING  9

UNIT IV  GENETIC ALGORITHM  9

UNIT V  APPLICATIONS IN GEOMATICS  9

TOTAL:45 PERIODS

COURSE OUTCOMES:
- On completion of the course the student is expected to be able to
  CO1: Acquaint with the necessity of soft computing techniques and fundamentals of Artificial Neural Networks.
  CO2: Imparts the concepts of uncertainty and its impacts on artificial intelligence.
  CO3: Implement hybrid computing techniques in geomatics.
  CO4: Apply Genetic algorithm in geomatic applications.
  CO5: Implement soft computing techniques in geomatic fields.

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UNIT I  NATURAL RESOURCE MANAGEMENT APPLICATIONS  9

UNIT II  DISASTER MANAGEMENT & FACILITY MANAGEMENT APPLICATIONS  9

UNIT III  LOCATION BASED SERVICES APPLICATION  9
Vehicle tracking: Automatic vehicle location (AVL), Components of AVL: In vehicle equipment, various communication channels, web server, client - Vehicle tracking alarms used in vehicle tracking, fleet management - Vehicle navigation - Emergency call: Address geocoding, distress call application.

UNIT IV  LAND INFORMATION SYSTEM & WEB GIS APPLICATIONS  9
Land information system (LIS) - Tax mapping - Mobile mapping - Other LIS applications - Web GIS: Architecture of web GIS, map server, web GIS applications - Bhuvan - NUIS – EPRIS

UNIT V  DEMOGRAPHIC APPLICATIONS  9
Business applications: Sitting retail store, Customer loyalty studies, market penetration studies - Health application: Disaster surveillance, health information system - Crime mapping: Mapping crime data, hotspot analysis - 3D GIS

TOTAL: 45 PERIODS

COURSE OUTCOMES:
- On completion of the course the student is expected to be able to
  CO1: Apply geomatics technology for management of natural resources.
  CO2: Evaluate use of geomatics technology for disaster management and facility management.
  CO3: Understand the use of geomatics in location based services.
  CO4: Assess the applications of land information in tax and other domains.
  CO5: Apply geomatics for solving social and business issues.

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RG3004 THERMAL AND HYPERSPECTRAL REMOTE SENSING L T P C 3 0 0 3

UNIT I FUNDAMENTALS OF THERMAL REMOTE SENSING 9
Radiation science basics - Thermal radiation principles, thermal interaction behavior of terrain elements, thermal sensors and specifications - MUST (Medium Scale Surface Temperature Missions) infrared sensors and radiometers - Aerial thermal images - Image characters, spatial and radiometry - Sources of image degradation - Radiometric and geometric errors and correction - Interpretation of thermal image

UNIT II THERMAL IMAGE AND INTERPRETATION 9
Extraction of environmental variables - LST retrieval methods - Mapping of surface energy balance components - Surface flux studies - Thermal and optical RS for plant biophysics, hydrology, forestry and agriculture applications - Case studies.

UNIT III FIELD AND IMAGE SPECTROMETRY 9
Spectral radiometry - Imaging spectrometry: Considerations - Experimental design and instrumentation - Factors affecting the field spectrum - Hyper spectral sensor systems - Imaging spectrometry - Scattering principles - BDRF and hemispherical reflectance - Models; MODTRAN Sensors and platforms - Data characteristics.

UNIT IV HYPERSPECTRAL IMAGE ANALYSIS 9

UNIT V HYPERSPECTRAL IMAGE APPLICATIONS 9
Application to lithology, mineral exploration - Agricultural crop systems - Stress detection, plant production, vegetal biophysics and biochemistry, soil moisture, soil characteristics, degradation status - Forestry canopy characters, ecosystem, forest health, biodiversity, gap dynamics, environmental and resource management.

TOTAL: 45 PERIODS
COURSE OUTCOMES:
- On completion of the course the student is expected to be able to
  CO1: Understand the principles of thermal radiation and thermal image processing.
  CO2: Understand the satellite thermal image for environmental parameter estimation.
  CO3: Understand the spectrometry principles of satellite images.
  CO4: Understanding the hyper spectral image analysis to derive various parameters of vegetation, soil and water.
  CO5: The hyper spectral image to resource management in various fields.

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UNIT I DISASTER PRINCIPLES
Disaster - Concepts and principles - Classification - Causes, characteristics and effects of various types of natural and manmade disasters - Global scenario - vulnerability profile in India - Institutional framework for disaster management - Role of government administration and NGOs - International disaster assistance - Sharing technology and technical expertise.

