VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

Scheme of Teaching and Examinations – 2020 - 21

M.Tech (Geoinformatics)

Choice Based Credit System (CBCS) and Outcome Based Education(OBE)

II SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Hours /Week			Examination				Credits
				Theory	Practical/ Seminar	Skill Development Activities	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	P	SDA					
1	PCC	20CGI21	Satellite Data Image Processing and	03	--	02	03	40	60	100	4
2	PCC	20CGI22	Geoinformatics in Natural Resource and Environmental	03	--	02	03	40	60	100	4
3	PCC	20CGI23	Cartography, Geodesy and Global Navigation	03	--	02	03	40	60	100	4
4	PEC	20CGI24X	Professional elective 1	04	--	--	03	40	60	100	4
5	PEC	20CGI25X	Professional elective 2	04	--	--	03	40	60	100	4
6	PCC	20CGIL26	Geoinformatics Laboratory- II	--	04	--	03	40	60	100	2
7	PCC	20CGI27	Technical Seminar	--	02	--	--	100	--	100	2
TOTAL				**17**	**06**	**06**	**18**	**340**	**360**	**700**	**24**

Note: PCC: Professional core, PEC: Professional Elective.

Professional Elective 1		**Professional Elective 2**	
Course Code under	**Course title**	**Course Code under**	**Course title**
20CGI241	Web Applications in Geoinformatics	20CGI251	Computational Intelligence in Geoinformatics
20CGI242	Programming C and C++	20CGI252	Programming in .Net, JavaScript and HTML
20CGI243	Advanced Remote Sensing Techniques	20CGI253	Advanced Geographic Information System
20CGI244	Earth Observation Systems	20CGI254	Unmanned Aerial Vehicles (UAV's) Data Acquisition, Analysis and Applications

Note:

1. Technical Seminar: CIE marks shall be awarded by a committee comprising of HoD as Chairman,

Guide/co-guide, if any, and a senior faculty of the department. Participation in the seminar by all postgraduate students of the programme shall be mandatory.

The CIE marks awarded for Technical Seminar shall be based on the evaluation of Seminar Report, Presentation skill and performance in Question and Answer session in the ratio 50:25:25.

2. Internship: All the students shall have to undergo mandatory internship of 6 weeks during the vacation of I and II semesters and /or II and III semesters. A University examination shall be conducted during III semester and the prescribed internship credit shall be counted in the same semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the internship shall be declared as fail in internship course and have to complete the same during the subsequent University examination after satisfying the internship requirements.

SATELLITE DATA IMAGE PROCESSING AND ANALYSIS			
Course Code	20CGI21	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

Digital Data: Introduction- Satellite data acquisition –Storage and retrieval – Data Formats – Compression – Digital Image processing hardware and software.

Image Quality Assessment and Statistical Evaluation: The histogram and its significance to DIP, metadata, Univariate and multi-variate statistics.

Module-2

Image Enhancement: Contrast Manipulation –Gray-Level Thresholding- Level Slicing Contrast Stretching – Spatial Convolution – Edge Enhancement – Spatial feature manipulation –Fourier Analysis.

Multi Image Manipulation: Spectral Rationing –Principal and Canonical Components– Vegetative Components, Vegetation indices – Intensity – Hue – Saturation – Colour Space Transformation, Texture transformation.

Module-3

Obtaining ground reference information: Importance of ground truth data collection, instruments for reference data collection, Geo- tagging.

Information Extraction: Pattern recognition, Multispectral Classification – Supervised and Un-supervised Classification methods, Hybrid –Classification – Classification of Mixed Pixels.

Output generation: Graphic Products – tabular data, Digital Information files – Post Classification Smoothing – Classification Accuracy Assessment. Classification error matrix, sampling considerations, Kappa analysis.

Module-4

Data Merging and GIS Integration: Multi-temporal Data merging, Multi-sensor image merging – Merging of image data with Ancillary data- Incorporating GIS Data into automated land cover classification

Change detection: Binary change detection, multi-date composite image change detection, and spectral change vector analysis, visual on-screen change detection.

Module-5

Information Extraction using Imaging Spectroscopy: Radiometric & Atmospheric corrections, Hyper spectral data analysis: Spectral angle mapper**,** Hyper-spectral image analysis techniques, Derivative spectroscopy.

Information extraction using Artificial Intelligence: Expert systems, Decision tree classification, machine learning, Artificial Neural Network concepts, genetic algorithms.

Course outcomes:

At the end of the course the student will be able to:

Students will acquire skills of information extraction from raw data; they would also learn data processing, enhancement and output generation.

