

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI  
Scheme of Teaching and Examinations – 2020 - 21

**M.Tech (Geoinformatics)**

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

<b>III SEMESTER</b>											
Sl. No	Course	Course Code	Course Title	Teaching Hours /Week			Examination				Credits
				Theory	Practical/ Mini-Project/ Internship	Skill Development activities	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	P	SDA					
1	PCC	20CGI31	Geoinformatics Project Planning and Management	03	--	02	03	40	60	100	4
2	PEC	20CGI32X	Professional elective 3	03	--	--	03	40	60	100	3
3	PEC	20CGI33X	Professional elective 4	03	--	--	03	40	60	100	3
4	Project	20CGI34	Project Work phase -1	--	02	--	--	100	--	100	2
5	PCC	20CGI35	Mini-Project	--	02	--	--	100	--	100	2
6	Internship	20CGII36	Internship	(Completed during the intervening vacation of I and II semesters and /or II and III semesters.)			03	40	60	100	6
<b>TOTAL</b>				<b>09</b>	<b>04</b>	<b>02</b>	<b>12</b>	<b>360</b>	<b>240</b>	<b>600</b>	<b>20</b>
<b>Note: PCC: Professional core, PEC: Professional Elective.</b>											
<b>Professional elective 3</b>						<b>Professional elective 4</b>					
<b>Course Code under 20CGI32X</b>		<b>Course title</b>				<b>Course Code under</b>		<b>Course title</b>			
20CGI321		Geoinformatics in Urban Planning and Management				20CGI331		Geoinformatics in Disaster Management			
20CGI322		Geoinformatics in Marine and Coastal Resources Management				20CGI332		Emerging Trends in Spatial Data Analytics and Location Based Intelligence			
20CGI323		Geoinformatics in Demography, Business, Health and Infrastructure				20CGI333		Geoinformatics in Water Resource Management.			
20CGI324		Geoinformatics in Public Health Management				20CGI334		Geoinformatics in weather and climate studies			
<b>Note:</b>											

**1. Project Work Phase-1:** Students in consultation with the guide/co-guide if any, shall pursue literature survey and complete the preliminary requirements of selected Project work. Each student shall prepare relevant introductory project document, and present a 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. The CIE marks awarded for project work phase -1, shall be based on the evaluation of Project Report, Project Presentation skill and performance in Question and Answer session in the ratio 50:25:25.

SEE (University examination) shall be as per the University norms.

**2. Internship:** Those, who have not pursued /completed the internship shall be declared as fail in internship course and have to complete the same during subsequent University examinations after satisfying the internship requirements. Internship SEE (University examination) shall be as per the University norms.

<b>GEOINFORMATICS PROJECT PLANNING AND MANAGEMENT</b>			
Course Code	20CGI31	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03
<b>Module-1</b>			
<p><b>Introduction:</b> Definition of plan, project, program and scheme. Functions of planning and management. Components of Geoinformatics project. Overview of Geoinformatics projects, types of projects.</p> <p><b>GIS Project Planning:</b> Project phases and Project life cycle, project stakeholders, system development lifecycle, Project initiation, systems planning and methodology, systems analysis and user requirements studies, GIS software evaluation and selection, Hardware considerations and acquisition, Geographic database design, Techno-economic feasibility analysis, project formulation, product and project design, project report preparation. Project proposals.</p>			
<b>Module-2</b>			
<p><b>Project Costs:</b> Elements of cost, costing techniques, resources planning, cost components of a geo-informatics project- men, Hardware and software costs, cost of Remote Sensed Data /Imageries, Maintenance cost, organizational cost, service charges, outsourcing cost, pricing the product / service. Cost budgeting.</p> <p><b>Project Appraisal:</b> Project appraisal Methods -Discounting and non-discounting techniques, Benefit Cost Ratio, Break Even Point Analysis, Cost and Return simulation, return on investment.</p> <p><b>Project Time, Quality and Cost Management:</b> Project scheduling- network analysis, PERT and CPM techniques, Gant chart, time and cost crashing. Project cost and time control, feedback mechanisms, quality control / quality assurance. Data standards, interoperability, ISO standards.</p>			
<b>Module-3</b>			
<p><b>Planning A Geo-informatics Project:</b> Geo-informatics projects, Corporate or Enterprise GIS, Health GIS, Census GIS, Market/Business GIS, GIS Strategic Plan, Needs Assessment and Requirements Analysis, Organizational Involvement, Evaluating Existing Data, Accuracy, Completeness. Maintenance, Software and hardware Selection, Technical Environment, Assessing Costs and Benefits, Pulling the needs and ends together.</p> <p><b>Project Scope and Risk Management:</b> Project scope definition, scope verification, scope change control, risk management planning, project risk identification, quantitative and qualitative risk analysis, risk response planning, risk monitoring and control.</p>			
<b>Module-4</b>			
<p><b>GIS Organizations:</b> Vision, mission, goals and objectives, organizational chart, organizational approaches- democratic, authoritative, roles and responsibilities of personnel, recruitments, training, motivation, organizational behaviour, conflict resolving, team building, promotion/ demotion.</p>			