UNIT II LONG TERM MITIGATION MEASURES

UNIT III PREPAREDNESS, RESPONSE AND RECOVERY
Forecasting of disasters - Institutional arrangement for forecasting - Role of university and research organizations - Support by satellite remote sensing agencies - Preparedness - Trigger mechanism - Crisis management plan - Recovery - Reconstruction after disasters: Issues of practices.
UNIT IV  SAFETY RATING OF STRUCTURES  9
Structural safety of hill slopes, dams, bridges, hospital, industrial structures - Planning seawalls and
groynes - Cyclone shelter projects and their implications - Disaster resistant construction practices -
Low cost housing for disaster prone areas

UNIT V  REMOTE SENSING AND GIS FOR DISASTER MANAGEMENT  9
Remote sensing applications: Hazard evaluation - Zonation - Risk assessment and vulnerability-
Damage assessment - Land use planning and regulation for sustainable development - Post disaster
review GIS Applications: Spatial and non-spatial data bank creation - Operational emergency
management - Vulnerability analysis of infrastructures and settlements - Pre-disaster and post
disaster planning for relief operations - Disaster mapping

TOTAL:45 PERIODS

COURSE OUTCOMES:
- On completion of the course the student is expected to be able to
  CO1: Understand various types of disasters and infrastructural facilities available for managing
  Disasters.
  CO2: Understand long term disaster mitigation principles.
  CO3: Understand the requirements for disaster preparedness, response and recovery.
  CO4: Gain knowledge about safety evaluation of essential social infrastructures.
  CO5: Understand the applications of remote sensing and GIS in disaster management.

REFERENCES:
   13:978-9380386423.
2. Tushar Bhattacharya., “Disaster Science and Management”, McGraw Hill India Education Pvt Ltd,
   F.N SPON, 2014.
5. “Mitigating Natural Disasters, Phenomena, Effects and Options, A Manual for Policy makers and
6. Gupta Anil K, Sreeja S, Nair., “Environmental Knowledge for Disaster Risk Management”, NIDM,
   2012.
   2010.

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UNIT I HYDROLOGIC COMPONENTS

Hydrologic cycle - Estimation of various components - Clouds: Types of clouds - rainfall: Types of rainfall - Runoff - Climate parameters - Data collection technologies - Spectral properties of water - Useful satellite surrogate parameters and data products for water management.

UNIT II SURFACE WATER MODELLING


UNIT III RISK AND DAMAGE ASSESSMENT

Mapping of snow - Covered area - Snowmelt runoff - Glacier runoff modelling - Flood risk zoning - Flood damage assessment - Flood Modelling - Early warning system for flood mitigation - Drought - Types - Assessment of droughts and mitigation - Drought management with modern technology water harvesting structures.

UNIT IV GROUNDWATER MODELLING


UNIT V IRRIGATION AND WATERSHED MANAGEMENT


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RG3007 PYTHON AND R PROGRAMMING

UNIT I INTRODUCTION
Overview - Installation of Python and relevant libraries - Introduction to development environments - Data structures - Variables, data types - Basic operations - Control structures - Lists, tuples, dictionaries, and sets - Geospatial libraries in Python.

UNIT II GEOSPATIAL LIBRARIES OF PYTHON
Importing, reading, and writing geospatial data - Geospatial data manipulation and attribute handling - Plotting and visualizing geospatial data - Customizing plots and creating maps - Geospatial analysis and processing - Spatial operations - Geometric calculations and measurements - Automating geospatial tasks.

UNIT III WEB MAPPING AND GEOSPATIAL SERVICES
Introduction to web mapping libraries (Folium, Leaflet) - Interacting with web maps and geospatial services - Creating interactive geospatial visualizations.

UNIT IV INTRODUCTION TO R PROGRAMMING
Overview - Installation of R and relevant packages - Introduction to RStudio and the R development environment - R Basics and data structures - Variables, data types, and basic operations in R - Control structures (conditionals, loops) - Vectors, matrices, data frames, and lists in R.

UNIT V GEOSPATIAL DATA MANIPULATION IN R
Introduction to geospatial packages (e.g., sf, sp) - Importing, reading, and writing geospatial data - Geospatial data manipulation and attribute handling - Data visualization packages (e.g., ggplot2) in R - Plotting and visualizing geospatial data - Customizing plots and creating maps - Geospatial data analysis - Spatial operations (e.g., buffering, overlay) - Descriptive statistics and spatial analysis.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
- On completion of the course the student is expected to be able to
  CO1: Understand the fundamentals of Python programming language and its syntax.
  CO2: Apply Python programming techniques to process, analyze, and visualize geospatial data.
  CO3: Build geospatial applications and tools using Python for specific geomatics domains, such as remote sensing, GIS, or spatial analysis.
  CO4: Understand the fundamentals of the R programming language and its libraries.
  CO5: Apply R programming techniques to process, analyze, and visualize geospatial data.
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RG3008 GEOMATICS FOR URBAN PLANNING AND MANAGEMENT 3 0 0 3

UNIT I INTRODUCTION
Scope and limitations of geomatics in urban planning and management - Overview of geospatial technologies and their relevance in urban contexts - Introduction to spatial data infrastructure and geospatial data standards - Data sources for urban planning - Overview of satellite sensors, data types, and spatial resolutions – Optical, Microwave, Thermal sensors and their applications - UAV, Laser scanners and Nightlight Images.

UNIT II SPATIO TEMPROAL MAPPING OF URBAN AREAS
Urban area - Definition and characterization - Principles of image interpretation for urban features - Urban landuse classification - Digital techniques for landuse mapping - Multi-source data fusion and data integration - Feature extraction techniques - Mapping of urban form and structure - Change detection - Sprawl detection and characterization - Urban heat island analysis and mapping urban green and blue infrastructure mapping.