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.

Reference Books

(1) John R Jenson 'Introductory Digital Image Processing- A Remote Sensing Perspective" 4th Ed, 2016, Pearson

(2) R. A. Schowengergt, 'Techniques for Image Processing and Classification in Remote Sensing'; 1983

(3) Robert A Schowengergt, 'Remote Sensing – Models and Methods for Image Processing' Academic Press 1997

(4) Remote Sensing and Image Interpretation: Lillesand, Keifer and Chipmann.

GEOINFORMATICS IN NATURAL RESOURCES AND ENVIRONMENTAL MANAGEMENT

Course Code	20CGI22	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

Concepts of natural resources management: Types of natural resources, renewable, non-renewable, Linkages of natural resources with the economy, impact of natural resources utilization on Earth system functioning.

Geological Resources Exploration: Geomorphological Mapping: Mapping geological structures like folds, faults, joints and lineaments, Lithological mapping, Mineral resources mapping and Mineral Resources Information System.

Land Resources Management: Classification of soils and soil mapping, Land Use Land Cover Mapping, Wetland Mapping, Wasteland Mapping, Land Degradation Mapping, Soil Erosion Modelling, Land capability Maps, land irritability maps.

Module-2

Agro-ecosystem management: Forecasting Agriculture output through Satellite and Land-based observations (FASAL), crop stress detection and crop insurance programmes, Thermal and Microwave RS applications, Space inputs for precision agriculture, Site suitability studies for agricultural and horticultural crops, Web-GIS applications in agriculture (e.g., Agricultural Planning and Information Bank, SILKS portal, Bhuvan portal etc.).

Forest Resources management: Mapping of forest cover types, Biodiversity assessment, Forest biomass estimation, forest fire risk zonation, Inputs for preparation of working plan / management plan. Environmental Impact assessment of mining and Industrial activities, Thermal and microwave remote sensing application in forestry, Wildlife ecology applications.

Module-3

Water Resources Management: Surface water resources mapping and management; Estimation and monitoring of precipitation (rainfall and snow cover), Integrated river basin management, Site suitability for hydro-electric power plants, Digital Terrain Models and their applications, preparation of ground water prospecting and recharging maps.

Module-4

Introduction to Environment: Components of environment, biotic and abiotic components, laws of conservation of mass and energy, concepts of ecosystem, bio-geo-chemical cycles, ecological pyramids, food webs, energy flow and ecosystem functioning. Applications in EIA and Cost-Benefit Analysis., quantifying impacts of developmental projects and use in the preparation of EMP.

Sustainable Development: Concept of sustainability, Integrated Mission for Sustainable Development, Watershed characterization, watershed prioritization, Acton Plans for Sustainable development, and Space-based Information System for Decentralized Planning (SIS-DP), Sujala Watershed Project in Karnataka.

Module-5

Water Pollution Applications: Point source pollution mapping, non-point source pollution modelling, methane production area mapping and modelling, oil slicks tracing and monitoring, turbidity and sedimentation mapping, Coastal habitat degradation mapping, Groundwater-pollution hazard assessment.

Air and Atmospheric Pollution Applications: Types of air pollutants**,** Aerosol remote sensing, air quality indexing and mapping, modelling spread and dispersion of smoke plumes from industries and power plants, oil wells, etc.

Applications in Managing Diseases: Use of RS+GIS in studying ecology of vector-borne diseases, mapping epidemic vulnerable zones, management of pandemics (e.g., COVID-19), public health administration.

Course outcomes:

At the end of the course the student will be able to:

Learn the basic concepts of natural resources management, environmental protection, earth system

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module

Reference Books

(1) Introduction to Environmental Remote Sensing by Barrett E.C., Curtis, I.F., Chapman and Hall, New York, 1992.

(2) Remote Sensing principles and Interpretations- Sabins, F.F., (Ed) W.H. Freeman and Co., New York, 1986

(3) Remote sensing and Image interpretation - Thomas M. Lillesand and Ralph W. Kiefer, John Wiley and Sons Inc., New York, 1994.

CARTOGRAPHY, GEODESY, GLOBAL NAVIGATION SATELLITE SYSTEMS

Course Code	20CGI23	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

Introduction to Cartography: Definitions, history, terms, cartographic concepts, science and art in cartography, applications, essential cartographic process, conventional signs; plan and profile, representation of relief, conventional cartography, cartographic products.