## Module-5

**Management Issues in GIS:** Making GIS efficient, effective and safe to use, data as management issue, GIS as a management tool, impact of broad societal issues.

**Trends in GIS:** Enterprise GIS, Corporate GIS, BPO in GIS, Spatial Data Warehouse, Interoperability and Open GIS, NSDI.

### **Course outcomes:**

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

Students will learn the essentials of project costing, scheduling, monitoring & management of the projects.

### **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) A guide to the Project Management Body Of Knowledge-2000 edition, Project Management Institute, USA

(2) The Design and Implementation of Geographic Information Systems, John E. Harmon, Steven J. Anderson by Wiley Publishers ISBN: 0-471-20488-9

(3) Geographic Information Systems, abridged by Paul A Longley, Michael F Goodchild, David J. Maguire, and David W. Rhind, second edition, 2005

(4) Project Management using PERT / CPM – Weist & Levy, PHI

(5) Concepts and Techniques of Geographic Information System by C P Lo Albert K W Yeung, 2002, EEEPrantice Hall of India Private Ltd.

(6) Project Management PERT / CPM & Precedence Diagramming

(7) UNIDO Guide to Project Appraisal

**GEOINFORMATICS IN URBAN PLANNING  
AND MANAGEMENT  
(Professional Elective- III)**

Course Code	20CGI321	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

**Module-1**

**Large Scale Mapping and Cadastral Information System:** Technologies for Large Scale Mapping (LSM) of urban areas – Aerial Photography - High- Resolution Satellite Remote Sensing - Issues in Large Scale Mapping (LSM), Integrated approach to LSM using Total Station and DGPS, Concept of Cadastre, History of cadastral survey, Cadastral survey methods and survey maintenance, cadastral map reproduction, development of cadastral information system, need for Land Information System (LIS), SVAMITVA (Survey of villages and mapping with improvised technology in village areas).

**Module-2**

**Urban Mapping and Spatial Analysis:** Urban process, the physical structure and composition of urban areas, Urbanisation process, and growth trend, problems of urbanisation, information requirements for perspective planning. Urban GIS, spatial analytical techniques, statistics and visualization, conceptual modelling of urban processes; Urban Sprawl: Change detection in Land Use Land Cover monitoring physical growth of urban area, trends in urban sprawl and associated problems.

**Urban Planning:** Plans – planning needs, types of plans, urban and regional planning; LU/LC mapping Urban Planning: Zoning of Land Use, Zonal Land Use Plan, Object oriented GIS data modelling for urban design, landscape architecture, urban infrastructure, Site selection for urban development, site suitability analysis for utilities and civic amenities, interim master plan, Master Plan.

**AM/FM Applications:** GIS/GPS applications in Automated mapping (AM) and Facility Management (FM), Urban infrastructure planning and management.

**Module-3**

**Demographic and Business Applications:** Geo-Demographics Population distribution maps by age, gender, education, occupation, socioeconomic grouping, health criteria index, crime rates and types.

**Business GIS -** Market analysis, retail site selection, retail planning, health care planning, financial services planning, educational institutions planning, water demand modelling and planning distribution network, household analysis, real estate inventory, mapping and GIS. Crime Analysis, Electoral Redistricting.

**Network Applications:** Transportation demand modelling and analysis, transportation planning, Vehicle Routing and Scheduling, Vehicle Tracking and Navigation: Integration of GPS and GIS data, intelligent transportation systems, streets network analysis; pavement management system (PMS) Water and sewage related- GIS based urban water demand analysis, pipeline planning and alignment.

#### Module-4

**Urban Ecology Applications:** Urban area heat budgeting, Logistic management and spatial planning for solid waste management. Noise pollution, Visibility pollution.

**Cultural GIS:** Mapping heritage buildings, monuments, places of worship, tourism spots, recreation facilities, sports facilities and serving on web GIS.