UNIT III URBAN PLAN FORMULATION

34
UNIT IV SPATIOTEMPORAL ANALYSIS OF URBAN INFRASTRUCTURE
Geodemographic analysis and applications - GDP forecasting through remote sensing - Property tax assessment and management - Land value analysis - Asset inventory and spatial analysis - Case studies and applications - Optimization of facility locations - Site suitability analysis for infrastructure - Network analysis for route optimization - Accessibility assessment to urban infrastructure - Traffic modeling.

UNIT V TRENDS AND ADVANCEMENTS
Spatial statistics and modeling for urban applications - Web-based mapping for urban applications - 3D city modelling - Integration of BIM and GIS - Digital 3D reconstruction of urban heritage conservation - Digital twins concepts and applications - Geomatics for smart cities - Recent advancements - Case studies.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
- On completion of the course the student is expected to be able to
  CO1: Understand the fundamental concepts and principles of urban geomatics, including the integration of geospatial data and urban planning.
  CO2: Develop skills in acquiring, processing, and analyzing geospatial data specific to urban environments.
  CO3: Apply geomatics techniques to urban planning and management scenarios.
  CO4: Utilize geospatial data visualization and cartographic techniques to communicate urban spatial patterns and trends effectively.
  CO5: Understand the trends and developments in application of advanced geomatics tools for efficient planning and management of urban areas.

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35
UNIT I  LASER AND SPACE BORNE LASER PROFILERS  

UNIT II  AIRBORNE LASER SCANNERS  
Components of airborne laser scanning system - GPS, IMU, LASER scanner, Position and Orientation System(PoS) - Types of scanning mechanism and ground measuring pattern - UAV based topographic laser scanner - Synchronization of laser scanner and PoS - LASER scanners specification and salient features - Concept of multi return - 3D cloud points - Reflectivity of ground features - Range correction factor.

UNIT III  LIDAR DATA PROCESSING  
Pre Processing: direct georeferencing, combining inertial and navigation data - Determination of optimal flight trajectory - Data processing - Coordinate transformations - Geolocating Laser foot prints - Strip adjustment - Digital Surface Model(DSM) to Digital Elevation Model(DEM): filtering, ground point filtering - Flight planning - Quality control parameters - Preparation of flight plan.

UNIT IV  LIDAR DATA MANAGEMENT AND APPLICATIONS  
Airborne laser scanner error sources - LiDAR data format: ASCII vs Binary, LAS format - Software used for LiDAR data processing and management - Merits of airborne laser terrain mapping - Overview of LiDAR applications - 3D city models - Road and building extraction - Forestry applications - Power line mapping.

UNIT V  TERRESTRIAL AND BATHYMETRIC LASER SCANNER  

TOTAL:45 PERIODS

COURSE OUTCOMES:
- On completion of the course the student is expected to be able to
  CO1: Understand types of LASER and its classification, types of LiDAR and Satellite Laser Scanning Missions.
  CO2: Understand components of ALS, various scanning mechanisms and concept of multi returns.
  CO3: Analyze and process the Navigation and Inertial data for optimal flight path selection and coordinate transformation techniques for geolocating laser foot prints.
  CO4: Apply derived products of ALS in various application domains with reference to case studies
  CO5: Understand the concepts of TLS and ABS and its application.

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**RG3010 GEOMATICS FOR OCEAN AND COASTAL ZONE MANAGEMENT**

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**UNIT I OCEAN ENGINEERING**

**UNIT II OCEAN GENERAL STUDIES**

**UNIT III COASTAL ENGINEERING**

**UNIT IV REMOTE SENSING APPLICATION FOR OCEAN**
- Various satellite and sensors for ocean and coastal applications - Application of CZCS - Chlorophyll and suspended sediment estimation - Retrieval of physical oceanographic parameters - Sea surface temperature - Significant wave height - Wind speed and wind direction - Coastal bathymetry - Sea level rise.

**UNIT V COASTAL ZONE MANAGEMENT**

**TOTAL: 45 PERIODS**
COURSE OUTCOMES:
- On completion of the course the student is expected to be able to
  
  CO1: Understand the mechanism of various coastal processes and ocean circulations.
  CO2: Gain knowledge about the sea water characteristics and sampling instruments.
  CO3: Understand the concepts of coastal hydrodynamics and design of protective structures.
  CO4: Gain knowledge on missions and sensors for ocean observation and retrieval of biophysical parameters through Remote observation.
  CO5: Impart the skills required to identify and analyze the major coastal issues relevant to coastal resources and the applicability of Remote Sensing for its sustainable management.

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RG3011 PLANETARY REMOTE SENSING

UNIT I UNIVERSE AND SOLAR SYSTEM
Origin of Universe - Big Bang and Steady state theories, Solar System - Planets, satellites asteroids, meteorites and comets and internal differentiation of the planets - Planetary exploration mission and sensors.