Introduction to Map: Types of map, map scale, classes of maps, map composition, the mapping process; map projection, Map Numbering Systems, Map Legend, Symbols & Border Information, Label placement; Design & Layout of Maps, geographic content of the map, Base map & Thematic map.
Digital Cartography: Digital cartography, Cartography in context of GIS, Principles of cartographic design in GIS, cartographic generalization, atlases and electronic atlases, hyper maps and digital spatial libraries, conventional cartography vs. Digital cartography; web cartography; overview of cartography.

Module-2

Geodesy
Introduction to Geodesy: Definitions, terms, types, history, classification**,** fundamental goals of geodesy; shape and size of the earth, applications.
Projections : Classification of map projections, Scale factor, Introduction to Azimuthal, Conical and Cylindrical projections with emphasis on LCC, Polyconic and UTM; Transformations.
Geometric Geodesy: Earth, Geoid and Reference Ellipsoid; Everest Spheroid, WGS 84, Vertical datum, Mean Sea Level, geometry of ellipsoid, level surfaces, plumb line and deflection of the vertical, coordinate system in geodesy.

Module-3

Satellite Geodesy: Introduction, Fundamentals of celestial mechanics, Normal orbits, Equation of motion and laws of Kepler, geometry of elliptic orbit, perturbed satellite motion, Lagrange and Gaussian Planetary equations, Gravitational perturbation, Doppler surveying, Advantages of satellite geodesy**.**

Module-4

Introduction to satellite-based Positioning systems: GNSS, Definition, concept, GLONASS, GALILEO, GAGAN, India's NavIC. GPS working principle, Components of GPS – Space segment; control segment, user segment; principle of ranging; types of receivers; GPS satellite signals, GPS pseudo range and code phase tracking, Precise Point Positioning (PPP); satellite geometry and accuracy measure, signal propagation error; phase-tracking error, International GPS Geodynamic Services (IGS); GPS modernization,

Module-5

DGPS – History, need for DGPS, concepts and principles, differential corrections, local area DGPS, wide area DGPS, carrier phase DGPS, LAAS, WAAS; rapid methods with GPS – rapid static method, semi kinematic method, Real time kinematic method. GPS accuracy, GPS pseudolites,

Planning and Realization of GPS Observations: Ground control provision by DGPS for geometric correction of satellite imagery / photograph. Ground control points, types, density, planning, reconnaissance survey, field observations, Criteria for selecting reference station, operational procedures, post processing, Receiver Independent Exchange Format (RINEX).

Applications: Applications in Engineering and Monitoring; Special applications of GPS; GPS technique and project cost, Continuously Operating Reference Station (CORS), applications of Location Based Services, Geo-fencing.

Course outcomes:

At the end of the course the student will be able to:

Familiarization with Maps, Map reading, projection systems, Global Navigation, Satellite Systems & their applications in infrastructure planning & facilities of management.

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Reference Books

(1) Satellite Geodesy: Gunter Seebar,

(2) GPS satellite surveying: Alfred leick

(3) Essentials of GPS, N K Agrawal

WEB APPLICATIONS IN GEOINFORMATICS

Course Code	20CGI241	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

Introduction to Web GIS: Definition, concept of Web GIS, History of web GIS, components of web GIS, internet, web GIS v/s Internet GIS, Fundamentals of computer networking – network environment – network communication models –protocols – TCP/IP. Applications of web GIS, users and stake holders of web GIS, advantages and limitations of web GIS, overview of Web GIS.

Client/server Computing: Client – server Concepts, client/server system partition– layered architecture – advantages and disadvantages of client server architecture. Distributed component framework – web mapping – static and interactive web mapping – open GIS web map server.

Distributed geographic information services: Principle – components – logic and data components.

Module-2

Geographic Markup Language: Principles – characteristics – commercial web mapping programs - mobile GIS. Distributed GIS in data warehousing and data sharing.

Functions of Web GIS: Display of general information for the public, display of planning information, interactive display of spatial information sharing and distribution of spatial data as well as management of spatial data.

Design of User Graphic Interface User friendly interface, characteristics, menus and icons, common terms. Graphic Appearance - colours, sizes, fonts, scales and arrangement.

Module-3

Software. Proprietary and Open Source for developing server and client applications. Evaluation of different software - ArcIMS, Map Objects, Mapguide, Map Server, Geomedia web map, Openlayers, Geoserver etc.

Web GIS Data. Classification of WEB GIS data, Geospatial data, type, characteristics, distribution, GIS interactive maps, - general maps at regional level, and very detailed maps down to lot level. Level of Service (LOS) Level of Contents (LOC) Level of GIS Functions or Level of Functions (LOF). A Cross Tabular Matrix (CTM) approach.