#### Module-5

**Urban Governance (E- Governance):** Governance of urban regions: mapping administrative boundaries, city base map generation, property enumeration and property GIS, Asset mapping; tax revenue rationalization, e-governance, Metropolitan Spatial Data Infrastructure, metropolitan information management system, Urban GIS and Smart Cities.

#### Course outcomes:

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

Basics of Urban Planning, Demographic changes & an assessment of infrastructure needs will be learnt.

#### 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) Remote Sensing and Urban Analysis Jean-Paul Donnay et al, GISDATA Series, 2001, Taylor and Francis Inc.

(2) GIS and GPS based asset management for Road and Railway Transportation Systems - GPS based vehicle tracking system. [www.gisdevelopment.net](http://www.gisdevelopment.net), [www.esri.com](http://www.esri.com), [www.aboutgis.com](http://www.aboutgis.com)

**GEOINFORMATICS IN MARINE  
AND COASTAL RESOURCES MANAGEMENT  
(Professional Elective -III)**

Course Code	20CGI322	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

**Module-1**

**Introduction:** Types of marine and coastal resources, properties of sea water, thermocline and pycnocline, air-sea interactions, Upwelling and Downwelling, El Nino-Sothern Oscillation (ENSO) phenomena.  
Generic spatial data-processing tasks: Sensor calibration, Atmospheric correction, Positional registration, Geophysical product derivation, etc.

**Module-2**

**Oceanographic Studies:** Interdisciplinary nature of oceanography, Remote sensing of oceans, ocean processes, satellites and sensors for ocean studies, spectral bands for study of ocean parameters, Physical oceanography applications – Estimation of wind velocity & direction, sea surface temperature, upwelling, sea surface velocities, mixed layer depth, salinity, ocean colour, etc.; Biological oceanography applications - Phytoplankton mapping, Ocean primary production, potential fishing zones.

**Module-3**

**Coastal Engineering Applications:** The Coast- beaches and shoreline processes, Coastal erosion and protection, Hydrodynamics of pollution dispersion, Modelling of suspend sediment. Coastal Bathymetry; Coastal Geomorphology, Coastal habitat (Mangrove, Coral reefs, wet lands etc.); Integrated Coastal Zone Management.

**Module-4**

**Coastal Zone Applications:** Introduction – Major issues/problem – coastal wetland classification – thematic maps on coastal resources- site suitability analysis for aquaculture – Coastal Regulation zone – Coastal aquifer modelling using GIS- Integrated coastal Zone Management – conflict analysis – Resources association.

**Module-5**

**Meteorology Applications:** Estimation of weather and climate parameters, and modelling aspects, global climatology. Rainfall mapping, potential and actual Evapo-transpiration, Hydrometeorology: atmospheric water content, cloud mapping, rain forecasting, artificial rain, cyclone forecasting.

**Course outcomes:**

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

Learn the basic relationship between Marine & Coastal Resources Air-Sea interactions & basic of weather

**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) Introduction to Environmental Remote Sensing Barrett E.C., Curtis, I.F., Chapman and Hall, New York, 1988

(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

(4) Coastal and Marine Geo-Information Systems: Applying the Technology to the Environment. David R.



**GEOINFORMATICS IN DEMOGRAPHY, BUSINESS, HEALTH  
AND INFRASTRUCTURE PLANNING  
(Professional Elective -III)**

Course Code	20CGI323	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

**Module-1**

**Geodemographics:** Spatial distribution of population according to age, gender, and socio-group, racial and socioeconomic segregation, geoethnography, labour market exploration, health equality, crime analysis, population and environmental linkage, spatial planning, temporal analysis, spatial dispersal and sparsity, changing pattern of demography, GIS functionality for demographic analysis.

**Module-2**

**Business GIS:** Competitive market analysis, trade area analysis, site analysis and selection for distribution centers and shopping centres, customer service stations, facility management, target marketing, market demographics demographic analysis for marketing based on customer profiling, lifestyle matching and consumer behaviour, sales promotion planning, advertisements targeting; geo-market segmentation by product category, sales territory rationalization, forecasting market potential and modeling sales.

**Module-3**

**Health GIS:** Spatial epidemiology: RS and GIS in study of epidemics and their control- malaria, leprosy, polio, TB, filariasis, dengue, chikengunya, cholera, AIDs Cancer; disease mapping, ecological analysis, disease clustering, bioterrorism and disease surveillance, infectious disease modeling. Health infrastructure and facility location mapping, planning future health facility requirement, disease surveillance and monitoring and other health indicators, Karnataka Health Systems Development Project, health and disease atlas of India and medical geography, internet and health GIS, integrated disease surveillance system, spatial distribution and spread of diseases.