UNIT II TERRESTRIAL PLANETS
Geology and geophysics of terrestrial planets: Earth, Mars, Venus and Mercury; Physical properties, Composition, Mineralogy and Petrology of the planets and the Moon.

UNIT III PLANETARY ATMOSPHERE
Exo and Endogenic processes associated with origin and internal evolution of planets - Planetary volcanism, Craters, Elemental Composition; Mineralogy and Petrology; Thermal, Seismic and Magnetic properties.

38
UNIT IV REMOTE SENSING FOR PLANETARY GEOLOGY
Approaches to Remote Sensing analysis of the planetary surfaces; applications derived from interaction of electromagnetic radiation (X-ray, gamma-ray, visible, near-IR, mid-IR, radar).

UNIT V PLANETARY EXPLORATION MISSIONS
Laser Altimetry and its application in Planetary science - Past, present and future missions - Analyses and Interpretation of data gathered through various missions; Identification of morphological features.

COURSE OUTCOMES:
- On completion of the course the student is expected to be able to
  CO1: Identify the components of Solar System and understand the payloads of related exploratory Missions.
  CO2: Understand the mineralogy and petrology of terrestrial planets.
  CO3: Describe the exo–endogenic process of Planetary Atmosphere.
  CO5: Describe the various past and present planetary missions.

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SPATIAL DATA MODELLING

RG3012

UNIT I MODELLING SPATIAL PROBLEMS
Introduction - Need for Spatial models - Conceptual model for solving spatial problems - Steps involved - Types of spatial models - Descriptive and process models - Types of process models - Creating conceptual models - Site suitability model - Case Study.

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025
UNIT II  MODEL BUILDER IN GIS ENVIRONMENT  9

UNIT III  GEOSTATISTICAL ANALYSIS AND MODELING–MAPPING  9
Stepwise regression - Ordinary least squares (OLS) - Variogram and kriging: Ordinary kriging, simple kriging, universal kriging - Developing variogram model and Kriging - Spatial autoregressive (SAR) - Binary classification tree (BCTs) - Cokriging - Geospatial models for presence and absence data - GARP model - Maxent model - Logistic regression - Classification and regression tree (CART) - Envelope model.

UNIT IV  SPATIOTEMPORAL MODELING  9
Concept - Cellular model: Definition, type, application - Integration with fuzzy, ANN - Agent based modeling: Concept, agent, analysis, application - Big data: Definition, tools, analysis and application, NetLogo models integrated GIS: Case studies.

UNIT V  MACHINE LEARNING TOOLS  9
Artificial intelligence: Definition, types - Expert system - Sources of knowledge - Knowledge acquisition methods - Representation schemes - Types of inference: Forward and backward chaining - Artificial neural network - BPN - Fuzzy logic - Integration with GIS - Case studies.

TOTAL:45 PERIODS

COURSE OUTCOMES:
- On completion of the course the student is expected to be able to
  CO1: Understand the descriptive and process spatial models.
  CO2: Understand model builder in GIS environment.
  CO3: Apply geostatistical analysis and modeling.
  CO4: Study various Spatio-Temporal models.
  CO5: Understand the machine learning tools.

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**WEB TECHNOLOGY PROGRAMMING FOR GIS**

**UNIT I** SPATIAL DATA STRUCTURES AND DATABASE MANAGEMENT

Spatial Data structures and Formats, Basic file formats (vector, raster) – JSON, GeoJSON, Geodatabase, Projections and EPSG Co-ordinate Systems, Attribute Tables – Spatial and Attribute Table linkage – Spatial Data modeling – design standards – Centralized / Distributed data model – Spatial Database administration – Data management and optimization - PostgreSQL- QGIS with Postgres- OGC Web Map services - WMS, WFS, WCS, WPS – Styling, tiling & caching.

**UNIT II** WEB GIS ARCHITECTURE


**UNIT III** HTML AND CSS PROGRAMMING


**UNIT IV** WEB PROGRAMMING: PHP AND JAVASCRIPT


**UNIT V** MAPSERVER AND GEOSERVER


TOTAL: 45 PERIODS
COURSE OUTCOMES:
- On completion of the course the student is expected to be able to
  
  CO1: To introduce the Web GIS Architectures, Services for the GIS Spatial data.
  CO2: To understand the markup languages, Cascaded Style Sheets concepts for the GIS Spatial Data.
  CO3: To study the concepts of Java Scripts in programming the GIS Spatial Data.
  CO4: To introduce the use of PHP programming for the GIS Spatial Data presentation.
  CO5: To implement the complete GIS solution using the GeoServer concepts using case studies

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RG3014   METEOROLOGICAL APPLICATIONS AND GEOMATICS     L T P C
UNIT I GENERAL CONCEPTS IN METEOROLOGY      3 0 0 3