Module-4

Applications of WEB GIS: Participatory GIS -Web-based GIS For Collaborative Planning And Public Participation, Digital Democracy for planning, Local Environmental Decision-making, regional and local level planning. Community GIS, Intelligent transportation systems, planning and resource management. E-Governance.

Module-5

Python Scripting in Spatial data analysis: Graphs, Graphs algorithm, Networking programming, GML processing, GUI programming Database Access, Geoprocessing using python, python in GIS.

Course outcomes:

At the end of the course the student will be able to:

Students understand the concept of client-server model, hosting of server/client application. Development of

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.

Reference Books

(1) Zhong- Ren Peng, Ming-Hsiang Tsou, (2003) Internet GIS: Distributed Geographic Information Services for the Internet and Wireless Networks, Wiley.

(2) Paul A Zandbergen ESRI press, (2013) Python : Scripting for ArcGIS.

(3) Korte, G. B., (2001})"The GIS book": 5th Edition, Onward press, Australia.

PROGRAMMING IN C AND C++

(Professional Elective -I)

Course Code	20CGI242	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

Introduction: Functionalities of Computer, Generations of computers, Types of Computers, Components of Computer, Central Processing Unit, Input/output Devices, Memory, RAM,ROM, Motherboard, Memory Units, Ports, Data & Information, Networking

Operating Systems: Operating system Structures, Process Management, memory management, Storage management, Protection & Security, Virtual machines, Distributed systems, Influential Operating systems, Case Studies: Linux, Windows

Module-2

Introduction to C (Procedure Oriented Programming): History of Programming language, importance of computer languages, Understanding Compiler. Input /Output functions: Console input output, Formatted input output, Contants, Variables. Data types and operators: types and uses of various operators and Expressions Control structures: Various looping mechanism, types of loops.

Module-3

Introduction to Array: Understanding Array, Working with Single multidimensional array. Limitations of array, handling the strings Structure Unions. Introduction to functions: Need of function, defining, calling function, different types of functions. Pointer, pointer with function and structure. File handling: Reading and writing the data to file.

Module-4

Introduction to C++ (Object Oriented Programming): Understanding Compiler. Input /Output functions: Console input output, Formatted input output, Importance of OOP Understanding Classes, objects, Methods and properties. Characteristic of OOP: Abstraction, Inheritance, Polymorphism, Encapsulation. OOP and POP: Difference between OOP and POP.

Module-5

Constructors and destructors: Creating classes and objects. Memory allocation for objects. Passing and returning of objects as parameters. Static data members and static member functions Access modifiers: modifying access of Classes, methods using public, private keywords. Functions and Operators: Function overloading and Overriding, Friend functions, Virtual base class, Virtual functions.

Course outcomes:

At the end of the course the student will be able to:

Basics of computer components, Basic of Operating System (OS), CPU & Softwares. Skill will be imparted to

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.

Reference Books

(1) Operating System Concepts – Avil Sillberschatz, Peter Baer Galvin, Greg Gayne

(2) Programming Language Pragmatics - Michael L. Scott, 2nd Edition, Elsevier,2006

(3) Programming Languages Concepts and Constructs - Ravi Sethi, 2nd Edition, Pearson Education, 1996

(4) JavaScript: The Definitive Guide - David Flanagan, 6th Edition

(5) C++: The Complete Reference : The Complete Reference C++ 4th Edition

(6) .Object Oriented Programming with C++ 6th Edition by Balaguru Swamy

(7) The Complete Reference C 4th Edition (English, Paperback, Herbert Schildt)

ADVANCED REMOTE SENSING TECHNIQUES

(Professional Elective-I)

Course Code	20CGI243	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

Thermal Remote Sensing: Thermal radiation principles, processes and thermal properties of materials, thermal conductivity, IR detection and imaging technology, thermal sensors and scanners, spatial resolution and ground coverage, geometric characteristics of across track and along track IR imageries, distortions and displacements, radiometric calibration of thermal scanners, interpretation of thermal IR imagery, temperature mapping with thermal scanner data, thermal inertia mapping, apparent thermal inertia, applications of thermal remote sensing in agriculture, geology, hydrogeology, urban heat budgeting.

Module-2

Passive Microwave Remote Sensing: Basics of spectral characteristics of microwave radiometers, passive microwave scanners and sensors, applications in atmosphere, ocean and land.