**Module-4**

**Power:** Site suitability assessment for power plants- thermal, hydroelectric, nuclear, mini-hydroelectric power plants, wind power, and impact assessment. Electrification and network planning, GIS in management of electricity distribution network, underground cable maintenance and management in power sector, GIS as decision support system,

**Telecommunication:** Applications of GIS in telecommunication industry, internet GIS for telecommunication,

facility management in telecommunication industry, optical fiber cable alignment.

**Transportation:** Transportation GIS: vehicle routing and scheduling, optimizing routes and schedules, delivery routing/fleet management, vehicle navigation, vehicle tracking system, intelligent transportation system

#### Module-5

**Tourism:** Tourism internet GIS applications, tourism planning, tourism marketing, tourism research, tourism impact, ecotourism planning,

**Archeology:** RS and GIS applications in mapping cultural heritage, spotting historical monuments and sites, identification of palaeorivers, GIS of historical maps.

#### Course outcomes:

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

The students will be exposed to the concepts of spatial Based Decision Supports in the areas of Health, Power, Transportation etc. and how the spatial based related data can be analysed and applied for better facilities.

#### 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) "GIS and GPS based asset management for Road and Railway Transportation Systems " - GPS based vehicle tracking system.

(2) [www.gisdevelopment.net](http://www.gisdevelopment.net), [www.esri.com](http://www.esri.com) [www.aboutgis.com](http://www.aboutgis.com)

<b>GEOINFORMATICS IN PUBLIC HEALTH MANGEMENT</b>			
Course Code	20CGI324	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03
<b>Module-1</b>			
<b>Introduction to Geoinformatics in Public Health:</b> Basics of Epidemiological Data, Measures of Disease Frequency, Role of Remote Sensing in Public Health, Geographic Information Systems (GIS) in Public Health Research, Statistical Methods for Spatial Data in Public Health Research, Global Positioning System (GPS) in Public Health Research.			
<b>Module-2</b>			
<b>Spatial Database for Public Health and Cartographic Visualization:</b> Scale of Public Health Data, Digital Cartographic Data, Database Integration, Public Health Data Sharing, Data Visualization and Exploration,			
<b>Module-3</b>			
<b>Data Models and Spatio-temporal Analysis of Public Health Events:</b> Data Used in Spatial Analysis, Types of Spatial Analysis, Temporal Data Analysis and GIS, Spatio-Temporal (ST) Methods, Spatial Epidemiology, Case Studies on Spatio-Temporal Distribution of public health events. Benefits of Spatial and Temporal Analysis in Epidemiology.			
<b>Module-4</b>			
<b>Exploring Ecology and Associated Disease Pattern:</b> Ecological Conditions and Disease Interaction, Environmental Impacts of Controlling Disease Pattern and Distribution, Ecosystem Modifications, Loss of Predators and Host Species Imbalance, Land Use and Environmental Change, Rehabilitated Habitat, with Propagation of Reservoir or Vector Populations., A few case studies.			
<b>Module-5</b>			
<b>Disease Risk Assessment with Geospatial Technology:</b> Components of Early Warning System, Role of Earth Observation in Disease Risk Analysis and Early Warning System, Spatial Scale of Early Warning System, Case Studies: Assessment of Visceral Leishmaniasis Risk in Muzaffarpur District (Bihar), Environment and Spatial Technology in Public Health Planning and Policy,			
<b>Course outcomes:</b>			
At the end of the course the student will be able to:			
The students will be exposed to the basics of epidemiology, role of environment and climate change in the spatio-temporal dispersion of public health events, get equipped with multiple novel spatial statistical and			

**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) Geospatial Analysis of Public Health, by Gouri Sankar Bhunia and Pravat Kumar Shit, © Springer Nature Switzerland AG 2019.

(2) Climate Change – A Holistic View, by RR Kelakar, 2010. B.S. Publications, Hyderabad

(1) Satellite Meteorology, 2<sup>nd</sup> Edition, RR Kelakar, 2017, CRC Press, B.S. Publications, Hyderabad.

**GEOINFORMATICS IN  
DISASTER MANAGEMENT  
(Professional Elective - IV)**

Course Code	20CGI331	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

**Module-1**

**Introduction:** Definition, classification of disasters, Institutional frame work for disaster management in India, importance of Geoinformatics in Disaster Management, Satellites and sensors for disaster management. Role of satellite-based communication systems in disaster management.

