Program Outcome of this course

Sl. No.	Description	POs
1	Qualitative improvement in Civil Engineering education	PO1
2	Usage of Geospatial technologies in problem solving	PO2
3	Sustainable development of cities and communities	PO3
4	Understand Environment and develop climate smart action plans	PO4
5	Natural Resource management and disaster resilience	PO5
6	Critical Analysis of problems and Innovations in developmental planning.	PO6
7	Design and development of Geoinformatics- based solutions.	PO7
8	Subject specific skill development	PO8
9	Socio-economic development through efficient project management	PO9
10	Providing inputs for transparent administration through e-governance	PO10
11	Innovation and creativity through research and development	PO11
12	Entrepreneurship	PO12

Semester- I (BSC)

Introduction to Geospatial Science & Statistics			
Course Code	**22CGI11**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning objectives:
To introduce and familiarize the students with the basic concepts EMR, survey, programming skills and statistical analysis which serve as a prerequisite for understanding Geoinformatics.

Module-1	
Basic Concepts: Electromagnetic Radiation (EMR), propagation of EM waves from one medium to another, attenuation, quantum nature of EMR, thermal radiation, Sources of EMR for remote sensing, Fundamentals of radiometry, Introductory physics of sensors, Introduction to geographic information system (GIS), Basics of Survey and Cartography.	
Teaching-Learning Process	Structured lectures on the physical, mathematical and theoretical basis of geospatial technologies prepared from standard books written by eminent authors through audio-visual technologies. Understand the concepts EMR, GIS and survey and cartography.
Module-2	
Basic Statistics and Probability Theory: Central tendency and dispersion, Skewness, Kurtosis: Mean mode, median, standard deviation, variance, and covariance. Introduction to probability theory, kinds of probability, probability models.	
Teaching-Learning Process	Structured lectures on general statistics prepared from standard books written by eminentauthors through audio-visual technologies. To understand basic concepts of statistics and probability theory.
Module-3	
Sampling and Testing of Hypothesis: Introduction, sampling, sample mean, sampling from normal distribution, stratification and sampling, simple hypothesis testing, composite hypothesis, tests of hypotheses – sampling from normal distribution, chi-square tests, tests of hypotheses and confidence intervals.	
Teaching-Learning Process	Encouraging students to give seminars, testing the outcome of teaching through conduct of internal tests, assignments, discussion in the class. Acquire skills on sampling and testing hypothesis.
Module-4	
Simple Regression and Correlation: Estimation using regression line, correlation analysis, making inferences, limitations and errors. **Time Series and Forecasting:** Introduction, variation in time series, trend analysis, cyclical variation, seasonal variation, irregular variation, time series analysis in forecasting.	
Teaching-Learning Process	Interactive/participative methods, through lectures, discussion, remedial instruction, study assignment (reading books, periodicals, research papers, and exercises for practicing at home). To acquire skills on Simple regression and correlation.
Module-5	
Introduction to Spatial data analysis in R: Basic data types and data structures in R Looping, functions, Linear, Multi regression, Analysis of Covariance, Time series analysis in R, Visualising Spatial Data using R, working with vector data and raster data in R.	
Teaching-Learning Process	Structured lectures on R statistical programming prepared from open source literature and manuals/guides written by eminent authors.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

1. Three Unit Tests each of **20 Marks**
2. Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks** to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
4. Each full question will have a sub-question covering all the topics under a module.
5. The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Books

1. Fundamentals of Remote Sensing; George Joseph
2. An Introduction to Spatial Data Analysis and Visualisation in R Guy Lansley and James Cheshire
3. Applied Spatial Data Analysis with R Roger S. Bivand, Edzer J. Pebesma Virgilio Gómez-Rubio
4. Statistics for Management Richard I.Levin, David S. Rubin, Sanjay Rastogi, Masood Hussain Siddiqui
5. An Introduction to R Spatial Analysis and Mapping Chris Brunsdon and Lex Comber

Web links and Video Lectures (e-Resources):

- https://github.com/topics/r-programming-projects
- https://www.coursera.org/learn/r-programming

Skill Development Activities Suggested

- To develop the skills on R statistical programming.

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	Basic physical concepts remote sensing and survey	I, II
CO2	Basic Statistics, Probability Theory	I,II
CO3	Stratification and Sampling, Testing of Hypothesis	III,IV
CO4	Simple Regression and Correlation, Time Series and Forecasting	IV,V
CO5	Introduction to Spatial data analysis in R	II,III,IV

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	x									
CO2		x								
CO3								x		
CO4						x				
CO5						x	x	x		

Semester – I (IPCC)

REMOTE SENSING AND PHOTOGRAMMETRY			
Course Code	**22CGI12**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	3:2:0	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 10-12 Lab slots	Total Marks	100
Credits	04	Exam Hours	03.00

Course objectives:

i) To understand the basic concepts of remote sensing, systems & techniques of data acquisition.

ii) To acquire skills in image processing techniques and interpretation of remotely sensed data.

iii) To impart skills for extraction of information from aerial/satellite stereo-data.

MODULE-1

Introduction: Definition of terms, Concepts and types of remote sensing; evolution of remote sensing technology, interdisciplinary nature and relation with other disciplines, Types of remote sensing with respect to wavelength regions; spectral reflectance of land covers; radiative transfer equation; energy interaction in the atmosphere. Geometry of aerial photograph: scale, relief displacement, scale of tilted photograph; digital aerial cameras, Principles of stereoscopic vision, types of stereoscopes, stereoscopic viewing, stereoscopic parallax.

Sensors & Platforms: Types of sensors- passive sensors and active sensors; imaging systems, photographic sensors, characteristics of optical sensors; Sensor resolutions, Multispectral and hyperspectral scanners, Imaging spectrometer; space borne imaging sensors, microwave sensors; thermal sensors. Types of platforms and their characteristics.

Teaching-Learning Process	Structured lectures on the fundamentals prepared from standard books written by eminent authors through audio-visual technologies. Understanding the concept of Remote Sensing techniques, its platforms and sensors.

MODULE-2

Image Interpretation and Digital Image Processing: Basics of image interpretation, elements of interpretation, Generations of Thematic maps. Importance of ground truth, reference data, use of smart phone, geo-tagging. Data formats, image rectification, radiometric correction, atmospheric correction.

Advanced Remote Sensing Technologies: Microwave remote sensing, Synthetic Aperture Radar; Hyper spectral Imaging Spectrometer; Thermal Imaging System; Advanced Laser Terrain Mapping.

Teaching-Learning Process	Encouraging students to give seminars, testing the outcome of teaching through conduct of internal tests, assignments, discussion in the class. Understanding the techniques of image interpretation, image pre-processing and advance remote sensing techniques.

MODULE-3

Analytical and Digital Photogrammetry: Image coordinate system and Object space coordinate system; Minor Control Points (MCPs), collinearity equations of vertical and tilted photograph, Epipolar geometry co-planarity equations, Relationship between image and object space. Basic photogrammetric operation in digital environment, Inner Orientation, Exterior Orientation procedures in digital photogrammetry. **Flight Planning and Block Control:** Flight planning, choice of photo scale, photographic end lap and side lap, purpose of photography, ground coverage, weather conditions, season of the year, flight map, specifications, General requirements of ground control points; planning Block Control Points (BCP), pre-pointing and post pointing.	
Teaching-Learning Process	Interactive/participative methods, through lectures, discussion, remedial instruction, study assignment (reading books, periodicals, research papers, and exercises for practicing at home). Acquiring knowledge on photogrammetric processing and production standard.
MODULE-4	
Aero Triangulation (AT): Definition, Classification of AT, GPS supported AT, geometric relationship between a camera and GPS antenna with respect to its position and attitude, synchronization of GPS coordinates with camera exposures, and INS parameters in bundle block adjustments for each exposure stations. **Concept of Block/Bundle/Strip Adjustments:** definition of block, types of block adjustments, development of block adjustment; bundle block adjustment, accuracy of block adjustment, space resection, space intersection,. Artificial Intelligence (AI) in Bundle adjustment**.**	
Teaching-Learning Process	Tutorial methods for the laggards, seminar methods for the groups, demonstration method where the faculty member / instructor himself performs a set of operations using the instruments and software tools. Evaluating the methods of production and issues on designing specifications.
MODULE 5	
Soft copy Photogrammetry: Digital photogrammetric system, Configuration of Digital photogrammetric work station, photogrammetric scanners, softcopy photogrammetry, 3D visualization in digital environment (stereo-viewing), Quad buffer, characteristics of digital image data, image enhancement, image matching, feature extraction by 2D and 3D mode, Advantages of digital photogrammetry. Digital surface modelling by DTM/DEM, Interpolation techniques, GRID and TIN, break lines, profiles, mass points / random points, DTM generation process, differential rectification, mosaic, Seamless data generation.	
Teaching-Learning Process	Demonstration method where the faculty member / instructor himself performs a set of operations using the instruments and software tools. Analysing the latest technology and the integration of spatial science with computer technology.

PRACTICAL COMPONENT OF IPCC *(May cover all / major modules)*

Sl.NO	Experiments
1	Generating the spectral reflectance of land covers using a spectroradiometer or a Hyperspectral satellite RS Data.
2	Interpretation of false colour composites made of VNIR, thermal and microwave sensor data.
3	Calculation of scale of a satellite image using a SOI toposheet
4	Identification of Land Use Land Cover types at Level-II (1:50,000 scale) using interpretation keys.
5	Ground truth collection and geotagging of sample sites using any hand-held GPS or a Mobile App.
6	Image rectification and image registration using ERDAS Imagine software or any Open Source Software.
7	Mirror stereoscope- computation of base line and orientation of aerial photographs and 3-D photo interpretation.
8	To find the height of a point using Parallax bar.
9	Selection of Block Control Points and post pointing (field work)
10	Chalking of details
11	**Generate a LULC Map and estimate the areas of each cover type using a box grid.**
12	**Estimate the height of a tree or a building using a stereo pair of photographs and parallax bar.**

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

CIE for the theory component of IPCC

1. Two Tests each of 20 Marks

2. Two assignments each of 10 Marks/One Skill Development Activity of 20 marks
3. Total Marks of two tests and two assignments/one Skill Development Activity added will be CIE for 60 marks, marks scored will be proportionally scaled down to 30 marks.

CIE for the practical component of IPCC

- On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The15 marks are for conducting the experiment and preparation of the laboratory record, the other 05 marks shall be for the test conducted at the end of the semester.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.
- The laboratory test at the end /after completion of all the experiments shall be conducted for 50 marks and scaled down to 05 marks.

Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for 20 marks.

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SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (duration 03 hours)

1. The question paper will be set for 100 marks and marks scored will be scaled down proportionately to 50 marks.
2. The question paper will have ten questions. Each question is set for 20 marks.
3. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
4. The students have to answer 5 full questions, selecting one full question from each module.

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component).

- The minimum marks to be secured in CIE to appear for SEE shall be the 15 (50% of maximum marks-30) in the theory component and 10 (50% of maximum marks -20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included. The maximum of 04/05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than the 20 marks.
- SEE will be conducted for 100 marks and students shall secure 40% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50. (Student has to secure an aggregate of 50% of maximum marks of the course(CIE+SEE)

Suggested Learning Resources:

Books

- Fundamentals of Remote Sensing by George Joseph 1st edition 2003
- Remote Sensing and Image Interpretation by by Lillesand Kiefer Chipman 6th edition 2014
- Remote Sensing and GIS by Basudeb Bhatta 2nd edition 2011
- Elements of Photogrammetry by Paul R Wolf Indian edition 2014.
- Introduction to Modern Photogrammetry by E M Mikhail, James S Bethel and J C McGlone 2001.