Module-3

Active Microwave Remote Sensing: RADAR- definition and development, RADAR equation, Radar Systems – airborne and space borne Side Looking Radars (SLR), and Synthetic Aperture Radar (SAR) and their components, imaging systems, scattering theory, factors affecting radar resolution, geometric characteristics of radar imagery, RADARgrammetry, coherence, phase unwrapping, polarization, image registration, baseline determination, measurement of surface topography and deformation analysis, RADAR image interpretation. SAR interferometry- principle, image processing, factors affecting SAR interferometry, Applications of active microwave sensors.

Module-4

LIDAR Remote Sensing: Physics of laser, laser interaction with objects, LiDAR: principle, Multiple return, Components of LiDAR Airborne Laser Terrain Mappers (ALTM), system, INS-GPS integration, measurement of laser range, calibration, flight planning, components of LiDAR, raw data and DEM processing, data classification techniques, LiDAR data integration with spectral data, Space- borne LIDARS, LiDAR Applications

Module-5

Hyper-spectral Remote Sensing: Hyper-spectral Imaging: Hyper spectral concepts, data collection systems, calibration techniques, data processing, N-dimensional scatter-plots, Spectral angle mapping, Spectral mixture analysis, Spectral Matching, Classification techniques, airborne and space-borne hyperspectral sensors and applications.

Course outcomes:

At the end of the course the student will be able to:

Students will get exposure to modern and advanced satellite remote sensing techniques including retrieval of physical parameters like SST, LST, Terrain Analysis etc.

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.

Reference Books

(1) Fawaz T Ulaby, Richard K Moore and Adrian K Fung, Microwave Remote Sensing active and passive, Vol. 1, 2 and 3 Addison – Wesly Publication company 1981, 1982, and 1986.

(2) Philip N Slater, Remote Sensing, optics and optical systems. 1980

(3) Robert M Haralick and Simmonet, Image processing for remote sensing 1983.

(4) Robert N Colwell Manual of Remote sensing Volume1, American Society of Photogrammetry 1983.

(5) Travett J W Imaging Radar for Resources surveys, Chapman andHall, London 1986.

(6) Remote sensing and Image Interpretation by Thomas M Lillesand and Ralph W. Keifer fourth Edition,

(7) Remote Sensing Geology by Ravi P Gupta, Second edition, 2003, Springer
(8) Remote Sensing Principles and Interpretation by Floyd F Sabins, 1997, W H Freeman And Company

EARTH OBSERVATION SYSTEMS			
Course Code	20CGI244	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

Introduction to Earth Observation system: Introduction Of Earth Observation System, Sensing Platforms, Airborne Platforms, Spaceborne Platforms, Near-Polar Orbits, Geosynchronous Orbits, Sensors, Optical Sensors, Photographic Cameras Digital Aerial Cameras, Video Cameras, Radiometers, Electro-Optical Scanners, Microwave Sensors, Passive Microwave Sensors, Active Microwave Sensors, LiDAR ,The Ground Segment ,Earth-Observing Systems .

Module-2

International Satellite Programmes: The Landsat System, Satellite Pour l' observation De La Terre (SPOT), Pleiades Systems, The Earth Observing System Mission, Terra (Eos-Am), Aqua (Eos Pm), 8 Earth Observing-1 (Eo-1) Mission, Rapid eye.

Module-3

Indian Remote Sensing Satellites Missions: IRS IA/IB, IRS IC/ID, Resource sat series, Cartosat series, OCM series, RISAT series, HySi.

Module-4

Hyperspectral and Hyper Resolution Data: High Spatial Resolution Remote Sensing Systems, Early bird & Quick bird, Ikonos, Orbview-3, Geoeye-1, Worldview Missions Hyperspectral resolution sensors of India and world-wide systems.

Module-5

Microwave Missions: Spaceborne Imaging Microwave Systems , Seasat , European Remote Sensing Satellite (Ers-1 And -2) , Sentinel-1 Japanese Earth Resources Satellite (Jers-1), Advanced Land Observation Satellite (Alos-1), Radarsat Missions, Radarsat-1 , Radarsat-2 , Radarsat Constellation Mission (Rcm) , Envisat , Radar Imaging Satellite (Risat) Missions, Radar Imaging Satellite (Risat-2), Radar Imaging Satellite (Risat-1), Soil Moisture And Ocean Salinity Mission (Smos)., Measurement Principle , Soil Moisture Active Passive Mission (Smap).

Course outcomes:

At the end of the course the student will be able to learn:

- Existing and emerging earth observation system.
- Various satellite platforms
- IRNNS program and its data processing

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.

Reference Books

(1) Aoki, S., 2006. Nihon no Uchu Senryaku (Japanese Space Strategy), Keio University Press, Tokyo, p. 309.