**Module-2**

**Drought:** Drought types and causes, delineation of drought vulnerable areas mapping, Use of RS and GIS in Meteorological and Hydrological drought assessment. RS and GIS role in agricultural drought severity mapping and monitoring.

**Forest Fire:** Forest fire causes, forest fire management using geospatial information system, forest fire risk zonation mapping.

**Module-3**

**Cyclones:** Causes for cyclone formation, Life cycle of a cyclone, Cyclone tracking, Cyclone early warning, impact assessment and management.

**Floods:** Types of floods, causes and mitigation measures, flood early warning, flood affected area mapping and damage assessment, flood risk analysis using RS and GIS.

**Module-4**

**Earthquakes and Tsunami:** Causes of earthquake, damage evaluation and loss estimation, RS and GIS application for post-quake rehabilitation, micro-level seismic zonation, Tsunami- types, causes, RS and GIS applications for post Tsunami damage assessment and rehabilitation.

**Volcano:** Causes of Volcanoes, types of volcanoes, role of remote sensing in mapping damage and volcano hazard management.

**Landslide:** Landslides, causes, types, land slide susceptibility mapping, geospatial technology for landslide management.

**Module-5**

**Soil Erosion:** Soil erosion by water and wind. Application of RS and GIS for soil erosion and sediment estimation, desertification studies, estimation of soil erosion, soil erosion mapping, universal soil loss

equation, land degradation studies, sodic soil mapping.

**Recent Trends:** The role of Mobile GIS and SDI as an integrated framework in Emergency Management.

**Course outcomes:**

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

Learn the impact of disasters on economic development, the causes & effects and major disasters, importance of disaster risk reduction in overall Disaster Management Programme

**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) Amdahl G (2002) Disaster Response: GIS for Public Safety, Published by ESRI, Redlands California.

(2) <http://www.esri.com/news/arcnews/winter0102articles/gishomeland>.

**EMERGING TRENDS IN SPATIAL DATA ANALYTICS &  
LOCATION BASED INTELLIGENCE  
(Professional Elective - IV)**

Course Code	20CGI332	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

**Module-1: Global and National Scenario and Trends**

**Hardware and Software Products/Packages & OEM's**

GIS software Packages, Remote Sensing Packages, Photogrammetry Packages, GPS Instrument and Chipsets, Survey Instruments and software, Application development framework

**Global and Indian Institutions:** NASA, JPL, Canadian Institute of Remote Sensing, International Institute of Photogrammetry and Remote Sensing, PERS, GSDI

India- ISRO and its subunits, NRSA, SAC, Antrix, IIRS, RRSSCs; State Remote Sensing Centres; ISG, ISRS, AGI, DST, SOI, NATMO, GSI, NSDI, NGIS, K-GIS,

**World and Indian Space Programmes:** Satellites and sensors (Optical Imaging, Weather/Meteorology, Microwave, Ocean) and their products and applications; Open data; Geoinformatics usage by Government and Private Sectors - User Departments of Central Govt. and State Govt. and their major projects: Central - SOI, MES, MOEF, MOUD, MOD, few Case studies.

**Education and Training facilities in Geoinformatics:** Global Geoinformatics Courses, scholarships; Web Resources for e-learning; eBooks; open sources of free software; International Journals, Review magazines,

News Letters, e-journals.

### **Module-2: Advanced Technologies on Survey and Remote Sensing**

**Positioning Technologies:** NAVSTAR GPS / GLONASS / BEIDOU, GALILEO, IRNSS, GAGAN, OMISTAR

**Survey and Mapping:** Smart Station, Scanners

**Advance Remote Sensing:** Airborne LIDAR, Terrestrial LIDAR, Mobile LIDAR, Close Range Photogrammetry, Videogrammetry, Integrated Sensor for Asset Mapping (Laser, Image Compass), RADAR, SAR, GPR.