Students are encouraged to visit SWAYAM web site where there are several Massive Open Online Courses (MOOC), **http://swayam.gov.in**

Students are encouraged to take the benefits of SWAYAM PRABHA- the direct to home (DTH) 34 channels telecasting educational programmes on 24x7 basis using GSAT-15 satellite. The channels are up-linked from BISAG-N, Gandhinagar.

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- To learn skill in image interpretation techniques in practical class.
- To get familiarized with filed instruments.
- To get knowledge about photogrammetry software.
- To learn Mirror Stereoscope for height of tree or building.

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	Introduction to RS and Photogrammetry, Sensors and Platforms	I, II
CO2	Image Interpretation, Digital Image Processing, Advanced Remote Sensing Technologies.	II, III
CO3	Analytical and Digital Photogrammetry, Flight Planning and Block Control	II, III
CO4	Aero Triangulation, Concept of Block/Bundle/Strip Adjustments	III, IV
CO5	Soft copy Photogrammetry	V, VI

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	x											
CO2		x						x			x	
CO3						x						
CO4		x						x				
CO5						x					x	

Semester – I (PCC)

GIS & SPATIAL DATA ANALYTICS			
Course Code	**22CGI13**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	3:0:2	SEE Marks	50
Total Hours of Pedagogy	40 Hours of teaching +10-12 sessions of SDA	Total Marks	100
Credits	04	Exam Hours	03.00

Course Learning objectives:
To understand the basic principles of GIS, creation of GIS database, understanding the formats of raster and vector data, measurement techniques, modelling, and spatial data analytics.

Module-1

Introduction to GIS: Definitions, Components of GIS, interdisciplinary relations, Discrete geographic objects, Continuous geographic features, Vector and Raster Data structures. Spatial Data types, Non-spatial / Attribute Data types, Tessellations to represent geographic objects, Basic Data Models –raster and vector, Spaghetti model and Topological model, Advanced data models, raster and vector data formats.

Teaching-Learning Process	Structured lectures on the fundamentals of GIS and spatial data analytics prepared from standard books written by eminent authors through audio-visual technologies. Students will acquire knowledge of terminology and elements of data analytics.

Module-2

Data Sources and Data Entry: Primary and secondary methods of acquisition of spatial and non-spatial data: surveying, remote sensing, Photogrammetry, Global Navigation Satellite System (GNSS), Database creation, Data capturing, map scanning and digitizing, data exchange standards, topology building, editing and cleaning, linking of spatial and non-spatial data.

Teaching-Learning Process	Encouraging students to give seminars, testing the outcome of teaching through conduct of internal tests, assignments, discussion in the class. Students will acquire conceptual knowledge on the subject.

Module-3

Data Processing and Data quality: Hardware and software needed**,** data editing, data conversion, scale changes, coordinate thinning, georeferencing, sliver removal, edge matching, interactive editing, rubber sheeting. components of geographic data quality, Sources of error in geographic data, error management; quality assurance & quality control (QA/QC), components and types of GIS standards, international GIS standards, interoperability of GIS.	
Teaching-Learning Process	Interactive/participative methods, through lectures, discussion, remedial instruction, study assignment (reading books, periodicals, research papers, and exercises for practicing at home). Students will learn the sources of error and quantifying it.
Module-4	
Spatial Data Analysis and Visualization: Spatial Measurements, Queries, Vector Data Analysis, Raster Data Analysis, Network Analysis, Terrain analysis, spatial analysis of 3-Dimentional data, Data integration and map overlay. GIS and Maps**,** Visualization process and strategies, mapping qualitative and quantitative data., map / information dissemination.	
Teaching-Learning Process	Tutorial methods for the laggards, seminar methods for the groups, demonstration method where the faculty member / instructor himself performs a set of operations using the instruments and software tools for spatial data analysis and visualization.
Module-5	
Advanced Spatial Data Modelling: Trend surface analysis, Spatial interpolation, fuzzy analysis, GIS analytical models: Digital Terrain Models, Hydrologic modelling, Spatial Multi Criteria Analysis and engineering GIS applications, recent advances in GIS & Spatial Data Analytics (SDA), Career opportunities in GIS and SDA.	
Teaching-Learning Process	Demonstration method where the faculty member / instructor himself performs a set of operations using the instruments and software tools (COTS and Open Sources).

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

3. Three Unit Tests each of **20 Marks**
4. Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks** to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

6. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
7. The question paper will have ten full questions carrying equal marks.
8. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
9. Each full question will have a sub-question covering all the topics under a module.
10. The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Books

1. Concepts and Techniques of Geographic Information Systems, CP Lo Albert K W Yeung, 2005 Prantice Hall of India.
2. Principles of GIS for Land Resources Assessment by P.A.Burrough, Oxford: Science publications, 1986.\
3. An Introduction to Geographical Information Systems by Ian Heywood, S Cornelius, Second edition
4. Introduction to GIS by Kang-tsung Change, Third edition

Web links and Video Lectures (e-Resources):

- Students are encouraged to visit SWAYAM web site where there are several Massive Open Online Courses (MOOC), **http://swayam.gov.in**
- SWAYAM PRABHA web site

Skill Development Activities Suggested

- Visualization maps using different software
- Integrated the ancillary data with satellite images using softwares.

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	Basic concepts of GIS and understanding raster and vector formats.	I, II
CO2	Concepts spatial and non-spatial Data Sources and Data Entry.	II,III
CO3	Acquiring spatial data processing techniques and quality /assurance	III,IV
CO4	Acquiring knowledge Spatial Data Analysis and Visualization	IV,V
CO5	Knowledge about advanced Spatial Data Modelling for output product	V,VI

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		x										
CO2	x											
CO3							x					
CO4						x						
CO5								x				

Semester- I (PCC)

CARTOGRAPHY, GEODESY AND GLOBAL NAVIGATION SATELLITE SYSTEMS			
Course Code	**22CGI14**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	3:0:2	SEE Marks	50
Total Hours of Pedagogy	40 Hours of teaching +10-12 sessions of SDA	Total Marks	100
Credits	03	Exam Hours	03.00

Course Learning objectives:
Upon completion of this subject students should have gained the knowledge of Cartography, Geodesy, and Global Positioning System and also they become familiar with the basic principles and their applications in Geoinformatics Projects.

Module-1	
Introduction to Cartography and Map: Cartographic concepts, science and art in cartography, essential cartographic process. Types of map, map scale, map composition, conventional signs; plan and profile, representation of relief, Map Numbering Systems, Map Legend, Symbols & Border Information, Layout of Maps, Base map and Thematic map. **Digital Cartography:** Digital cartography, cartographic generalization, hyper maps; web cartography.	
Teaching-Learning Process	Structured lectures prepared from standard books written by eminent authors through audio-visual technologies, explain cartographic process, how a map is prepared through digitisation
Module-2	
Introduction to Geodesy: Definitions, classification, shape and size of the earth, applications. Earth, Geoid and Reference Ellipsoid; Everest Spheroid, WGS 84, Vertical datum, Mean Sea Level, level surfaces, plumb line and deflection of the vertical, coordinate system in geodesy; Datum transformation. **Projections:** Classification of map projections, Scale factor, LCC, Polyconic and UTM.	
Teaching-Learning Process	Encouraging students to give seminars, testing the outcome of teaching through conduct of internal tests, assignments, discussion in the class, explain physical and geometric geodesy, co-ordinate system, illustrate important map projections.
Module-3	
Satellite Geodesy: Introduction, Fundamentals of celestial mechanics, Normal orbits, Equation of motion and laws and elements of Kepler, geometry of elliptic orbit, perturbed satellite motion, Doppler surveying, Advantages of satellite geodesy.	
Teaching-Learning Process	Interactive/participative methods, through lectures, discussion, remedial instruction, study assignment (reading books, periodicals, research papers, and exercises for practicing at home), explain 2-body motion in orbit, Kepler's elements and concept of Doppler's survey.
Module-4	
Introduction to satellite-based Positioning systems: Concept of GNSS, GLONASS, GALILEO, GAGAN, India's NavIC. Components of GPS, principle of ranging, types of receivers; GPS satellite signals, Precise Point Positioning (PPP); satellite geometry and accuracy measure, signal propagation error, International GPS Geodynamic Services (IGS)	
Teaching-Learning Process	Tutorial methods for the laggards, seminar methods for the groups, demonstration method where the faculty member / instructor himself performs a set of operations using the instruments, explain the characteristics of GPS, its signal propagation, range measurement and geometry of satellites in the orbit.
Module-5	

Differential GPS – DGPS, concepts and principles, differential corrections, local area DGPS, wide area DGPS, LAAS, WAAS; Measurement with GPS – rapid static method, semi kinematic method, Real time kinematic method. GPS pseudolites. **Planning and Field Observations:** Ground control points, field observations, criteria for selecting reference station, post processing, Receiver Independent Exchange Format (RINEX). Geo-referencing of satellite imagery / photograph. **Applications:** Continuously Operating Reference Station (CORS) system, applications of Location Based Services, Geo-fencing.	
Teaching-Learning Process	Demonstration method where the faculty member / instructor himself performs a set of operations using the instruments and software tools, develop observation procedure with Differential GPS, create field planning and carry out data processing.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

5. Three Unit Tests each of **20 Marks**
6. Two assignments each of **20 Marks**or**oneSkill Development Activity of 40 marks** to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

5. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
6. The question paper will have ten full questions carrying equal marks.
7. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
8. Each full question will have a sub-question covering all the topics under a module.
9. The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Books

1. Satellite Geodesy: Gunter Seebar,
2. GPS satellite surveying: Alfred leick
3. Essentials of GPS, N K Agrawal
4. Fundamentals of Cartography by R P Misra, 2nd edition

Web links and Video Lectures (e-Resources):

- https://1lib.in/

Skill Development Activities Suggested

- Map reading
- Field observation using DGPS

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	Understand the concept of cartography and production of map on various scales using latest digital technology.	I,II
CO2	Understand the analytical and equipotential surface of Earth, its gravity field and projection system.	II,III
CO3	Acquire knowledge about satellite orbits, perturbation and application of force factor.	III,IV
CO4	Understand the concept of constellation in Global Navigation Satellite System and its usage in position determination.	II,III
CO5	Acquire knowledge about the usage of Differential GPS, create field planning and carry out data processing.	IV,V

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	x									
CO2		x								
CO3							x			
CO4		x								
CO5								x		

Semester- I (PCC)

GEOSPATIAL DATABASE MANAGEMENT SYSTEMS AND PROGRAMMING SKILLS			
Course Code	**22CGI15**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	2:0:2	SEE Marks	50
Total Hours of Pedagogy	25 Hours of teaching +10-12 sessions of SDA	Total Marks	100
Credits	03	Exam Hours	03.00

Course Learning objectives:

i) To understand the basic concepts of Database management system, creation of GIS database.
ii) To understanding the advanced concepts of Hadoop, MongoDB, Hive.
iii) To acquire programming skills in python using different libraries.