(2) Richards and jia “Global Earth Observation Systems”.

(3) Richards and jia “Global Earth Observation Systems”.

COMPUTATIONAL INTELLIGENCE IN GEOINFORMATICS

(Professional Elective –II)

Course Code	20CGI251	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

Computational Intelligence: An overview of computational intelligence: various paradigms - Expert Systems, Artificial Neural Network, Fuzzy Logic, Genetic Algorithms/Programming, History and development.

Expert Systems: An Overview of expert systems, Knowledge Representation, Symbolic Representation, Rule-Based Systems, Logic Programming, Knowledge Acquisition, Heuristic Classification, Tools for Building Expert Systems, Machine Learning, Hybrid Systems.

Module-2

Artificial Neural Networks : Fundamental Concepts: Introduction to Neural networks, Biological neurons and their mathematical models such as McCulloch-Pitts, Perceptron and AdaLine, Linear separability problem, Different types of learning algorithms: Supervised, Unsupervised and Reinforcement learning algorithms.

Module-3

Multi-layer Feed Forward Networks: Multi-Layer Perceptron (MLP) with generalized delta rule, delta rule with momentum term, Radial Basis function network (RBF) and its learning algorithms, Neural network design: selection of hidden layer, hidden node, learning rate, number of epoch, initialization of weight matrix and selection of training and testing patterns. Application to function approximation, pattern classification.

Competitive and Recurrent Networks: Competitive network: Hebbian learning algorithm, Winner-Take-All learning, Self-Organizing feature map network, Principal component network and Independent component network, Recurrent network: Basic models, Hopfield network: network dynamics, learning methods, application to pattern recognition and storage problems.

Module-4

Fuzzy Logic: Introduction and background to fuzzy logic: Linguistic variables, Membership functions, Fuzzification, Defuzzification, Basic operations on fuzzy sets, Fuzzy relations, Fuzzy c-means clustering, Applications to pattern recognition, data analysis.

Module-5
Genetic Algorithm and Programming Introduction and background to genetic algorithm, Darwinian principle, Genetic operators, Schema theorem, Fitness and scaling problems, Introduction to Genetic programming, Introduction to Automatically Defined Functions -- Regression example. Application of GP to pattern recognition problems.
Course outcomes: At the end of the course the student will be able to: Artificial Intelligence is the law for Network Route Planning and in Image analysis. Students are exposed to
Question paper pattern: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60. • The question paper will have ten full questions carrying equal marks. • Each full question is for 20 marks. • There will be two full questions (with a maximum of four sub questions) from each module. • Each full question will have sub question covering all the topics under a module.
Reference Books
(1) Expert Systems and Applied Artificial Intelligence, E. Turban, Macmillan, 1992
(2) Introduction to Expert Systems, Peter Jackson, Harlow, England: Addison Wesley Longman, 1999.
(3) Neural networks: A comprehensive Foundation, Simon Haykins, Prentice Hall Inc., 1999.
(4) Fuzzy sets, uncertainty and information, Geroge J. Klir, Tina A. Folger, Prentice Hall inc., 2000.
(5) Genetic Algorithms in Search, Optimization, and Machine Learning, Goldberg, David Edward, Addison-
(6) Genetic Programming: On the Programming of Computers by Means of Natural Selection, J. Koza, The MIT

PROGRAMMING IN .NET, JAVASCRIPT AND HTML

(Professional Elective -II)

Course Code	20CGI252	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

Introduction to Java: Classes: Classes in Java;Declaring a class; Class name; Super classes; Constructors; Creating instances of class; Inner classes. Inheritance: Simple, multiple, and multilevel inheritance; Overriding, overloading. Exception handling: Exception handling in Java, Multi Threaded Programming: What are threads? How to make the classes threadable; Extending threads; Implementing runnable; Synchronization; Changing state of the thread; Bounded buffer problems, read-write problem, producer-consumer problems.

Module-2

Swings: The origins of Swing; Two key Swing features; Components and Containers; The Swing Packages; A simple Swing Application; Create a Swing Applet; Jlabel and ImageIcon; JTextField;The Swing Buttons; JTabbedpane; JScrollPane; JList; JComboBox; JTable.