**Communication - Sensor / IoT Devices:** GSM, Bluetooth, Wi-Fi, Modems, Sensors - Automatic weather station, Rain Gauge, Water / Air Quality monitoring

### **Module-3: Enterprise and Advanced GIS**

**Vector and Raster Data Formats:** CAD / GIS format – DGN, DXF, DWG, Shape file, GDB, PGDB, IMG, GEOTIFF, IMG, JPEG, PNG, GIF, Multiband Image, Data Compression - ECW, MrSID,

**Concept of Enterprise GIS:** n-Tier Architecture, Database (SQL and No SQL database), Web / Application Engines, Middleware – Enterprise Service Bus, Mobile Application

**Application Development Framework:** COTS / Open Source (.NET / Java); UI Design / Style; AJAX, Modular / Object Oriented Framework, Mobile Platforms (Android, iOS, Windows, Hybrid)

**Data Interoperability:** GML, XML, City GML, OGC Compliance - WMS, WFS, WCS, WFS-T, REST, SOAP, Geo JSON

### **Module-4: Location Based Services and Data Analytics**

**Location Based Services:** Concept of Location, Introduction and General aspects of Location Based Services, Navigation System, Spatial Database, Middleware for LBS, Interoperability through standards, data collection, Data Transmission in Mobile communication systems, Architecture and Protocol for LBS, Network Architecture, Functional entities, Procedures, Privacy options in LBS, Location Intelligence Social Media Network, Crowd Sourcing, Data mining.

**Advanced Analytics:** Geostatistical Analysis; Google Earth Engine, Virtual Reality, Artificial Intelligence, Machine Learning, Big Data Analytics, Block Chain

### **Module-5: Geospatial Market - Laws and Policies**

**Global and Indian Geoinformatics Market:** Present trends and future prospects and problems, GIS BPO in private sector in India, GIS companies in India.

**Laws and Policy Perspectives and International Co-operations:** Laws and policy matters at international and national level with respect to Space, Ocean, photogrammetry, Indian Remote Sensing Data Policy, Open Data sharing policy, data security, interoperability; Open data initiatives, Global and national Geoinformatics survey reports, case-studies, show cases of best practices.

**Course outcomes:**

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

Students will learn modern trends in satellite Remote Sensing and GIS, Various products and OEM, Advanced Analytics, data integration with GIS & in value addition to geospatial 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.
- ~~The students will have to answer five full questions selecting one full question from each module.~~

**Reference Books**

(1) "GIS Development".net, ESRI web site, NCGIA, UCGIA, Google



**GEOINFORMATICS IN  
WATER RESOURCES MANAGEMENT  
(Professional Elective - IV)**

Course Code	20CGI333	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

**Module-1**

**Introduction:** Hydrology – definition and its importance, hydrological cycle, water budgeting, water demand estimation, surface water bodies, water content in ocean, sea, ice, lakes, dams, tanks, rivers and ground, water resource scenario in India and Karnataka, RS and GIS applications in water resources development and management.

**Module-2**

**Surface Fresh Water:** Rainfall mapping, potential and actual evapo-transpiration, atmospheric water content, rainfall estimation & forecasting, monitoring of snow-covered area and snowmelt runoff estimation, Surface Fresh Water: river diversion studies, site suitability for surface storages and hydro-electric power plants.

**Module-3**

**Irrigation and Watershed Management:** Mapping and monitoring of catchment and command areas, land irrigability mapping, agriculture water demand estimation for different crops, tank information system, wetland mapping, siltation mapping; Watershed: delineation, morphometric analysis, rainfall-surface runoff model, reservoir sedimentation, water-harvesting structures, watershed development planning, Concept of Natural Recharge and Artificial Recharge, Uses of DEM.

**Module-4**

**Ground Water:** Concepts of Ground water, types of Aquifers, Lineament studies, Groundwater Resources of India, Groundwater Resources of Karnataka. Theory of Groundwater flow- Darcy's law and its applications. Groundwater quality assessment, groundwater prospect zones mapping and groundwater information system.

**Module-5**

**Groundwater development and management:** Planning and management of groundwater. Methods of artificial groundwater recharge; rainwater harvesting, problems of over-exploitation of groundwater; water management in rural and urban areas, geological and geophysical methods of groundwater exploration

**Water Quality** Physical and chemical properties of water, quality criteria for different uses, groundwater

quality provinces of India, Groundwater contamination.

**Course outcomes:**

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

Students would learn the basic concepts of Water resources management, Ground water development water quality assessment and watershed development.

**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) GIS for Water Resources and Watershed Management - John G Lyon

(2) Application of GIS in Hydrology and Water Resources Management - K.Kovar

(3) Geographic Information Systems in Water Resources Engineering - Lynn E.Johnson

(4) Introduction to Environmental Remote Sensing – Barrett E C

(5) Remote Sensing principles and interpretation – Sabins F. F

(6) Groundwater – C. F. Tolman – McGraw-Hill Book Co. Inc.

(7) Groundwater Hydrology (2nd Ed.) – D. K. Todd, John Wiley and Sons Inc. NewYork

(8) Hydrology – S. N. Davis and R. J. M. Dewiest – John Wiley and Sons Inc. New York.