Module-1	
Databases and Users: Introduction, characteristics of database approach, intended uses of a DBMS, implications of database approach. **Database System Concepts and Architecture:** Data models, schemas and instances, DBMS architecture and data independence, database languages and interfaces, database system environment, classification of database management systems. **Data Modelling: C**onceptual data models for database design, ER model- concepts, schema constructs and simple applications.	
Teaching-Learning Process	Structured lectures prepared from standard books written by eminent authors through audio-visual technologies, explain the basic Database system concepts with their models.
Module-2	
Relational Data Model: Concepts and constraints, update operations on relations, relational algebra, simple examples. **Structured Query Language:** Data definition in SQL, queries, update statements, views in SQL, DDL, and DML. Relation Database Management System, querying operation. **Database design:** Functional dependencies and normalization for relational databases, Normal forms based on primary keys, gene general definition of second and third normal forms, Boyce-Codd normal form.	
Teaching-Learning Process	Encouraging students to give seminars, testing the outcome of teaching through conduct of internal tests, assignments, discussion in the class, explain relation data model, SQL queries and design of database system.
Module-3	
Introduction to Hadoop: Distributed Computing Challenges, Hadoop Distributed File System, Processing Data with Hadoop Managing Resources and applications, interactive with Hadoop Ecosystem. **Introduction to MongoDB:** Data types in MongoDB, MongoDB Query Language **Introduction Hive:** Architecture, Data types, File formats, HQL, RCFile implemention, SerDe, User defined Function (UDF)	
Teaching-Learning Process	Interactive/participative methods, through lectures, discussion, remedial instruction, study assignment (reading tutorials, periodicals, and exercises for practicing at home), explain advanced concepts of Hadoop, MongoDB, Hive.
Module-4	
Python Scripting: Introduction, Environment setup, Debugging, Syntax, Variable Types, Operators, Decision statements, Loops, Numbers, Strings, Lists, Tuples, Dictionary, Modules, File I/O, Exceptions & Exception Handling, Arrays-2D. **Python OOPs and SQLITE in Python:** OOPs concepts -Encapsulation, Inheritance, Polymorphism, Abstraction., SQILTE- Create , Insert, Update and Delete	

Python Pandas: Introduction to Pandas and Data Frames, Understanding the Usage of Data Frames, Various Data Frame methods and Operations, Selecting and Indexing Operations, Pandas Aggregation Operations. Outlier treatment.	
Teaching-Learning Process	Tutorial methods for the laggards, seminar methods for the groups, demonstration method where the faculty member / instructor himself performs a set of operations/libraries for in python programming.
Module-5	
Python for Spatial Analysis: Introduction to Geopandas, geopy, rasterio & Fiona. Reading and writing files, Installing and using libraries, Building scripts and automating workflows. **Introduction to Python Data Visualization:** Tabular and Vector Data Visualization, Creating charts and plots using Pandas, Creating maps with GeoPandas Raster and Gridded Data Visualization, Raster Data Visualization using Xarray and rioxarray, Interactive Mapping, Creating Interactive Maps with Folium, Creating Multi-Layer Interactive Maps with GeoPandas	
Teaching-Learning Process	Demonstration method where the faculty member / instructor himself performs a set of operations spatial analysis tools and data visualization using python.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

7. Three Unit Tests each of **20 Marks**
8. Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks** to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
4. Each full question will have a sub-question covering all the topics under a module.
5. The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Books

1. Fundamentals of Database Systems by Elmasri and Navathe 5th and 6th edition
2. Big Data and Analytics by Seema Acharya and Subhashini Chellappan
3. Python Geospatial Analysis Cookbook by Michael Diener
4. Arcpy and ArcGIS by Jerry Davis second edition

Web links and Video Lectures (e-Resources):

- Web Tutorial in python programming
- https://github.com/

Skill Development Activities Suggested

- To learn the programming skill with different libraries.

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	Understanding the concepts of DB system architecture and modelling.	I,II
CO2	Acquiring the skills for write the query and designing the DB and model.	II, III
CO3	Understanding the advance concepts of Hadoop, MongoDB and Hive	IV,V
CO4	Understanding the concepts of Python programming skills	II,III
CO5	Acquiring the skills for different libraries of python programming.	V, VI

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	x										
CO2							x				
CO3		x									
CO4								x			
CO5											x

Semester –I (PCCL)

Geoinformatics Laboratory- I			
Course Code	**22CGIL17**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	1:0:2:0	SEE Marks	50
Credits	02	Exam Hours	03.00

Course objectives:

i) Students would be able to model and analyse the spatial data, utilize GIS as navigation guide, decision support and expert tool.

ii) Understand how to use a wide range of vector-based GIS tools to address quarries relevant to natural resource management and hands programming skills.

iii) Analyse the requirements of a proposed application and synthesise an appropriate solution and customise a GIS.

Sl.NO	Experiments
1	Downloading Satellite images from different websites NRSC, USGS etc., Mosaicking and Subsetting Radiometric Correction of Satellite Images.
2	Features extraction (Polygon, Line, Point) ERDAS imagine and ArcMap Creation Geodatabase using ArcGIS for Spatial Data GIS Software environment, Joining the non-spatial with spatial data, editing the vector layers.
3	Familiarization in open source like (Q- GIS)
4	Familiarization with GPS Instrument and Software GPS Survey of Natural and Man-made features GPS & GIS data integration and output preparation
5	Vector based and Raster based analysis
6	Network Analysis and creation DEM and TIN.

7	Spatial and non-spatial data visualization using R statistical software
8	Interpolation Techniques
	Demonstration Experiments (For CIE) if any
9	Creation Data types or Data Objects in R, Linear, Multi regression analysis covariance and time series analysis using R software
10	Vector analysis and Image pre-processing with R programming
11	Basic spatial programs using python libraries.
12	Basic query using SQL, Hadoop, MongoDB, Hive.

Course outcomes (Course Skill Set):

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

- Students will be equipped with modern tools, software of GIS and be confident to implement a GIS project independently or as a team effort.
- Students will be able to write code for programs.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. The student has to secure not less than 40%of maximum marks in the semester-end examination (SEE). In total of CIE and SEE student has to secure 50% maximum marks of the course.

Continuous Internal Evaluation (CIE):

CIE marks for the practical course is 50 Marks.

The split-up of CIE marks for record/ journal and test are in the ratio 60:40.

- Each experiment to be evaluated for conduction with observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed by the faculty who is handling the laboratory session and is made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled downed to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct 02 tests for 100 marks, the first test shall be conducted after the 8th week of the semester and the second test shall be conducted after the 14th week of the semester.
- In each test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- The average of 02 tests is scaled down to 20 marks (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and average marks of two tests is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

SEE marks for the practical course is 50 Marks.
SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the University.
All laboratory experiments are to be included for practical examination.
(Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. OR based on the course requirement evaluation rubrics shall be decided jointly by examiners.
Students can pick one question (experiment) from the questions lot prepared by the internal /external examiners jointly.
Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.
General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)
Change of experiment is allowed only once and 10% Marks allotted to the procedure part to be made zero.
The duration of SEE is 03 hours

Suggested Learning Resources:

- Web Tutorial and ESRI guide books.

Semester –I (MCC)

Research Methodology and IPR			
Course Code	22RMI16	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:0	SEE Marks	60
Total Hours of Pedagogy	40	Maximum Marks	100
Credits	3	Exam Hours	03

Module-1

Research Methodology: Introduction, Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Importance of Knowing How Research is Done, Research Process, Criteria of Good Research, and Problems Encountered by Researchers in India.

Defining the Research Problem: Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, An Illustration.

Module-2

Reviewing the literature: Place of the literature review in research, Bringing clarity and focus to your research problem, Improving research methodology, Broadening knowledge base in research area, Enabling contextual findings, How to review the literature, searching the existing literature, reviewing the selected literature, Developing a theoretical framework, Developing a conceptual framework, Writing about the literature reviewed.

Research Design: Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs, Important Experimental Designs.

Module-3

Design of Sampling: Introduction, Sample Design, Sampling and Non-sampling Errors, Sample Survey versus Census Survey, Types of Sampling Designs.

Measurement and Scaling: Qualitative and Quantitative Data, Classifications of Measurement Scales, Goodness of Measurement Scales, Sources of Error in Measurement Tools, Scaling, Scale Classification Bases, Scaling Technics, Multidimensional Scaling, Deciding the Scale.

Data Collection: Experimental and Surveys, Collection of Primary Data, Collection of Secondary Data, Selection of

Module-4

Testing of Hypotheses: Hypothesis, Basic Concepts Concerning Testing of Hypotheses, Testing of Hypothesis, Test Statistics and Critical Region, Critical Value and Decision Rule, Procedure for Hypothesis Testing, Hypothesis Testing for Mean, Proportion, Variance, for Difference of Two Mean, for Difference of Two Proportions, for Difference of Two Variances, P-Value approach, Power of Test, Limitations of the Tests of Hypothesis.

Chi-square Test: Test of Difference of more than Two Proportions, Test of Independence of Attributes, Test of Goodness of Fit, Cautions in Using Chi Square Tests. □

Module-5 **Interpretation**

and Report Writing: Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports.

Intellectual Property: The Concept, Intellectual Property System in India, Development of TRIPS Complied Regime in India, Patents Act, 1970, Trade Mark Act, 1999,The Designs Act, 2000, The Geographical Indications of Goods (Registration and Protection) Act1999, Copyright Act,1957,The Protection of Plant Varieties and Farmers' Rights Act, 2001,The Semi-Conductor

Integrated Circuits Layout Design Act, 2000, Trade Secrets,

Utility Models, IPR and Biodiversity, the Convention on Biological Diversity (CBD) 1992, Competing Rationales for Protection of IPRs, Leading International Instruments Concerning IPR, World Intellectual Property Organisation (WIPO),WIPO and WTO, Paris Convention for the Protection of Industrial Property, National Treatment, Right of Priority, Common Rules, Patents, Marks, Industrial Designs, Trade Names, Indications of Source, Unfair Competition.

Patent Cooperation Treaty (PCT), Advantages of PCT Filing, Berne Convention for the Protection of Literary and Artistic Works, Basic Principles, Duration of Protection, Trade Related Aspects of Intellectual Property Rights(TRIPS) Agreement, Covered under TRIPS Agreement, Features of the Agreement, Protection of Intellectual Property under TRIPS, Copyright and Related Rights, Trademarks, Geographical indications, Industrial Designs, Patents, Patentable Subject Matter, Rights Conferred, Exceptions, Term of protection, Conditions on Patent Applicants, Process Patents, Other Use without Authorization of the Right Holder, Layout-Designs of Integrated Circuits, Protection of Undisclosed Information, Enforcement of Intellectual Property Rights, UNSECO.

Course outcomes:

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

- Discuss research methodology and the technique of defining a research problem
- Explain the functions of the literature review in research, carrying out a literature search, developing theoretical and conceptual frameworks and writing a review.
- Explain various research designs, sampling designs, measurement and scaling techniques and also different methods of data collections.
- Explain several parametric tests of hypotheses, Chi-square test, art of interpretation and writing research reports
- Discuss various forms of the intellectual property, its relevance and business impact in the changing global business environment and leading International Instruments concerning IPR.

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. □

Textbooks

(1) Research Methodology: Methods and Techniques, C.R. Kothari, Gaurav Garg,New Age International,4th Edition, 2018.

(2) Research Methodology a step-by-step guide for beginners. (For the topic Reviewing the literature under module 2), RanjitKumar,SAGE Publications,3rd Edition, 2011.