UNIT II RADIO METEOROLOGY     9
Principles and classifications of radar - Meteorological applications of radar - Atmospheric sounding - Radio Sonde - Pilot balloons - Wind estimation through radar - RawinSonde - Doppler techniques for precipitation estimation - Precipitation Radar (PR) - Global Precipitation Measurement (GPM), ozone soundings - Principle and satellite measurements of ozone - Aerosol soundings tracking of weather thunderstorms, tropical cyclones, tornadoes through radar - Hydro meteorological applications of radar - Applications to aviation meteorology - TIROS Operational and vertical sounder - Retrieval methods and algorithms.
UNIT III  METEOROLOGICAL MISSIONS
Orbital dynamics of satellite - Critical velocities - Polar and geostationary weather satellites - Active and passive sensors (radar/lidar/radiometry, scatterometer and altimeter) - Absorption bands of atmospheric gases - Design and characteristic of different types of sounders and imagers used in meteorological satellites - Viewing geometry - INSAT meteorology data processing system (IMDPS), IRS series - APT - AVHRR - Need for Remote Sensing techniques in weather forecasting and Numerical Weather Prediction (NWP) - Imaging and non imaging techniques in meteorology.

UNIT IV  METEOROLOGICAL APPLICATIONS
Precipitation - Soil moisture estimation and their applications - Normalised Difference Vegetation Index (NDVI) - Ocean colour monitoring - Coastal zone mapping - Satellite communication systems in operational meteorological applications (cyclone warning dissemination system / automatic weather stations / meteorological data dissemination) - Estimation of snow and ice cover - Water body boundary mapping - Aerosols - Dust storms and volcanic ash clouds and fires - Maritime, dwelt, floods and agriculture.

UNIT V  GLOBAL METEOROLOGICAL APPLICATIONS
Global and sub global events - Tracking of large weather system - Cloud motion vector - Dvorak’s techniques of cyclone intensity estimation - T-phi and other climatic charts - T number and current intensity no. - Applications to storm surge estimation - Satellite soundings - Global warming - Sea level changes and consequences.

COURSE OUTCOMES:
● On completion of the course the student is expected to be able to
CO1 : Impacts the knowledge about the basis of Meteorology.
CO2 : Acquire knowledge about radar techniques in Meteorology.
CO3 : Understand the knowledge about platforms and sensors used in Meteorology.
CO4 : Develops knowledge about the remote sensing for Meteorology.
CO5 : Gives solutions to manage critical meteorological events.

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RG3015 GEOMATICS FOR ENVIRONMENTAL MONITORING AND MODELING

UNIT I SATELLITE FOR ENVIRONMENTAL MANAGEMENT 9

UNIT II WATER QUALITY MANAGEMENT 9
Classification of water quality - Sampling procedure - Quality analysis and GIS modeling, Pipe Network Design using GIS - Water distribution design - EPANET 2.0, LOOP version 4.0, BRANCHSpectral responses of clear and contaminated water - Aquifer Vulnerability: Intrinsic and specific vulnerability - DRASTIC, SINTACS - Exposure to surface water and groundwater quality modelling software’s - MIKE 21, WASP, QUAL2E and MODFLOW - Sea water Intrusion Modelling - Pollution diffusion model in river - Case studies

UNIT III AIR QUALITY 9
Structure and composition of atmosphere - Sources and classification of air pollutants, Air Quality Standards – Chemical and Physical Components - Sampling - Mapping of atmospheric pollution - Air pollution due to industrial activity - Plume behaviors - Dispersion model: Gaussian Plume model - Introduction to commonly used software based models such as ADMS, AERMOD, CALINE, CALPUFF, DEGADIS, HYROAD, INDUSTRIAL SOURCE COMPLEX, SCREEN, HYSPLIT, INDEX etc. - Remote Sensing to monitor atmosphere constituents - Case Studies

UNIT IV SOLID WASTE MANAGEMENT 9
Definition - Sources - Elements of integrated waste management and roles of stakeholders - Seven elements and seven step approach to integrated solid waste management planning, identification of storage and collection location - Analysis of collection route - Site selection: Transfer station, Disposal site - Waste allocation - leachate model - Case Studies

UNIT V GLOBAL PROSPECTIVE AND CLIMATE CHANGE 9
Prevention and Control measures - Carbon footprints and sinks, carbon trading, carbon credits and marketing, Indian and international status - Case studies - Definitions - Climate, Climate system, climate change - Drivers of Climate change - Characteristics of climate system components - Greenhouse effect – Carbon cycle - Climate model - types of model - General Circulation Models (GCM) - Issues with GCMs - Introduction to RCMs and LAMs - RCMs modellers - Advantages and disadvantages of GCMs and RCMs - case studies

TOTAL:45 PERIODS

Attested

DIRECTOR

Centre for Academic Courses
Anna University, Chennai-600 025
COURSE OUTCOMES:
- On completion of the course the student is expected to be able to
  CO1: Gives knowledge about the platforms and sensors used for monitoring.
  CO2: Acquire knowledge about sampling, testing of water and vulnerability models.
  CO3: Understand about the air pollution and dispersion.
  CO4: Gives knowledge about SW collection and management.
  CO5: Impart knowledge about the effects of climate change and its control.