(9) Groundwater Resources Evaluation-W.C. Walton- McGraw-Hill Book Co. New York

(10) Hydrogeology – K. R. Karanth – Tata McGraw Hill Publishing Co. Ltd.

(11) Ground Water Assessment, Development and Management – K. R. Karanath – Tata McGraw Hill

<b>GEOINFORMATICS IN WEATHER AND CLIMATE STUDIES</b>			
Course Code	20CGI334	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03
<b>Module-1</b>			
<b>Elements of weather and Climate:</b> Global and regional variations in the temperature, pressure, wind, humidity, precipitation, the modifying factors like latitude, altitude, distance to the ocean and/ or sea, orientation of mountain ranges toward prevailing winds and ocean currents. Atmospheric circulations and Oceanic circulations.			
<b>Module-2</b>			
<b>Basics of agro-meteorology, Weather-borne Disasters and their Impacts:</b> Identification of critical weather variables affecting crop production, meat production, animal husbandry in each of 10 agro-climatic zones of Karnataka. Weather in relationship to crop growth, productivity, crop water requirements, irrigation scheduling, soil and water conservation techniques.			
<b>Module-3</b>			
The biotic and abiotic components of an ecosystem. Spatial distribution and spread of Crop Pests / diseases, Identification of endemic zones of crop pests and diseases. Spatial information kiosks in the rural development. etc.			
<b>Module-4</b>			
<b>Satellite Meteorology:</b> Principles of meteorological remote sensing, characteristics of satellite imagery, weather systems observed in satellite imagery, summer monsoons, tropical weather systems, winter weather systems, extra-tropical weather systems, Interaction between tropical and mid-latitude systems.			
<b>Module-5</b>			
<b>Climate Change Management:</b> Causes of climate, Indicators of climate change, Basics of climate change adaptations, Global regulations, International Geosphere Biosphere programmes, Indian National Programmes, role of Geoinformatics in climate change studies, Satellite-based inputs for environmental Management.			
<b>Course outcomes:</b>			
At the end of the course the student will be able to:			
The students will be exposed to the basics of weather and climate, analysis of weather and climate data learns			

**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) Monsoon Prediction by RR Kelakar, 2008, B.S. Publications, Hyderabad.

(2) Climate Change – A Holistic View, by RR Kelakar, 2010. B.S. Publications, Hyderabad

(3) Satellite Meteorology, 2<sup>nd</sup> Edition, RR Kelakar, 2017, CRC Press, B.S. Publications, Hyderabad.

<b>PROJECT WORK PHASE – 1</b>			
Course Code	20CGI34	CIE Marks	100
Number of contact Hours/Week	2	SEE Marks	--
Credits	02	Exam Hours	--
<p><b>Course objectives:</b></p> <ul style="list-style-type: none"> <li>• Support independent learning.</li> <li>• Guide to select and utilize adequate information from varied resources maintaining ethics.</li> <li>• Guide to organize the work in the appropriate manner and present information (acknowledging the sources) clearly.</li> <li>• Develop interactive, communication, organisation, time management, and presentation skills.</li> <li>• Impart flexibility and adaptability.</li> <li>• Inspire independent and team working.</li> <li>• Expand intellectual capacity, credibility, judgement, intuition.</li> <li>• Adhere to punctuality, setting and meeting deadlines.</li> <li>• Instil responsibilities to oneself and others.</li> <li>• Train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas.</li> </ul> <p><b>Project Phase-1</b> Students in consultation with the guide/s shall carry out literature survey/ visit industries to finalize the topic of the Project. Subsequently, the students shall collect the material required for the selected project, prepare synopsis and narrate the methodology to carry out the project work.</p> <p><b>Seminar:</b> Each student, under the guidance of a Faculty, is required to</p> <ul style="list-style-type: none"> <li>• Present the seminar on the selected project orally and/or through power point slides.</li> <li>• Answer the queries and involve in debate/discussion.</li> <li>• Submit two copies of the typed report with a list of references.</li> </ul> <p>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.</p>			
<p><b>Course outcomes:</b></p> <p>At the end of the course the student will be able to:</p> <ul style="list-style-type: none"> <li>• Demonstrate a sound technical knowledge of their selected project topic.</li> <li>• Undertake problem identification, formulation, and solution.</li> <li>• Design engineering solutions to complex problems utilising a systems approach.</li> <li>• Communicate with engineers and the community at large in written and oral forms.</li> </ul>			
<p><b>Continuous Internal Evaluation</b></p> <p>CIE marks for the project report (50 marks), seminar (30 marks) and question and answer (20 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session by the student) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three faculty from the department with the senior most acting as the Chairperson</p>			