(3) Study Material (For the topic Intellectual Property under module 5),

Professional Programme Intellectual Property Rights, Law and Practice, The Institute of Company Secretaries of India, Statutory Body Under an Act of Parliament, September 2013.

Reference Books

(1) Research Methods: the concise knowledge base, Trochim, Atomic Dog Publishing, 2005.

(2) Conducting Research Literature Reviews: From the Internet to Paper, Fink A, Sage Publications, 2009.

Semester- II (PCC)

Geoinformatics in Natural Resource and Environmental Management			
Course Code	**22CGI21**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	2:0:2	SEE Marks	50
Total Hours of Pedagogy	25 Hours of teaching +10-12 sessions of SDA	Total Marks	100
Credits	03	Exam Hours	03.00

Course Learning objectives:

i) To understand the concepts of natural resources management, linkages with economy, Earth system functioning.

ii) To impart the basics of sustainable development and prepare suitable action plans for sustaining the ecosystem services through geospatial technologies, and

iii) To explore the use of geoinformatics in assessing the natural resources and monitoring the changes in the environment.

Module-1	
Introduction to Land Resources Management: Types of natural resources, Linkages of natural resources with the economy, impact of natural resources utilization on Earth system functioning, Geomorphological Mapping, geological structures and lithological mapping, Mineral resources mapping, classification of soils and soil mapping, Land Use Land Cover Mapping, role of land and soil in the climate system.	
Teaching-Learning Process	Structured lectures on the fundamentals of NRM and EnM prepared from standard books written by eminent authors through audio-visual technologies. Field visit to mineral rich geological formations in Karnataka, conducting a quick soil survey in the nearby university campus, students will acquire factual knowledge about land resources (The abiotic components of the environment).
Module-2	
Agro-ecosystem Forest Resources Management: Forecasting Agriculture output through Satellite and Land-based observations (FASAL), crop stress detection and crop insurance programmes, Space inputs for precision agriculture, Site suitability studies for agricultural and horticultural crops, Web-GIS applications in agriculture. Mapping of forest types, Forest biomass estimation, Inputs for preparation of working plans / schemes, Thermal and microwave remote sensing applications in agriculture and forestry.	
Teaching-Learning Process	Encouraging students to give seminars, testing the outcome through conduct of internal tests, assignments, discussion in the class room. Students will acquire conceptual knowledge on the biotic components of the environment.
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.	
Teaching-Learning Process	Interactive/participative methods, through lectures, discussion, remedial instruction, study assignments. Students will learn the use of geoinformatics in water resources management.
Module-4	
Environment and Sustainable Development: Components of environment, concepts of ecosystem, energy flow and ecosystem functioning and services, Applications in EIA and EMP, quantifying impacts of developmental projects. Concepts of sustainable development, Watershed-based Acton Plans for Sustainable development.	
Teaching-Learning Process	Structured lectures through PPTs, seminar methods where the faculty member / instructor himself moderates the discussions, on the components of environment and sustainable development.

Module-5	
Environmental Pollution Applications: Point and non-point source pollution, methane production area mapping and modelling, oil slicks tracing and monitoring, turbidity and sedimentation mapping, Groundwater-pollution hazard assessment, Aerosol remote sensing, air quality indexing and mapping, Use of RS+GIS in studying ecology of vector-borne diseases, public health administration.	
Teaching-Learning Process	The faculty members conduct field visits to polluting industries, crop lands treated with agrochemicals, consulting research papers, case studies, and success stories describing the use of geoinformatics in managing environmental pollution.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

9. Three Unit Tests each of **20 Marks**
10. Two assignments each of **20 Marks**or**oneSkill Development Activity of 40 marks** to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

5. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
6. The question paper will have ten full questions carrying equal marks.
7. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
8. Each full question will have a sub-question covering all the topics under a module.
9. The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Books

1. Introduction to Environmental Remote Sensing by Barrett E.C., Curtis, I.F., Chapman and Hall, New York, 1982
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. Remote Sensing in Geology by Ravi P Gupta second edition.
5. Geoinformatics in Environmental Management by M Anji Reddy

Web links and Video Lectures (e-Resources):

- Remote Sensing Application by NRSC
- Indian Society of Remote Sensing Journal https://www.isrs-india.org/
- https://isgindia.org/journal-of-geomatics/

Skill Development Activities Suggested

- Field data collation for Geological features and water sample for test the concentrations of chemical elements.
- Collection air pollution data using instruments.

Sl. No.	Description	Blooms Level
CO1	Understanding concepts natural resources, Geological features, Land and soil resources mapping.	II, III
CO2	Acquiring the knowledge about Agro-ecosystems and Forest Resources Management using RS and GIS.	II, III
CO3	Understanding concepts of Water Resources Management using RS and GIS	III,IV
CO4	Acquiring the concepts of Environment and Sustainable Development.	IV,V
CO5	Assessing Environmental Pollution using Geoinformatics	V,VI

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		x										
CO2				x								
CO3					x							
CO4				x								
CO5						x						

Semester – II (IPCC)

SATELLITE DATA IMAGE PROCESSING AND ANALYSIS			
Course Code	**22CGI22**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	3:2:0	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 10-12 Lab slots	Total Marks	100
Credits	04	Exam Hours	03.00

Course objectives:

i) To understand the basic concepts of raster formats using statistical equation.

ii) To acquire skills in image enhancement and transformation techniques

iii) To impart skills for classification techniques raster data merging and advanced computer based algorithms.

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.

Teaching-Learning Process	Structured lectures on the fundamentals prepared from standard books written by eminent authors through audio-visual technologies. Structures of raster formats are learnt.

MODULE-2

Image Enhancement and Manipulation: Contrast Manipulation –Gray-Level Thresholding- Level Slicing Contrast Stretching – Spatial Convolution – Edge Enhancement – Spatial feature manipulation –Fourier Analysis. Spectral Rationing –Principal and Canonical Components– Vegetative Components, Vegetation indices – Intensity – Hue – Saturation – Colour Space Transformation, Texture transformation.	
Teaching-Learning Process	Encouraging students to give seminars, testing the outcome of teaching through conduct of internal tests, assignments, discussion in the class. Computer based image enhancement and transformation techniques are learnt.
MODULE-3	
Information Extraction from Images: Importance of ground truth data collection, instruments for reference data collection, Geo- tagging, training sample separability. Multispectral Classification – Supervised and Un-supervised Classification methods, Hybrid –Classification – Classification of Mixed Pixels. Post Classification Smoothing, Classification Accuracy Assessment.	
Teaching-Learning Process	Interactive/participative methods, through lectures, discussion, remedial instruction, study assignment (reading books, periodicals, research papers, and exercises for practicing at home). Computer based image classification techniques are learnt.
MODULE-4	
Data Merging and Change Detection: Multi-temporal Data merging, Multi-sensor image merging – Merging of image data with Ancillary data- Incorporating GIS Data into automated land cover classification, Binary change detection, and spectral change vector analysis.	
Teaching-Learning Process	Tutorial methods for the laggards, seminar methods for the groups, demonstration method where the faculty member / instructor himself performs a set of operations using the instruments and software tools for data merging and change detection are learnt.
MODULE 5	
Advanced Imaging Sensors and Analysis: Hyper spectral data analysis: Spectral angle mapper**,** Derivative spectroscopy, Expert systems, Decision Tree classification, Machine learning, Artificial Neural Network concepts, genetic algorithms, etc.	
Teaching-Learning Process	Advancements taking place in imaging sensors and their data analysis will be collated through consulting the latest books, current periodicals, and latest research papers, invited lectures from eminent scientists from ISRO, ESSO, ESRI, IBM, Infosysis, IITs, and other institutions.

PRACTICAL COMPONENT OF IPCC *(May cover all / major modules)*

Sl.NO	Experiments
1	Generate the indices map using Model maker in ERDAS IMAGINE
2	Perform the Unsupervised Classification using ISODATA algorithm in ERDAS IMAGINE
3	Perform the supervised classification of given data using different algorithms. Calculate the accuracy assessment for classification satellite image.
4	Generate the NDVI map using ERDAS Imagine and draw the graph of different objects.
5	Using ERDAS IMAGINE generate the Principle Component Analysis
6	Filtering Techniques.
7	Change Detection of satellite images

8	Land use and Land cover map Preparation using ArcMap.
9	Unsupervised classification using Random Forest algorithm
10	Using Model maker calculate drought index using ERDAS imagine
11	**Perform the supervised classification of given data using different algorithms. Calculate the accuracy assessment for classification satellite image.**
12	**Unsupervised classification using Random Forest algorithm**

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

CIE for the theory component of IPCC

4. Two Tests each of **20 Marks**
5. Two assignments each of **10 Marks/One Skill Development Activity of 20 marks**
6. Total Marks of two tests and two assignments/one Skill Development Activity added will be CIE for 60 marks, marks scored will be proportionally scaled down to **30 marks**.

CIE for the practical component of IPCC

- On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The**15 marks** are for conducting the experiment and preparation of the laboratory record, the other **05 marks shall be for the test** conducted at the end of the semester.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.
- The laboratory test at the end /after completion of all the experiments shall be conducted for 50 marks and scaled down to 05 marks**.**

Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **20 marks**.

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SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (duration 03 hours)

5. The question paper will be set for 100 marks and marks scored will be scaled down proportionately to 50 marks.
6. The question paper will have ten questions. Each question is set for 20 marks.
7. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

8. The students have to answer 5 full questions, selecting one full question from each module.

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component).

- The minimum marks to be secured in CIE to appear for SEE shall be the 15 (50% of maximum marks-30) in the theory component and 10 (50% of maximum marks -20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included**.** The maximum of 04/05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than the 20 marks.
- SEE will be conducted for 100 marks and students shall secure 40% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50. (Student has to secure an aggregate of 50% of maximum marks of the course(CIE+SEE)

Suggested Learning Resources:

Books

- Introductory Digital Image Processing A Remote Sensing Perspective by John R. Jensen 4th edition 2014
- Remote Sensing and Image Interpretation by by Lillesand Kiefer Chipman 6th edition 2014

Web links and Video Lectures (e-Resources):

- Students are encouraged to visit SWAYAM web site where there are several Massive Open Online Courses (MOOC), **http://swayam.gov.in**
- Students are encouraged to take the benefits of SWAYAM PRABHA- the direct to home (DTH) 34 channels telecasting educational programmes on 24x7 basis using GSAT-15 satellite. The channels are up-linked from BISAG-N, Gandhinagar.
- https://1lib.in/book/5243197/3b23f7?dsource=recommend

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- To learn skill on image processing techniques and classification algorithm.
- To develop skill on ML and AI programming
- To get knowledge about different indices using different software.

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	To understand the concepts of data formats and hardware and software.	I,II
CO2	To Acquire skills on enhancement and manipulation of satellite images	II,III
CO3	To acquire skills on image classification statistical calculation.	III,IV
CO4	To understand the concepts of image fusion techniques and change of detection.	IV,V
CO5	To acquire skills on advance remote sensing and Artificial Intelligence technology	V,VI

Mapping of Cos and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1							x					
CO2	x											
CO3		x										
CO4		x				x						
CO5							x	x			x	

Semester- II (PEC)

Web Applications in Geoinformatics (Professional Elective 1)			
Course Code	**22CGI231**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	2:0:2	SEE Marks	50
Total Hours of Pedagogy	25 Hours of teaching +10-12 sessions of SDA	Total Marks	100
Credits	03	Exam Hours	03.00

Course Learning objectives:

i) To understand the basic concepts, computing map, their functionalities and applications in WebGIS.
ii) To understanding the advanced concepts of spatial data analysis using python programming.
iii) To acquire skills on Cloud based platform.