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RG3016 GEOMATICS FOR AGRICULTURE AND FORESTRY L T P C
3 0 0 3

UNIT I CROPS ACREAGE AND YIELD ESTIMATION 9

UNIT II SOIL MAPPING 9

Attested

DIRECTOR
(Area University, Chennai-600 025)
UNIT III  
DAMAGE ASSESSMENT

UNIT IV  
FORESTRY
Forest taxonomy - Inventory of forest land - Forest types and density mapping - Forest stock mapping - Factors influencing degradation of forest - Delineation of degraded forest - Forest change detection and monitoring - Forest fire mapping & damage assessment - Biomass estimation - Carbon storage - ALTM for forest studies - Urban forestry issues.

UNIT V  
CLIMATIC IMPACT OF AGRICULTURE AND FORESTRY
Concepts of integrated surveys - Global effects and climatic changes: Land degradation and desertification, extreme events - Effect on forest produces health, forest hazards, sustainable forest management and practice - Biodiversity issues - Invasive biotics - Mitigation and adaptation - RS & GIS for drawing out action plans - Watershed approach - Landuse planning for sustainable development - Precision farming - Case studies.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
On completion of the course the student is expected to be able to
CO1: Understand the spectral properties of agricultural crops and their applications.
CO2: Understand the spectral properties of soil and applications.
CO3: Understanding the RS and GIS application to damage assessment due to disaster.
CO4: Understand the spectral properties of forest species and application to forest management.
CO5: Understand the climate impacts on agriculture and forestry management.

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UNIT I  ENGINEERING SURVEYS AND GEOMETRIC DESIGN  9
Roadways and railways - Necessity for planning - Classification of roads and railways - Alignment surveys and investigations using conventional and remote sensing techniques (preliminary, reconnaissance and final location surveys) - Types of highway pavements - Design principles of highway geometric elements.

UNIT II  URBAN TRANSPORTATION SYSTEMS AND PLANNING  9
Urban transportation: Policy alternatives - Transportation and the environment - Urban transport planning processes - Socio-demographic data and travel surveys - Transportation modelling - Traffic congestion - Plan evaluation and implementation - Planning and financing - Critiques of transportation modelling and forecasting.

UNIT III  REMOTE SENSING IN TRANSPORTATION  9

UNIT IV  GIS AND TRANSPORTATION ANALYSIS  9

UNIT V  INTELLIGENT TRANSPORTATION SYSTEMS  9

COURSE OUTCOMES:
- On completion of the course the student is expected to be able to
CO1: Understand various highway geometric elements and surveys carried out for highway alignment.
CO2: Understand the factors involved in urban transportation planning.
CO3: Apply remote sensing techniques for transportation problems.
CO4: Apply GIS for transportation analysis.
CO5: Gain knowledge on latest developments in transportation planning.

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SPATIAL DATA ADJUSTMENT AND ANALYSIS

UNIT I MEASUREMENT AND ERROR
Definition and significance of spatial data adjustment - Concepts of measurement and error - Sources of errors in spatial data, types of errors, and their characteristics - Elementary concepts in probability - Reliability of measurement - Significant figures - Error propagation - Linearization - Multivariate distribution - Error ellipse - Weights of an observation - Stochastic model and functional model.

UNIT II LEAST SQUARES ADJUSTMENT
Introduction - Simple adjustment methods - Least squares method - Examples of least squares problems - Techniques of least squares - Concept of weight - Relation between weights and standard errors - Statistics of weighted observations - Least squares adjustment of indirect observations - Least square adjustment of observations only.

UNIT III VARIANCE-COVARIANCE PROPAGATION

UNIT IV PRE-ANALYSIS OF SURVEY MEASUREMENTS
Pre-analysis procedure - Horizontal angle measurement, distance measurement, and elevation difference - Survey tolerances - Mapping standards: SOI, ASPRS - GPS network pre-adjustment data analysis - Spatial data error modelling.

UNIT V GEODETIC COMPUTATIONS AND ADJUSTMENT
Rectangular, polar, and spherical coordinates - First and second geodetic problem - Methods of point determinations: Intersection, resection, arc section, and with over determinations - Two dimensional and Three dimensional transformation adjustments - GPS errors and the need for adjustment - Application of least squares in processing GPS data - Least squares adjustment of GPS networks - Code development.

COURSE OUTCOMES:
- On completion of the course the student is expected to be able to
  - CO1: Understand the concept and importance of spatial data adjustment.
  - CO2: Apply statistical concepts and techniques for spatial data adjustment.
  - CO3: Implement spatial data adjustment models and algorithms.
  - CO4: Evaluate and analyze the quality of spatial data.
  - CO5: Utilize software and tools for spatial data adjustment techniques for real world application.

TOTAL: 45 PERIODS

Attested

DIRECTOR

Centre for Academic Courses
Anna University, Chennai-600 025
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RG3019 TERRESTRIAL AND CLOSE-RANGE PHOTOGRAMMETRY

UNIT I FUNDAMENTALS

UNIT II IMAGING SYSTEMS
Imaging concepts - Geometric fundamentals - Imaging systems - Targeting and illumination - Image pre-processing - Geometric image transformation - Digital processing of single images - Image matching and 3D object reconstruction.