<b>MINI PROJECT</b>			
Course Code	20CGI35	CIE Marks	40
Number of contact Hours/Week	2	SEE Marks	60
Credits	02	Exam Hours/Batch	03
<p><b>Course objectives:</b></p> <ul style="list-style-type: none"> <li>• To support independent learning and innovative attitude.</li> <li>• To guide to select and utilize adequate information from varied resources upholding ethics.</li> <li>• To guide to organize the work in the appropriate manner and present information (acknowledging the sources) clearly.</li> <li>• To develop interactive, communication, organisation, time management, and presentation skills.</li> <li>• To impart flexibility and adaptability.</li> <li>• To inspire independent and team working.</li> <li>• To expand intellectual capacity, credibility, judgement, intuition.</li> <li>• To adhere to punctuality, setting and meeting deadlines.</li> <li>• To instil responsibilities to oneself and others.</li> <li>• To train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas.</li> </ul>			
<p><b>Mini-Project:</b> Each student of the project batch shall involve in carrying out the project work jointly in constant consultation with internal guide, co-guide, and external guide and prepare the project report as per the norms avoiding plagiarism.</p>			
<p><b>Course outcomes:</b></p> <p>At the end of the course the student will be able to:</p> <ul style="list-style-type: none"> <li>• Present the mini-project and be able to defend it.</li> <li>• Make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task.</li> <li>• Habituated to critical thinking and use problem solving skills.</li> <li>• Communicate effectively and to present ideas clearly and coherently in both the written and oral forms.</li> <li>• Work in a team to achieve common goal.</li> </ul>			
<p><b>CIE procedure for Mini - Project:</b></p> <p>The CIE marks awarded for Mini - Project, shall be based on the evaluation of Mini - Project Report, Project Presentation skill and Question and Answer session in the ratio 50:25:25. The marks awarded for Mini - Project report shall be the same for all the batch mates.</p>			
<p><b>Semester End Examination</b></p>			

<b>INTERNSHIP / PROFESSIONAL PRACTICE</b>			
Course Code	20CGII36	CIE Marks	40
Number of contact Hours/Week	2	SEE Marks	60
Credits	06	Exam Hours	03
<p><b>Course objectives:</b></p> <p>Internship/Professional practice provide students the opportunity of hands-on experience that include personal training, time and stress management, interactive skills, presentations, budgeting, marketing, liability and risk management, paperwork, equipment ordering, maintenance, responding to emergencies etc. The objective are further,</p> <p>To put theory into practice.            To expand thinking and broaden the knowledge and skills acquired through course work in the field.            To relate to, interact with, and learn from current professionals in the field.            To gain a greater understanding of the duties and responsibilities of a professional.            To understand and adhere to professional standards in the field.            To gain insight to professional communication including meetings, memos, reading, writing, public speaking, <u>research, client interaction, input of ideas, and confidentiality.</u></p> <p><b>Internship/Professional practice:</b> Students under the guidance of internal guide/s and external guide shall take part in all the activities regularly to acquire as much knowledge as possible without causing any inconvenience at the place of internship.</p> <p><b>Seminar:</b> Each student, is required to</p> <ul style="list-style-type: none"> <li>• Present the seminar on the internship orally and/or through power point slides.</li> <li>• Answer the queries and involve in debate/discussion.</li> <li>• Submit the report duly certified by the external guide.</li> <li>• 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. ■</li> </ul>			
<p><b>Course outcomes:</b></p> <p>At the end of the course the student will be able to:</p> <ul style="list-style-type: none"> <li>• Gain practical experience within industry in which the internship is done.</li> <li>• Acquire knowledge of the industry in which the internship is done.</li> <li>• Apply knowledge and skills learned to classroom work.</li> <li>• Develop a greater understanding about career options while more clearly defining personal career goals.</li> <li>• Experience the activities and functions of professionals.</li> <li>• Develop and refine oral and written communication skills.</li> <li>• Identify areas for future knowledge and skill development.</li> </ul>			
<p><b>Continuous Internal Evaluation</b></p> <p>CIE marks for the Internship/Professional practice report (20 marks), seminar (10 marks) and question and answer session (10 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session by the student) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three faculty from the department</p>			

**Semester End Examination**

SEE marks for the internship report (30 marks), seminar (20 marks) and question and answer session (10 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session) by the examiners appointed by the University. ■