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.

Teaching-Learning Process	Structured lectures prepared from standard books written by eminent authors through audio-visual technologies, explain the basics of WebGIS, Client/Server and distributed GIS services.

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.

Teaching-Learning Process	Encouraging students to give seminars, testing the outcome of teaching through conduct of internal tests, assignments, discussion in the class, explain GML, function of WebGIS and design of GUI.

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.

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.

Teaching-Learning Process	Interactive/participative methods, through lectures, discussion, remedial instruction, study assignment (reading tutorials, periodicals, and exercises for practicing at home), explain WebGIS software with their applications.

Module-4	
Python Scripting in Spatial data analysis: Graphs, Graphs algorithm, Networking programming, GML processing, GUI programming Database Access, Geoprocessing using python, python in GIS. Introduction to Leaflet API, Map box, cloud based and server less approaches.	
Teaching-Learning Process	Tutorial methods for the laggards, seminar methods for the groups, demonstration method where the faculty member / instructor himself performs a set of operations/libraries for in python programming.
Module-5	
Geo-data processing in Cloud computation platform: Google Earth Engine and Planetary Computing. Fundamentals of JavaScript programming, Working with Image Collections, Creating Mosaics and Composites, Working with Feature Collections, Map/Reduce Programming Concepts, Calculating Indices, Cloud Masking, Calculating Area and Statistics, Time-series Charts.	
Teaching-Learning Process	Demonstration method where the faculty member / instructor himself performs a set of operationsfor Geo data processing tools and cloud computing platform.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

11. Three Unit Tests each of **20 Marks**
12. Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks** to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

6. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
7. The question paper will have ten full questions carrying equal marks.
8. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
9. Each full question will have a sub-question covering all the topics under a module.
10. The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Books

1. Internet GIS by Zhong-Ren Peng
2. Python Geospatial Analysis Cookbook by Michael Diener
3. Arcpy and ArcGIS by Jerry Davis second edition
4. Python Scripting for ArcGIS by Paul A. Zandbergen

Web links and Video Lectures (e-Resources):

- Web Tutorial in python programming
- https://github.com/
- https://mapserver.org/

Skill Development Activities Suggested

- Working on Cloud based platform.
- Publishing the maps in Web GIS.

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	Understanding the WebGIS, Client/Server and Distributed GI servers	I,II
CO2	Acquiring knowledge about GML, Functions of Web GIS and GUI.	II,III
CO3	Acquiring knowledge about WebGIS software and application of webGIS.	III,IV
CO4	Acquiring the skills about spatial data analysis using python programming.	IV,V
CO5	Acquiring the skills for geo-data processing tools and assessing the cloud computing platform for generates the maps.	V,VI

Mapping of Cos and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	x										
CO2		x									
CO3										x	
CO4							x				
CO5								x			

Semester- II (PEC)

Programming Skills in spatial data analytics (Professional Elective 1)			
Course Code	**22CGI232**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	2:0:2	SEE Marks	50
Total Hours of Pedagogy	25 Hours of teaching +10-12 sessions of SDA	Total Marks	100
Credits	03	Exam Hours	03.00

Course Learning objectives:

i) To understand the basic installation of software and packages in python programming.
ii) To acquiring skills of spatial data analysis using python programming.
iii) To acquire skills to develop tools in QGIS using python programming.

Module-1

Geospatial Python Environment: Installing Pypro, Numpy, Shapely, matplotlib, Descartes, pyshp, geojson, pands, Scipy, PySAL, Ipythom, GDAL, OGR, geoDjang, and PostgreSQL with PostGIS.

Projection using python: Discovering projection(s) of a Shapefile or GeoJSON dataset, Listing projection(s) from a WMS server, Creating a projection definition for a Shapefile if it does not exist, Batch setting the projection definition of a folder full of Shapefiles, Reprojecting a Shapefile from one projection to another.

Teaching-Learning Process	Structured lectures prepared from standard books written by eminent authors through audio-visual technologies, explain the installation different software and packages in python environment and project system in programming.

Module-2

Spatial Data Formats: Converting a Shapefile to a PostGIS table using ogr2ogr, Batch importing a folder of Shapefiles into PostGIS using ogr2og, Batch exporting a list of tables from PostGIS to Shapefiles, Converting an Open Street Map (OSM) XML to a Shapefile, Converting a Shapefile (vector) to a GeoTiff (raster), Converting a raster (GeoTiff) to a vector (Shapefile) using GDAL.

PostGIS: PostGIS ST_Buffer analysis query and exporting it to GeoJSON, Splitting Line Strings at intersections using ST_Node, Executing a spatial join and assigning point attributes to a polygon.

Teaching-Learning Process	Encouraging students to give seminars, testing the outcome of teaching through conduct of internal tests, assignments, discussion in the class, explain Spatial data formats and PostGIS using GeoJSON.

Module-3

Vector Analysis using python: Clipping Line Strings to an area of interest, Splitting polygons with lines, Finding the location of a point on a line using linear referencing, Snapping a point to the nearest line, Calculating 3D ground distance and total elevation gain.

Overlay Analysis: Punching holes in polygons with a symmetric difference operation, Union polygons without merging, Union polygons with merging (dissolving), Performing an identity function (difference + intersection).

Teaching-Learning Process	Interactive/participative methods, through lectures, discussion, remedial instruction, study assignment (reading tutorials, periodicals, and exercises for practicing at home), explain vector analysis and overlay analysis using Python programming.

Module-4

Raster Analysis using python: Loading a DEM USGS ACSII CDED into PostGIS, Creating an elevation profile, Creating a hill shade raster from your DEM with ogr, Generating slope and aspect images from your DEM, Merging rasters to generate a color relief map.

Visualization of Spatial Data: Generating a leaflet web map with Folium, Visualizing DEM data with Three.js, Draping an orthophoto over a DEM.

Teaching-Learning Process	Demonstration method where the faculty member / instructor himself performs a set of operations to raster analysis and visualization of spatial data using python programming.

Module-5

QGIS using Python: Automating QGIS, Querying Vector data, Editing Vector Data, Using Raster data, Creating dynamic maps, Composing Static Maps, interacting with the user, QGIS work flows.

Teaching-Learning Process	Demonstration method where the faculty member / instructor himself performs a set of operations to develop the tools in QGIS using Python programming.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

13. Three Unit Tests each of **20 Marks**
14. Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks** to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

11. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
12. The question paper will have ten full questions carrying equal marks.
13. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
14. Each full question will have a sub-question covering all the topics under a module.
15. The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Books

1. Python Geospatial Analysis Cookbook by Michael Diener.
2. QGIS python Programming Cookbook by Joel Lawhead.
3. Python Scripting for ArcGIS by Paul A. Zandbergen

Web links and Video Lectures (e-Resources):

- Web Tutorial in python programming
- https://github.com/

Skill Development Activities Suggested

- Developing the new tools in QGIS using Python programming
- Generating spatial data maps using python programming

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	Understanding the installation software and packages in python environment.	I,II
CO2	Understanding the spatial data formats and PostGIS using GeoJSON.	II,III
CO3	Acquiring the skills for vector and overlay analysis using python programming.	III,IV
CO4	Acquire the skills to process the raster data and visualization of maps using python.	IV,V
CO5	Acquire the skills to develop the tools in QGIS using Python programming	V,VI

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1		x									
CO2							x				
CO3								x			
CO4							x				
CO5								x			

Semester- II (PEC)

Geoinformatics in Public Health Management (Professional Elective 1)			
Course Code	**22CGI233**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	2:0:2	SEE Marks	50
Total Hours of Pedagogy	25 Hours of teaching +10-12 sessions of SDA	Total Marks	100
Credits	03	Exam Hours	03.00

Course Learning objectives:

- On completion of study of this subject the student would be able to analyze Spatio-temporal Analysis of Public Health Events, epidemiological data and others and use it for making spatially informed decision and Disease Risk Assessment with Geospatial Technology.

Module-1

Introduction to Geoinformatics in Public Health: 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.

Teaching-Learning Process	Structured lectures prepared from standard books written by eminent authors through audio-visual technologies, explain the basics of public health management in geoinformatics.

Module-2

Spatial Database for Public Health and Cartographic Visualization: Spatial Databases for Public Health Scale of Public Health Data, Digital Cartographic Data, Database Integration, Public Health Data Sharing, Data Mapping Health Information, Visualization and Exploration.

Teaching-Learning Process	Encouraging students to give seminars, testing the outcome of teaching through conduct of internal tests, assignments, discussion in the class, explain Spatial database creation for public health management and visualization maps.

Module-3

Data Models and Spatio-temporal Analysis of Public Health Events: 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, Locating Health Services.

Teaching-Learning Process	Interactive/participative methods, through lectures, discussion, remedial instruction, study assignment (reading tutorials, periodicals, and exercises for practicing at home), explain data models and spatio- temporal analysis of public health events.

Module-4

Exploring Ecology and Associated Disease Pattern: Exploring the Ecology of Vector-Borne Diseases, 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.

Teaching-Learning Process	Tutorial methods for the laggards, seminar methods for the groups, demonstration method where the faculty member / instructor himself performs a set of operations explain exploring ecology and disease pattern.

Module-5

Disease Risk Assessment with Geospatial Technology: 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,

Teaching-Learning Process	Demonstration method where the faculty member / instructor himself performs a set of operations to Disease risk Assessment with Geospatial technology.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

15. Three Unit Tests each of **20 Marks**
16. Two assignments each of **20 Marks**or**oneSkill Development Activity of 40 marks** to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

16. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
17. The question paper will have ten full questions carrying equal marks.
18. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
19. Each full question will have a sub-question covering all the topics under a module.
20. The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Books

1. Geospatial Analysis of Public Health, by Gouri Sankar Bhunia and Pravat Kumar Shit, © Springer Nature Switzerland AG 2019.
2. GIS and Public Health by Ellen K Cromley and Sara L McLafferty, Guilford publications 2nd edition 2012.
3. Applied Spatial Analysis of Public Health Data by Lance A. Waller, Carol A. Gotway 1st edition 2004 Wiley-Interscience

Web links and Video Lectures (e-Resources):

- https://1lib.in/book/499542/d6f577

Skill Development Activities Suggested

- Collecting locations of disease affected areas and mapping the same.

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	Understanding the concepts of public health issues,	I, II
CO2	To create Spatial Database for Public Health and Cartographic Visualization	II,III
CO3	Developing Spatio-temporal Analysis of Public Health Events	III,IV
CO4	Understanding the Ecology and Associated vector borne Disease Patterns	V
CO5	Developing Disease Risk Assessment models.	VI

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1		x									
CO2						x					
CO3								x			
CO4				x							
CO5									x		

Semester- II (PEC)

Advanced Earth Observation Systems and Applications **(Professional Elective 1)**			
Course Code	**22CGI234**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	2:0:2	SEE Marks	50
Total Hours of Pedagogy	25 Hours of teaching +10-12 sessions of SDA	Total Marks	100
Credits	03	Exam Hours	03.00

Course Learning objectives:

i. To understand the physical basis of advanced Earth observations.

ii. To learn interpretation and analysis of Hyper spectral and Hyper spatial resolution data.

iii. To use the advance EO systems in understanding Earth system functioning and climate change.