Module-3

Introduction to java script: importance of Java script, creating sample program. Data type operators: Various Data type and its importance. Understanding and using various types of operators and Expressions Various are looping mechanism, Understanding loops. If else and Switch case Binding

Module-4

Iterative mechanisms:: Objects, Arrays, Functions, Classes & Modules, Pattern Matching with Regular Expressions. Creating dynamic web pages Understanding DOM API, Dojo Framework and Digits. Debugging in web application: working with developer tools in browser. Layout engines used in various browsers

Module-5

HTML (Hyper Text markeup Language): Syntax, Elements, Attributes, Headings, Paragraphs, Styles, Formatting, Comments, Colours, CSS, Links, Images, Tables, Lists, Blocks, Classes, HTML

Course outcomes:

At the end of the course the student will be able to:

Basics of computer components, Basic of Operating System (OS), CPU & Softwares. Skill will be imparted to

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.

Reference Books

(1) Computer Architecture A Quantitative Approach - John L. Hennessy, David A. Patterson, 4th Edition,

(2) Operating System Concepts – Avil Sillberschatz, Peter Baer Galvin, Greg Gayne

(3) Programming Language Pragmatics - Michael L. Scott, 2nd Edition, Elsevier,2006

(4) Programming Languages Concepts and Constructs - Ravi Sethi, 2nd Edition, Pearson Education, 1996.

(5) How to think like a computer scientist : learning with Python - Allen Downey, Je_rey Elkner, Chris Meyers.

(6) The Complete Reference Java Seventh Edition –Herbert Schildt

(7) JavaScript: The Definitive Guide - David Flanagan, 6th Edition

ADVANCED GEOGRAPHIC INFORMATION SYSTEMS

(Professional Elective-II)

Course Code	20CGI253	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

Geodatabase: Basic geodatabase and structure, Types of geodatabase, Advantages of geodatabase, Basic geodatabase structure, Topology, relational classes, geometric networks, raster data - Creating geodatabase, organizing data, defining database structure - Understanding spatial reference in geodatabase – Modifying spatial domain, Simple feature creation in geodatabase, Creating and editing map topology, - Types of geodatabase annotation - Adding behaviour to a geodatabase.

Module-2

Surface Analysis: Slope and aspect - Hydrologic functions - View sheds - Shaded relief maps Spatial analysis - Surface analysis - 3-D analysis – Map algebra - Cell statistics DEM, DTM and TIN

Model Building and Spatial Modelling: Why build models - Anatomy of a model - Model elements - Introduction to scripting. The object model in GIS. Vector and raster data extraction for modeling, Land use classification, Temporal land use analysis, Spatial modeling procedure, Cellular automata modeling, Methods of spatial interpolation.

Data Accuracy, Error Assessment and Propagation: Spatial data standards, Positional accuracy, Accuracy measurement techniques, Error in linear and area feature, Land use classification accuracy, Attribute accuracy, Error propagation in spatial attribute

Advanced Cartography: Annotations, labels, and metadata; Map making with advance tricks Working with labels and annotations – Managing (organizing and modifying) labels and annotations - Metadata file creation and management with new tools.

Module-3

Multi-Criteria Decision Analysis and Spatial Decision support System (SDSS): Elements of multi-criteria decision analysis, classification of decision problems, criteria evaluation, hierarchical decision alternatives and constraints, alternatives and decision variables, deterministic variables, criteria weighting , estimation weights, ranking methods, decision rules, multi-attribute decision rules, sensitivity analysis, SDSS, what is SDSS, requirements multi-criteria spatial decision support systems (SDSS). SDSS for location planning, application-specific capabilities.

Module-4

Expert GIS : Introduction to concepts of Expert GIS, Data formats, Proprietary file formats, translator and transfer formats, open formats, standards, metadata, standards gazetteer, XML and GML, GIS and databases Spatial databases, relational databases, object databases, advanced database technology, derived mapping – generalization, text placement, automated cartography, data from imagery, Web GIS, simple maps in web pages, web software, Mobile GIS –positioning, location based services, personal and vehicle navigation, LBS for mass market, telematics. –Applications

Module-5

Enterprise GIS : User need assessment; old and new spatial database models, SDE layers, Geodatabase, architecture design, capacity planning(Hardware), security planning, RDBMS, RDBMS software selection, GIS software selection, planning for migration. Enterprise GIS management.

Case Studies: GIS analysis in transportation, GIS analysis in water management, urban development, environmental analysis, hydrological modeling, Habitat suitability modeling, virtual cities 3D modeling and visual simulation, Automata based models of Urban system

Course outcomes:

At the end of the course the student will be able to:

Students will be equipped with modern tools, soft wares of GIS and be confident to implement a GIS project

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.

Textbook/ Textbooks

(1) GIS and Multi-criteria decision analysis by Jacek Malczewski, John Wiley and sons.