UNIT III ANALYTICAL METHODS

UNIT IV PHOTOGRAMMETRIC MEASURING SYSTEM
Comparators - Single camera systems - Stereoscopic processing systems - Multi-image measuring systems - Systems of surface measurement - Project planning - Camera calibration - Dynamic photogrammetry – Close-range aerial imagery.
UNIT V APPLICATION

TOTAL: 45 PERIODS

COURSE OUTCOMES:
- On completion of the course the student is expected to be able to
  CO1 Understand the fundamental principles and concepts of photogrammetry, including camera calibration, image acquisition, image orientation, and 3D reconstruction.
  CO2 Familiar with the techniques used to acquire data in terrestrial and close-range photogrammetry
  CO3 Gain knowledge to process and analyze terrestrial and close-range photogrammetric data
  CO4 Generate accurate and detailed 3D models using terrestrial and close-range photogrammetry techniques
  CO5 Achieve knowledge of the diverse applications of terrestrial and close-range photogrammetry

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RG3020 AI / DL FOR SATELLITE IMAGE ANALYSIS

UNIT I ARTIFICIAL INTELLIGENCE

Attested

Director

Centre for Academic Courses
Anna University, Chennai-600 025
UNIT II  EXPLORATORY DATA ANALYSIS  9

UNIT III  DEEP LEARNING CONCEPTS AND METHODS  9

UNIT IV  LEARNING BASED CLASSIFIERS  9

UNIT V  APPLICATIONS OF CNN  9

TOTAL:45 PERIODS

COURSE OUTCOMES:
- On completion of the course the student is expected to be able to
  CO1: Familiarize with the concept of Artificial Intelligence.
  CO2: Acquainted with the Knowledge about exploratory data analysis.
  CO3: Acquainted with the basics of Deep learning.
  CO4: Apply various methods of deep learning in Geomatics.
  CO5: Familiarize with the applications of CNN in Geomatics.

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RG3021 LAND INFORMATION SYSTEM

UNIT I CADASTRE - INTRODUCTION 9
History of cadastral survey - Types of survey - Tax - Real property - Legal cadastrale - Graphical and numerical cadastrale, legal characteristics of records - Torrens system - Field methods.

UNIT II METHODS OF SURVEYING 9
Cadastral survey methods - Survey of villages - Instruments used for cadastral survey - Orthogonal, polar survey methods - Boundary survey; stone accounts, correlation statements, jamabhandhi accounts; Natham survey, Rectangulation - Town survey - Calculation of area - PIR in town survey, government land, encroachment survey, GPS and Total Station in Cadastral survey - CORS network - Virtual control points - DGNSS.

UNIT III MAINTENANCE AND MEASUREMENT 9

UNIT IV LAND MODERNISATION 9
Land records in India - Digital conversions of records - Obsolete ownership - Record of rights - Digital solutions for land records - NLRMP - DILRMP - Smart cities; C40 cities - International and national efforts - Examples - Indian initiatives - Swaach bharath ; Tamil nilam.

UNIT V MODERN TECHNOLOGY 9
Current developments - Tools and techniques - GIS, LIS, digital Twin concepts - Documentation - Data maintenance - Data standards - Map standards - Dynamicity of land databases - Land related solutions - Block chain technology - Web technology

TOTAL: 45 PERIODS

COURSE OUTCOMES:
● On completion of the course the student is expected to be able to
  CO1: Understand the importance of land as resources and related principles of land records and taxation.
  CO2: Apply various methods used for surveying, mapping and maintenance of cadastral records.
  CO3: Understand the process in land record keeping, updation and of documentation of land records and the current national developments in this regard.
  CO4: Update with modern surveying technology and geospatial solutions for creation, maintenance and documentation of land records.
  CO5: Frame a more efficient methodology to create and maintain digital cadastral, LIS, etc. using the trending geospatial concepts.
REFERENCES:
4. The Tamil Nadu survey and boundaries act, 1923, Tamil Nadu Act No.VIII.

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RG3022 SUSTAINABLE DEVELOPMENT AND GEOMATICS L T P C 3 0 0 3

UNIT I ECOSYSTEM AND SUSTAINABILITY 9

UNIT II SUSTAINABLE PRACTICES 9
Climate change - greenhouse effect- ozone depletion- Sustainable land management (SLM) – FAO’s mandate- integrated approach and food security- food-energy-water nexus- water in cities and industries- rain water harvesting – green buildings- green labels- concept of 5R- eco tourism environmental policies in India

UNIT III SDG EVOLUTION AND WORLD EXPERIENCE 9

UNIT IV GEOMATIC TOOLS FOR GIS 9
Geospatial technology - Earth observation - Historical and current sensors and technology - Open and cost data products - Geo portals - Application areas - SDG focus indicators - National datasets - Data portals - GIS - Data assimilation - Modeling capabilities - Statistical disaggregation.

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UNIT V  
SDG - GEOSPATIAL ROAD MAP

Data availability - Focus indicators - Geospatial Indian story maps - Geo-viable SDG indicators - Water availability - Primary productivity - Building index - Land capability maps - Health indices - Land temperature maps - Watershed characteristics - Climate products from satellites - Assessment of SDG matrix.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

- On completion of the course the student is expected to be able to

CO1: Appreciate the importance of sustainable development and the understand history of the world's unified effort to achieve through SDGs and the participation of the partner countries including India to achieve the same.