Module-1

Introduction to Earth Observation system: Definition 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, LiDAR ,The Ground Segment ,Earth-Observing Systems.

Teaching-Learning Process	Structured lectures prepared from standard books written by eminent authors through audio-visual technologies, explain the basics of EOS.

Module-2

International Earth Observation Systems: The Earth Observing System (EOS) program of NASA, Japan (NASDA), Satellite Pour l' observation De La Terre (SPOT), Pleiades Systems, The Earth Observing System Mission, Terra (EoS-Am), Aqua (EoS Pm), Earth Observing-1 (EO-1) Mission, Rapid eye, Sentinel series of satellites under Copernicus programme. Intergovernmental Agencies and Partnerships.

Teaching-Learning Process	Encouraging students to give seminars, testing the outcome of teaching through conduct of internal tests, assignments, discussion in the class, explain International EOS.

Module-3

Hyperspectral and Hyper Resolution Data Systems: IRS IA/IB, IRS IC/ID, Resourcesat series, Cartosat series, OCM series, Megha-Tropiques, RISAT series, HySiS, SCATSAT, SARAL, EOS-04, INSAT-series having EO payloads. 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.

Teaching-Learning Process	Interactive/participative methods, through lectures, discussion, remedial instruction, study assignment (reading tutorials, periodicals, and exercises for practicing at home), explain Hyperspectral and Hyper resolution Data Systems.

Module-4

Microwave Missions: European Remote Sensing Satellite (ERS-1 and -2, ENVISAT), Sentinel-1, Japanese Earth Resources Satellite (JERS-1), Advanced Land Observation Satellite (Alos-1), Canada's RADARSAT Missions, India's Radar Imaging Satellite (RISAT) Missions, Soil Moisture And Ocean Salinity Mission (SMOS)., Soil Moisture Active Passive Mission (SMAP).

Teaching-Learning Process	Tutorial methods for the laggards, seminar methods for the groups, demonstration method where the faculty member / instructor himself performs a set of operations to exploring Microwave mission and their sensors.

Module-5

Applications of EOSs: Natural resources management, Forest and environmental applications, Cartography and land survey applications, Disaster management, LULC and climate change studies, Meteorological and oceanographic applications, Integrated Water resources conservation and development, River basin management, etc.

Teaching-Learning Process	Demonstration method where the faculty member / instructor himself performs to learn the application of EOSs.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

17. Three Unit Tests each of **20 Marks**
18. Two assignments each of **20 Marks**or**oneSkill Development Activity of 40 marks** to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

4. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
5. The question paper will have ten full questions carrying equal marks.
6. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
7. Each full question will have a sub-question covering all the topics under a module.
8. The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Books

9. 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.
10. Remote sensing and Image Interpretation by Thomas M Lillesand and Ralph W. Keifer fourth Edition, 2002, 2003, Joh
11. Remote Sensing Principles and Interpretation by Floyd F Sabins, 1997, W H Freeman And Company
12. Hyperspectral Imaging Remote Sensing by Dimitris Manolakis, Ronald Lockwood, Thomas Cooledy, 2016

Web links and Video Lectures (e-Resources):

- https://1lib.in/book/499542/d6f577

Skill Development Activities Suggested

To get knowledge about interpretation of Hyper spectral data and Microwave data.

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	Understanding the advances in Remote Sensing (RS) in terms of sensors specifications	II
CO2	Acquire information about development of EOS in the developed countries.	II, III
CO3	Get familiarised with advanced EO data formats and data types and products.	III,IV
CO4	Develop interpretation and analysis skills for information extraction.	IV,V
CO5	Develop innovative solutions through spatial data analytics (raster data)	V,VI

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1		x									
CO2							x				
CO3								x			
CO4						x					
CO5							x				

Semester- II (PEC)

Artificial Intelligence in Geoinformatics **(Professional Elective 2)**			
Course Code	**22CGI241**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	2:0:2	SEE Marks	50
Total Hours of Pedagogy	25 Hours of teaching +10-12 sessions of SDA	Total Marks	100
Credits	03	Exam Hours	03.00

Course Learning objectives:

i. To understand the concepts of computational intelligence algorithms and programming.
ii. To acquiring advance technologies like ANN, ML, Deep learning.
iii. To acquire advanced skills to develop genetic algorithms and programming.

Module-1

Introduction to AI: Heuristics, Knowledge Representation, Expert Systems, Neural Computing, Evolutionary Computation, Natural Language Processing, Major Parts of AI. Introduction to Machine Learning: Supervised learning -Naïve Bayes Classifier Algorithm, SVM, Linear, Logistic regression, Decision Tree, Random Forest, Nearest Neighbours, Unsupervised learning- K Means Clustering, Reinforcement learning (ANN).

Teaching-Learning Process	Structured lectures on the fundamentals prepared from standard books written by eminent authors through audio-visual technologies, explain introduction to Artificial intelligence and Machine learning.

Module-2

Neural Networks: Introduction to neural networks, Building a Perceptron-based classifier, Constructing a single-layer neural network, Constructing a multi-layer neural network, Building a vector quantizer, Analyzing sequential data using recurrent neural networks, Visualizing characters in an optical character recognition database, Building an optical character recognition engine. **Deep Learning with Convolutional Neural Networks:** The basics of Convolutional Neural Networks, Architecture of CNNs, Types of layers in a CNN, Building a perceptron-based linear regressor, Building an image classifier using a single-layer neural network, Building an image classifier using a Convolutional Neural Network,

Teaching-Learning Process	Encouraging students to give seminars, testing the outcome of teaching through conduct of internal tests, assignments, discussion in the class and give lectures on the Neural Networks with deep learning techniques.

Module-3

Recurrent Neural Networks and Other Deep Learning Models: The basics of Recurrent Neural Networks, Architecture of RNNs, A language modeling use case, Training an RN, **Creating Intelligent Agents with Reinforcement Learning:** Reinforcement learning versus supervised learning, Real-world examples of reinforcement learning, Building blocks of reinforcement learning, Creating an environment, Building a learning agent, Self-Organizing Maps in ANN.

Teaching-Learning Process	Interactive/participative methods, through lectures, discussion, remedial instruction, study assignment (reading books, periodicals, research papers, exercises for practicing at home), explain RNN and other deep learning techniques.

Module-4

Image Recognition: Importance of image recognition, OpenCV, Frame differencing, Tracking objects using color spaces, Object tracking using background subtraction, Building an interactive object tracker using the CAMShift algorithm, Optical flow-based tracking, Face detection and tracking, Eye detection and tracking.) and Natural Language Processing	
Teaching-Learning Process	Tutorial methods for the laggards, seminar methods for the groups., demonstration method where the faculty member / instructor himself performs a set of operations, give the lectures image recognition and NLP.
Module-5	
Genetic Algorithms and Genetic Programming: Understanding evolutionary and genetic algorithms, Fundamental concepts in genetic algorithms, Generating a bit pattern with predefined parameters, Visualizing the evolution, Solving the symbol regression problem, Building an intelligent robot controller, Genetic programming use cases **Artificial Intelligence on the Cloud:** Amazon Web Services (AWS), Microsoft Azure, Google Cloud Platform (GCP	
Teaching-Learning Process	Demonstration method where the faculty member / instructor himself performs to learn the genetic algorithms and programming and AI on the cloud.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

19. Three Unit Tests each of **20 Marks**
20. Two assignments each of **20 Marks**or**oneSkill Development Activity of 40 marks**
    to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
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 a 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

Suggested Learning Resources:

Books

- Artificial Intelligence, Machine Learning, and Deep Learning by Oswald Campesato 2020
- Artificial Intelligence with Python 2nd edition by Alberto Artasanchez Prateek Joshi packt publications 2020.
- Neural networks and Learning Machines 3rd edition by Simon S Haykin pearson publications 2009.
- Machine learning with R 2nd edition by Brett Lantz packt publications 2015.
- Mastering machine learning with R 2nd edition packt publications 2017

Web links and Video Lectures (e-Resources):

- https://1lib.in/
- Web Tutorials
- GitHub

Skill Development Activities Suggested

- To develop the skill on Machine learning techniques in RS and GIS
- To develop the skills on ANN techniques in RS and GIs.

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	Understanding the concepts of AI and Machine Learning with algorithms.	I,II
CO2	Acquire advance technology ANN with algorithms and programming skills.	II,III
CO3	Acquire advance technology RNN and Reinforcement and programming skills.	III,IV
CO4	Develop skills on image recognition and NLP.	IV,V
CO5	Create and Develop new algorithms and cloud based processing in AI.	V,VI

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	x							x				
CO2						x		x				
CO3							x				x	
CO4						x		x				
CO5		x				x	x					x

Semester- II (PEC)

Programming in .Net, JavaScript and HTML, Cloud Computing **(Professional Elective 2)**			
Course Code	**22CGI242**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	2:0:2	SEE Marks	50
Total Hours of Pedagogy	25 Hours of teaching +10-12 sessions of SDA	Total Marks	100
Credits	03	Exam Hours	03.00

Course Learning objectives:

i. To understand the concepts of Java and HTML programming.
ii. To acquiring advance programming skill on JavaScript working with objects.
iii. To acquire advanced skills to develop Angular JS Modules and Forms.

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.

Teaching-Learning Process	Structured lectures on the fundamentals prepared from standard books written by eminent authors through audio-visual technologies, explain concepts of Java programming.

Module-2

Introduction to HTML HTML Basics, Elements, Attributes, Styles, Forms, Form Elements, Input Element Types, Input Attributes, File Paths, Script tag, HTML &XHTML. **Introduction to CSS** CSS Introduction, Syntax, Selectors, Styling, Pseudo class, Pseudo Elements, CSS Tables, CSS Box Models, CSS Opacity, CSS Navigation Bar, Dropdowns.	
Teaching-Learning Process	Encouraging students to give seminars, testing the outcome of teaching through conduct of internal tests, assignments, discussion in the class and give lectures on the HTML and CSS programming.
Module-3	

Introduction to JavaScript: JavaScript Statements, Keywords, Functions, JavaScript Programs, Operators, Functions Function Parameters, Function Return Types, Data Types, Primitive Types **Working with Objects** Object Oriented Programming, Object Creation, Adding Methods of Objects, JavaScript Loops & Iteration, Adding Properties of Objects, JavaScript Conditional Statements, Enumerating Properties, Call-backs, JSON **Angular JS Basics:** What is Angular JS? Why Angular JS? Why MVC matters, MVC-The Angular JS way, Features of Angular JS, Model-View-Controller, My First Angular JS app	
Teaching-Learning Process	Interactive/participative methods, through lectures, discussion, remedial instruction, study assignment (reading books, periodicals, research papers, and exercises for practicing at home). To learn concepts of JavaScript with objects and Angular JS basics.
Module-4	
Angular Expressions: All about Angular Expressions, How to use expressions, Angular vs JavaScript **Filters:** Built-In Filters, Using Angular JS Filters, Creating Custom Filters **Directives:** Introduction to Directives, Directive Lifecycle, Binding controls to data, Matching directives, Using Angular JS built-in directives, Creating a custom directive	
Teaching-Learning Process	Tutorial methods for the laggards, seminar methods for the groups., demonstration method where the faculty member / instructor himself performs a set of operations, give the lectures on Angular expressions, filters and dircetives.
Module-5	
Controllers: Role of a Controller, Controllers & Modules, Attaching Properties and functions to scope, Nested Controllers, Using Filters in Controllers, Controllers in External Files **Angular JS Modules:** Introduction to Angular JS Modules, Bootstrapping Angular JS **Angular JS Forms:** Working with Angular Forms, Model Binding, Forms Events, Updating Models with a Twist, Form Controller, Validating Angular Forms, $error object **Scope:** What is scope, Scope Lifecycle, Scope Inheritance, Scope & Controllers, Root scope, Scope Broadcasting, Two-way data binding, Scope Inheritance Scope & Directives, $apply and $watch, Scope Events	
Teaching-Learning Process	Demonstration method where the faculty member / instructor himself performs to set operations of controllers, angular JS Modules, JS Forms and scope.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

21. Three Unit Tests each of **20 Marks**
22. Two assignments each of **20 Marks**or**oneSkill Development Activity of 40 marks** to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

i. The question paper will have ten full questions carrying equal marks.

ii. 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 a 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

Suggested Learning Resources:

Books

- JavaScript: The Definitive Guide - David Flanagan, 6th Edition
- The Complete Reference Java Seventh Edition –Herbert Schildt
- Programming Language Pragmatics - Michael L. Scott, 2nd Edition, Elsevier,2006
- Operating System Concepts – Avil Sillberschatz, Peter Baer Galvin, Greg Gayne
- Programming Languages Concepts and Constructs - Ravi Sethi, 2nd Edition, Pearson Education, 1996.