(2) Expert Systems by Peter Jackson, third edition, 1999, Pearson Education.

(3) Concepts and Techniques of Geographic Information Systems, CP Lo, Albert K W Yeung, 2005 Prantice

(4) Geographic Information Systems – An introduction by Tor Bernhardsen, John Wiley and Sons, Inc., New

(5) Remote sensing and Image interpretation by Thomas M. Lillesand and Ralph W. Kiefer, John Wiley and Sons Inc., New York, 1994.

(6) Geographical Information Systems – Principles and Applications, Volume I & II, edited by David J. Maguire, Micheal F Goodchild and David W Rhind, John Wiley Sons. Inc., New York 1991.

UNMANNED AERIAL VEHICLES (UAV'S) DATA ACQUISITION, ANALYSIS AND APPLICATIONS

Course Code	20CGI254	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

Introduction: Introduction to Drones, History of Drone/UAS/UAVs, payload, battery life, Specs for good results, Regulations of DGCA and Drone license, Pre, Post Flight planning- Flight execution and photography, data collection.

Module-2

Surveying with UAVs

Consideration for hardware selections, comparison on surveying drone and its accuracy, Techniques of controlling errors, Consideration of GCP in vertical and horizontal accuracies, Planning and estimation of drone surveying jobs, Autonomous flight vs. manual and hybrid flight profiles

Module-3

Image processing and Photogrammetry

Aerial Triangulation, post possessing software's, Analyzing Data, Contouring, DEM, DSM, Cut, Fill, and Volumetric Measurement Calculation and orthophoto generation.

Module-4

Modeling and analysis of UAV data

Introduction to mapping and modeling concepts, Understanding RTK, PPK and GCP's,Overview of popular data processing software platforms and functions. Image interpretations and analysis.

Module-5

Applications of UAV data

Application of drone for Surveying & Mapping, Construction, Agricultural, Engineering Land Survey and Architecture, crop insurance, disaster management, etc.

Course outcomes:

At the end of the course the student will be able to study:

- Data collection by UAV'S.
- Surveying with drones.
- Concepts of Image processing techniques.
- Modeling and mapping by drone data.

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.

Reference Books

(1) One Nation Under Drones: Legality, Morality, and Utility of Unmanned Combat Systems by John E. Jackson

(2) Drones and Support for the Use of Force by James Igoe Walsh.

GEOINFORMATICS LABORATORY- II			
Course Code	20CGIL26	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	0:4:0	SEE Marks	60
Credits	02	Exam Hours	03

Sl.NO	Experiments
1	Image Enhancement Techniques(Spatial, Spectral and Radiometric)
2	Classification Techniques – Unsupervised and Supervised Classification and Change Detection Calculation of area and Accuracy Assessment
3	Editing Vector Layers, Spatial and Non spatial querying using open source and proprietary GIS packages, Spatial data quality evaluation
4	Overlay Analysis, Buffer Creation and Analysis,
5	Network Analysis, DEM and TIN Creation
6	Familiarization with GPS Instrument and Software GPS Survey of Natural and Man-made features GPS & GIS data integration and output preparation
7	Delineation of Lithological/geomorphic units Identification of forest types and area estimation Generating the Indices maps Field visit and soil profile study
8	LU/LC Map Preparation Delineation of Watershed
9	Image pre-processing with R programming
10	Vector analysis with R

Course outcomes:

At the end of the course the student will be able to:

Students will be equipped with modern tools, softwares of GIS and be confident to implement a GIS project independently or as a team effort.

TECHNICAL SEMINAR			
Course Code	20CGI27	CIE Marks	100
Number of contact Hours/week (L:P:SDA)	0:0:2	SEE Marks	--
Credits	02	Exam Hours	--

Course objectives:

The objective of the seminar is to inculcate self-learning, face audience confidently, enhance communication skill, involve in group discussion and present and exchange ideas.

Each student, under the guidance of a Faculty, is required to

- Choose, preferably through peer reviewed journals, a recent topic of his/her interest relevant to the Course of Specialization.
- Carryout literature survey, organize the Course topics in a systematic order.
- Prepare the report with own sentences.
- Type the matter to acquaint with the use of Micro-soft equation and drawing tools or any such facilities.
- Present the seminar topic orally and/or through power point slides.
- Answer the queries and involve in debate/discussion.
- Submit two copies of the typed report with a list of references.

The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident.

Marks distribution for CIE of the course 20CGI27 seminar:

Seminar Report: 30 marks

Presentation skill:50 marks

Question and Answer:20 marks