CO2: Understand the relevance of SDGs, the role of the geospatial technology as central idea to realize the SDGs and the status of this technology worldwide

CO3: Acquire the knowledge about the standard geospatial focus indicators to achieve SDGs and evaluate the methodology to formulate them.

CO4: Acquire knowledge on the current development, issues, methods and solutions in application of geospatial technology in comprehending the SDGs for a better world future.

CO5: Analyze critically and evaluate methods by applying the knowledge gained and to be a part of innovation efforts and capacity building of geospatial technology to achieve SDGs.

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RG3023  GEOSPATIAL CLOUD COMPUTING AND BIG DATA ANALYTICS  L  T  P  C
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UNIT I  INTRODUCTION TO CLOUD COMPUTING

Introduction to cloud computing - Characteristics - Computing infrastructure - Service oriented architecture and infrastructure design - Cloud enterprise - Cloud service and deployment models - Cloud standards – open source and commercial clouds – challenges - Big data - Data stream analytics frameworks- Virtual machines on the big clouds - Spatial cloud computing- Cloud transformations - Emergence of a geospatial cloud.
UNIT II  CLOUD-BASED DISTRIBUTED DATA MANAGEMENT PLATFORMS  9
Challenge and opportunities of distributed Data - Transferring and sharing data - Managing identity and credentials - Open source framework to build a cloud - Eucalyptus, openStack, VMWare - Private, public and hybrid clouds - Geo-spatial technology through cloud-based platforms - Cloud Vendors- Globus and SaaS capability- Security in the cloud - Role-Based.

UNIT III  CLOUD SERVICES FOR GEOSPATIAL DATA  9

UNIT IV  CLOUD STREAMING FOR GEOSPATIAL DATA ANALYTICS  9

UNIT V  GEOSPATIAL CLOUD COMPUTING STRENGTH AND APPLICATIONS  9
GIS data - Sharing and mapping, asset management and environmental streamlining, Cloud-based GIS applications such as UPlan, IPLAN, and WATS’ Mi Community Remarks, multi-agency collaboration and partnerships - Case studies - Remote Sensing data integration - Climate, Environment, Ocean, Cryosphere, Transportation, Healthcare, Agriculture, Forestry, Disaster mitigation and management.

TOTAL:45 PERIODS

COURSE OUTCOMES:
- On completion of the course the student is expected to be able to
  CO1: Understand the basic concepts of cloud computing
  CO2: Learn about the cloud-based distributed data management platforms.
  CO3: Explore the potential of data-driven approaches in cloud streaming and big data analytics.
  CO4: Learn about the state-of-the-art of commercial and open-source cloud services available for geospatial data
  CO5: Explore the strength and various application areas of geospatial cloud computing.

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RG3024 SUBSURFACE SURVEY METHODS

UNIT I UNDERGROUND SURVEYING

UNIT II ALIGNMENT AND STOPE SURVEYING
Alignment / Gradient control of vertical and inclined shafts, sinking and raising shafts - Gradient control in development openings - Holing surveys - Fixing center lines for shafts - Measuring subsidence - Determining the true and apparent dip and strike from bore hole data - Determining the deviation in the borehole drilling - Stope surveying - Purpose and advantages - Classification of stope surveying - Methods and instruments used - Documentation of underground structures, mining maps.

UNIT III GROUND PENETRATING RADAR SURVEY
Electromagnetic principles of GPR - Electrical and magnetic properties of rocks - Soil and fluids - Types of GPR - Measurement configuration - Bands and polarizations - Manual and vehicle mounted GPR - Salient technical features of commercially available GPR - Ground penetrating radar surveys: Reflection survey - Multi source - Multi receiver - Data processing: Dewow - Time - Gain - Deconvolution - Migration - Topographic correction - Signal optimization, modulation, processing and filtration - Modeling and analysis - Processing software (commercially available & RGPR) - Other geophysical surveys for subsurface investigation.

UNIT IV GEOPHYSICAL SURVEY

UNIT V APPLICATIONS
Applications in ground water resources: Depth to water from the land surface - Archaeological science: Identification and mapping buried structures - Mapping of underground utilities like power cables - Pipelines and other buried utilities - Containment mapping - Imaging shallow stratigraphy: Delineation of soil profiles to shallow depth - Geological mapping: Depth to bedrock, karst features, groundwater contact.

TOTAL: 45 PERIODS
COURSE OUTCOMES:

- completion of the course the student is expected to be able to

**CO1:** Plan the subsurface survey for a given project also capable of extending consultancy service for real time Hydrographic and Mining operations.

**CO2:** Apply the knowledge of different methods of survey to investigate real subsurface condition

**CO3:** Apply the knowledge of survey to measure stope and traverse underground

**CO4:** Plan the subsurface investigation program for a given project and also capable of extending consultancy service for real time underground mapping and Foundation Engineering problems

**CO5:** Apply the knowledge of different methods of exploration to select appropriate methods of boring for investigating real field conditions.

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