Web links and Video Lectures (e-Resources):

- Tutorial on Java and JavaScript and HTML
- https://github.com/
- https://1lib.in/book/499542/d6f577

Skill Development Activities Suggested

- To learn the skills on web development using JavaScript and HTML programming.

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	Understanding the concepts of Java programming skills.	I,II
CO2	Acquire programming skills on HTML and CSS.	II, III
CO3	Get familiarised the JavaScript working with objects and Angular JS Modules.	III, IV
CO4	Develop skills on Angular Expression, Filters and Directives.	IV,V
CO5	Develop skills on Controllers, Angular JS Modules, Angular JS Forms and scope.	V,VI

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	x											
CO2	x							x				
CO3							x					
CO4								x				
CO5						x						

Semester- II (PEC)

Location Based Intelligence and Supply Chain Management. **(Professional Elective 2)**			
Course Code	**22CGI243**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	2:0:2	SEE Marks	50
Total Hours of Pedagogy	25 Hours of teaching +10-12 sessions of SDA	Total Marks	100
Credits	03	Exam Hours	03.00

Course Learning objectives:

i. To understand the basics of location science and services
ii. To apply the location science for collecting business intelligence.
iii. To develop network models for supply chain management.

Module-1

Introduction: Location Based Intelligence (LBI) and Location Based Services (LBS) World and Indian Navigation and Positioning Systems, GPS, GALILEO, GLONASS, BEIDOU, NavIC, GAGAN, OMISTAR, Japanese SBAS, etc.

Teaching-Learning Process	Structured lectures on the fundamentals prepared from standard books written by eminent authors through audio-visual technologies, Explain concepts of LBI and LBS.

Module-2

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

Teaching-Learning Process	Encouraging students to give seminars, testing the outcome of teaching through conduct of internal tests, assignments, discussion in the class. Explain advance remote sensing sensors and communication sensors.

Module-3

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.

Teaching-Learning Process	Interactive/participative methods, through lectures, discussion, remedial instruction, study assignment (reading books, periodicals, research papers, and exercises for practicing at home). Explain the concepts of enterprise GIS and applications frame works.

Module-4

Advanced data analytics and 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.

Teaching-Learning Process	Tutorial methods for the laggards, seminar methods for the groups., demonstration method where the faculty member / instructor himself performs a set of operations, Acquire knowledge on the advanced data analytics and LBS.
Module-5	
Supply Chain Management: Meaning of supply chain, the components of management supply chain, a few success stories of using LBS in supply chain management.	
Teaching-Learning Process	Demonstration method where the faculty member / instructor himself performs a set of operations, about supply chain management using LBS.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

23. Three Unit Tests each of **20 Marks**
24. Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks** to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
i. The question paper will have ten full questions carrying equal marks.
ii. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
v. Each full question will have a 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

Suggested Learning Resources:

Books

- Location Based Services Handbook Application, Technologies and security by Syed A Ahson and Mohammad Ilyas 1st edition 2010
- Location-Based Services and Geo-Information Engineering (Mastering GIS: Technol, Applications & Mgmnt) by Allan Brimicombe, Chao Li 1st edition 2009
- Sustainable Logistics and Supply Chain Management: Principles and Practices for Sustainable Operations and Management by David B. Grant, Chee Yew Wong, Alexander Trautrims 2nd edition 2017

Web links and Video Lectures (e-Resources):

- https://1lib.in/book/499542/d6f577
- On line courses on LBS and Supply chain Management.

Skill Development Activities Suggested

- Learn the Location Based services and information.
- Learn the supply chain models

Course outcome (Course Skill Set) At the end of the course the student will be able to :		
Sl. No.	**Description**	**Blooms Level**
CO1	Understand the basics of LBS and LBI.	I,II
CO2	Learn the concepts of communication systems used in LBI.	II,III
CO3	Apply the knowledge about global and Indian navigation systems.	III
CO4	Create database and Analyse the location information.	V
CO5	Produce different models for network operation and generate an optimum supply chain.	VI

Mapping of COS and POS

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		x										
CO2	x											
CO3		x										
CO4					x	x						
CO5											x	

Semester- II (PEC)

Unmanned Aerial System (UAS) and Applications **(Professional Elective 2)**			
Course Code	**22CGI244**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	2:0:2	SEE Marks	50
Total Hours of Pedagogy	25 Hours of teaching +10-12 sessions of SDA	Total Marks	100
Credits	03	Exam Hours	03.00

Course Learning objectives:

i. To impart basics of UAS, rules regulating their operations.
ii. To familiarise them with data acquisition, processing and analysis.
iii. To develop applications in various sectors.

Module-1	
Introduction: History of Drone/UAS/UAVs, classification of UAV platform, advantages, payload, battery life, system specifications, Regulations for flying drones and DGCA licensing policy, Flight planning, Flight execution(pre, during and post), characteristics of smart UAV.	
Teaching-Learning Process	Structured lectures on the fundamentals prepared from standard books written by eminent authors through audio-visual technologies, Explain the classification of UAV platform, payload structure. Acquire knowledge on flying regulations and flight planning.
Module-2	
Surveying with UAVs: Components of drone survey, large scale project survey, i-base establishment, data acquisition, Consideration for remote sensing payloads, main hardware components, comparison on Total station, GPS and UAV surveying and its accuracy, Techniques of controlling errors, Consideration of GCPs in vertical and horizontal accuracies, Autonomous flight vs. manual and hybrid flight profiles.	
Teaching-Learning Process	Encouraging students to give seminars, testing the outcome of teaching through conduct of internal tests, assignments, discussion in the class. Acquire knowledge on UAV survey, error control techniques, provision of Ground Control Points and flight profiles.
Module-3	

Image processing and Photogrammetry: UAV-based image processing, influencing factors of imaging, Image alignment-Aerial Triangulation, Block adjustment, structure from motion (sfm) photogrammetry, post processing software, point cloud evaluation, drone-based LiDAR technology, DEM, DSM, Contouring; Cut, Fill and Volumetric measurement calculation; orthophoto generation.	
Teaching-Learning Process	Interactive/participative methods, through lectures, discussion, remedial instruction, study assignment (reading books, periodicals, research papers, and exercises for practicing at home). Understand the stages of image data processing, evaluation of point clouds, measurement of volume from 3-D.
Module-4	
Modeling and analysis of UAV data: Concept of modeling, tools in UAV modeling, evaluation of output, Understanding RTK, PPK and GCPs, Overview of popular data processing software platforms and functions. Image interpretations and analysis.	
Teaching-Learning Process	Tutorial methods for the laggards, seminar methods for the groups., demonstration method where the faculty member / instructor himself performs a set of operations, Acquire knowledge on the concept of modeling, usage of popular software, image interpretation.
Module-5	
Applications of UAV data: Application of drone for Surveying, Mapping, Construction, Agricultural, Engineering Land Survey and Architecture, crop insurance, disaster management, etc.	
Teaching-Learning Process	Demonstration method where the faculty member / instructor himself performs a set of operations, Apply the technology in various fields such as Agriculture, Engineering, Disaster Management, etc.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

25. Three Unit Tests each of **20 Marks**
26. Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks** to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

i. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
ii. The question paper will have ten full questions carrying equal marks.
iii. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
x. Each full question will have a 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

Suggested Learning Resources:

Books.

- Theory, design, and applications of unmanned aerial vehicles by A. R. Jha Ph.D CRC Press / Taylor & Francis Group 2016.
- UAV or Drones for Remote Sensing Applications, Volume 1 by Felipe Gonzalez Toro, Antonios Tsourdos volume1 2018
- Unmanned Aerial Vehicle: Applications in Agriculture and Environment by Ram Avtar, Teiji Watanabe Springer 2019
- Drone Technology in Architecture, Engineering, and Construction: A Strategic Guide to Unmanned Aerial Vehicle Operation and Implementation by Daniel Tal, Jon Altschuld Wiley 2021

Web links and Video Lectures (e-Resources):

- https://1lib.in/book/11728318/96c900?dsource=recommend

Skill Development Activities Suggested

i. To develop the UAS system and fly in the field.

ii. To analyse the drone images in different software.

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	Understand UAV technology in image capturing. Illustrate flight planning within flying regulations.	I, II
CO2	Develop a plan for large scale survey integrated with Total station and GPS, hardware components and compare different flight profiles.	II,III
CO3	Image processing and Block adjustment. Analyse the products such as DSM, Orthophoto, etc.	III,IV
CO4	To develop different types of models compare RTK, PPK and GCP in model frames, evaluate different software and image interpretation.	IV,V
CO5	Design UAV application in different fields and show it as an essential GIS tool.	V,VI

Mapping of COS and POS

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	x							x				
CO2						x	x					
CO3							x					
CO4									x		x	
CO5											x	x

Semester –II (PCCL)

Geoinformatics Laboratory- II			
Course Code	**22CGIL26**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	1:0:2:0	SEE Marks	50
Credits	02	Exam Hours	03.00

Course objectives:

i) Understand how to use a wide range of vector-based GIS tools to address quarries relevant to natural resource management and hands programming skills.
ii) Understand how to use cloud based programming skills for raster and vector data.
iii) Raster and vector based solution using python programming.

Sl.NO	Experiments
1	Delineation of Lithological/geomorphic units Identification of forest types and area estimation
2	LU/LC Map Preparation, Delineation of Watershed
3	Make the different indices using Model Maker using ERDAS Imagine.
4	Semi Automation algorithm using QGIS.
5	Practical using Google Earth Engine
6	Image classification using R software
7	Raster data processing using python
8	Practical using Google Earth Engine
	Demonstration Experiments (For CIE) if any
9	Practical using Google Earth Engine
10	Raster data processing using python
11	practical on Map server and web server
12	Vector analysis using python programming

Course outcomes (Course Skill Set):

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

- Students will be equipped with modern tools, software of GIS and be confident to implement a GIS project independently or as a team effort.
- Students will be able to write code for programs.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. The student has to secure not less than 40%of maximum marks in the semester-end examination (SEE). In total of CIE and SEE student has to secure 50% maximum marks of the course.

Continuous Internal Evaluation (CIE):

CIE marks for the practical course is **50 Marks.**

The split-up of CIE marks for record/ journal and test are in the ratio 60:40.

- Each experiment to be evaluated for conduction with observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed by the faculty who is handling the laboratory session and is made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled downed to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct 02 tests for 100 marks, the first test shall be conducted after the 8th week of the semester and the second test shall be conducted after the 14th week of the semester.
- In each test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- The average of 02 tests is scaled down to 20 marks (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and average marks of two tests is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

SEE marks for the practical course is **50 Marks.**

SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the University.

All laboratory experiments are to be included for practical examination.

(Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. OR based on the course requirement evaluation rubrics shall be decided jointly by examiners.

Students can pick one question (experiment) from the questions lot prepared by the internal /external examiners jointly.

Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

Change of experiment is allowed only once and 10% Marks allotted to the procedure part to be made zero.

The duration of SEE is 03 hours

Suggested Learning Resources:

- Web Tutorial and ESRI guide books.

Semester- III

Geoinformatics Project Planning and Management			
Course Code	**22CGI31**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	03:00:02	SEE Marks	50
Total Hours of Pedagogy	40 Hours of teaching +10-12 sessions of SDA	Total Marks	100
Credits	04	Exam Hours	03.00

Course Learning objectives:

- To familiarize them how to select particular project with plan, quality with cost and time.
- To develop skills to hand project in organization.
- To enable the students to formulate, execute and manage Geoinformatics projects.

Module-1

Introduction: Definition of plan, project, program and scheme. Functions of planning and management. Components of Geoinformatics project. Types of projects. **GIS Project Planning:** Project phases and Project lifecycle, project stake holders, system development life cycle, GIS software evaluation and selection, Hardware considerations and acquisition, Techno-economic feasibility analysis, project formulation, product and project design, Project proposals.

Module-2

Project Costs and Appraisal: Elements of cost, costing techniques, cost components of a geo-informatics project- Manpower, Hardware and software costs, and Maintenance cost, organizational cost, service charges, outsourcing cost, Cost budgeting. Project appraisal Methods -Discounting and non-discounting techniques, Benefit Cost Ratio, Break Even Point Analysis, Cost and Return simulation, Return on Investment. **Project Time, Quality and Cost Management:** 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, ISO standards.

Module-3

Planning A Geo-informatics Project: Types of Geo-informatics projects, GIS Strategic Plan, Needs Assessment and Requirements Analysis, Organizational Involvement, Evaluating Existing Data, Accuracy, Completeness. Software and hardware Selection, Technical Environment, Assessing Costs and Benefits. **Project Scope and Risk Management:** 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.

Module-4

GIS Organizations: 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.

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.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum mark. The minimum passing mark for SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

1. Three Unit Tests each of **20 Marks**
2. Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks** to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
4. Each full question will have a sub-question covering all the topics under a module.
5. The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Books

1. A Guide to the Project Management Body of Knowledge(PMBOK Guide)Project Management Institute PM I6th edition 2017
2. Project Estimating and Cost Management (Project Management Essential Library) by ParvizF.Rad2001
3. Data Analytics for Engineering and Construction Project Risk Management BYIvan Damnjanovic, Kenneth Reinschmidt Springer International Publishing 2020.

Web links and Video Lectures (e-Resources):

- . https://1lib.in/book/5243197/3b23f7?dsource=recommend

Skill Development Activities Suggested

- To develop project with cost and time.
- To develop the skills to organising the different projects.

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	To understand different phases of geoinformatics projects and planning needs.	I,II
CO2	To learn elements of cost, cost budgeting and network analysis.	II, III
CO3	To apply GIS technology on corporate, health, business sector, Understand project scope and risk analysis.	III, IV
CO4	To develop organisational structure and how to motivate the employee and resolve the conflict.	IV, V
CO5	To develop effective tools to manage the database in GIS and open source GIS.	V, VI

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1								X				
CO2		X										
CO3		X				X						
CO4						X			X			
CO5											X	X

Geoinformatics in Urban Planning and Management Professional elective 3			
Course Code	**22CGI321**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	03:00:00	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03.00

Course Learning objectives:

- Student would be able to understand the concepts and principles large scale mapping and spatial analysis.
- To use the tools and techniques of geo-informatics for efficient planning and management of urban area.
- To get knowledge about application of urban areas.

Module-1

Large Scale Mapping and Cadastral Information System: Technologies for Large Scale Mapping (LSM) of urban areas, Issues in Large Scale Mapping (LSM), Integrated approach to LSM using Total Station and DGPS, Concept of Cadastre, classification of cadastral survey, development of cadastral information system, need for Land Information System (LIS), SVAMITVA (Survey of villages and mapping with improvised technology in village areas) objective and work flow.

Module-2

Urban Mapping and Spatial Analysis: Urbanisation process and growth trend, problems of urbanisation, Urban GIS, spatial analytical techniques, conceptual modelling of urban processes; Urban Sprawl: Change detection in Land Use Land Cover, Monitoring physical growth of urban area. **Urban Planning:** Plans – planning needs, types of plans, urban and regional planning; Zoning of Land Use, Object oriented GIS data modelling for urban design, urban infrastructure, Site selection for urban development, site suitability analysis for utilities and civic amenities,

Module-3

Demographic and Business GIS Applications: Geo-Demographics Population distribution maps, Market analysis ,retail site selection, healthcare planning, financial services planning, educational institutions planning, water demand modelling and planning distribution network, 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, intelligent transportation systems, streets network analysis, 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): E-Governance of urban regions: mapping administrative boundaries, city base map generation, property enumeration and property GIS, Asset mapping; tax revenue rationalization, Metropolitan Spatial Data Infrastructure, metropolitan information management system, Urban GIS and Smart Cities.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum mark. The minimum passing mark for SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

1. Three Unit Tests each of **20 Marks**
2. Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks** to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
4. Each full question will have a sub-question covering all the topics under a module.
5. The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Books

- Modeling Urban Dynamics: Mobility, Accessibility and Real Estate Value by Marius Theriault, Francois Des Rosiers(auth.)Wiley-ISTE,2010.
- GIS in Sustainable Urban Planning and Management by Flacke Johannes, Maarseveen Martin van, MartinezJavierCRCPress2019
- Intelligent Transport System in Smart Cities: Aspects and Challenges of Vehicular Networks and Cloud byRodolfo I. Meneguette, Robson E. De Grande, Antonio A. F. Loureiro Springer International Publishing 1stedition2018

Web links and Video Lectures (e-Resources):

- . https://1lib.in/book/5243197/3b23f7?dsource=recommend

Skill Development Activities Suggested

- To get familiarized the skills on smart city planning.
- To develop the model for network analysis etc.

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	To get familiarise latest technology for data capturing in urban area and creating LIS.	I, II
CO2	To understand concept of planning needs in urban and regional area	II,III
CO3	To Develop GIS on geo-demography, business and urban infrastructures.	III,IV
CO4	To Develop GIS on urban ecology and in the field of culture and recreation	IV,V
CO5	To create urban spatial database for various e-governance facilities.	V, VI

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		X										
CO2				X								
CO3							X					
CO4					X	X						
CO5							X			X		

Geoinformatics in Marine and Coastal Resources Management (Professional Elective Course-3)			
Course Code	**22CGI322**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	03:00:00	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03.00

Course Learning objectives:

i. The student would be able to use RS/GIS in various modeling tools in understanding the Earth's oceans,the ocean resources and their management.
ii. They have been exposed to geo-informatics applications to oceanography, marine and coastalenvironment.
iii. To learn the Applications on Coastal Resource Management

Module-1

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

Module-2

Oceanographic Studies: Interdisciplinary nature of oceanography, ocean processes, platforms and sensors for oceanography, spectral bands for study of ocean parameters, Mesoscale ocean features (Eddies, Fornts, other phenomena), Physical and Biological oceanography applications of geoinformatics, large ocean phenomena with human impact.

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).

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 and Climate 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, Using satellite data for climate monitoring.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum mark. The minimum passing mark for SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

1. Three Unit Tests each of **20 Marks**
2. Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks** to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- 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 a 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

Suggested Learning Resources:

Books

- Measuring the Oceans from space by Ian. S Rabinson Springer 2004
- Discovering the Oceans from Space (Vol-1,Vol-2) by Ian.S Rabinson springer2010
- Essentials of Oceanography by Alan P Trujillo and Harold V Thurman by10th edition2012
- Satellite Meteorology by R R Kelkar B S publications Second edition 2017
- GIS for Coastal Zone Management by Darius Bartlett and Jennifer Smith C R C Press200

Web links and Video Lectures (e-Resources):

- . https://1lib.in/book/3574775/66d182?dsource=recommend

Skill Development Activities Suggested

- To learn skills in applications of Ocean and metrological.

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	To understand concepts of marine resources and Ocean phenomenon.	I,II
CO2	To acquire knowledge about processing of ocean and applications of Physical and Biological oceanography.	II,III
CO3	To get knowledge on modelling on Coastal engineering application.	III,IV
CO4	To Develop database for applications of coastal zone management.	IV,V
CO5	To create models and mapping the applications of Meteorology	V, VI

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1					X							
CO2				X	X							
CO3				X							X	
CO4							X					
CO5		X					X					

Geoinformatics in Demography, Business and Infrastructure (Professional Elective Course-3)			
Course Code	**22CGI323**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	03:00:00	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03.00

Course Learning objectives:

- On completion of study of this subject the student would be able to analyse demographic data, economic data, epidemiological data and others and use it for making spatially informed decision.

Module-1

Geodemographics: Spatial distribution of population according to age, gender, and socio-group, racial and socio economic 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 centres 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-markets eg mentation by product category, sales territory rationalization, forecasting market potential and modelling sales.

Module-3

Health GIS: Spatial epidemiology: RS and GIS in study of epidemics and their control- malaria, leprosy, polio, TB, filarialsis, 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 an disease all as 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,

Archaeology: RS and GIS applications in mapping cultural heritage, spotting historical monument sand sites, identification of palaeo rivers, GIS of historical maps.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum mark. The minimum passing mark for SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- Three Unit Tests each of **20 Marks**
- Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks**
- to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- 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 a 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

Suggested Learning Resources:

Books

- "GIS and GPS based asset management for Road and Railway Transportation Systems"-GPS based vehicle tracking system.
- Demography and Infrastructure: National and Regional Aspects of Demographic Change Wilhelm Kucksh in richs(auth.),Tobias Kronenberg, Wilhelm Kucksh in richs (eds.)Springer Netherlands 1st edition 2011

Web links and Video Lectures (e-Resources):

- www.gisdevelopment.net,
- www.esri.com
- www.aboutgis.com

Skill Development Activities Suggested

- To develop the skill on Demography, Business GIS and Health GIS.
- To learn skill on communication on network and Archaeology mapping.

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	To understand concepts of Geo demographics distribution and analysis	I,II
CO2	To Acquire knowledge about analysis and marketing in GIS	II,III
CO3	To get knowledge about spatial disease distribution and modelling	IV,V
CO4	To understand the concepts of power, communication and transportation.	I,II
CO5	To Acquire skills on network analysis, tourism and Archaeology sites	V

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		X										
CO2						X						
CO3							X					
CO4			X									
CO5											X	

Geoinformatics in Disaster Management (Professional Elective-4)			
Course Code	**22CGI331**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	03:00:00	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03.00

Course Learning objectives:

- To introduce various types of natural disasters and application of Geoinformatics inputs for disastermanagement and
- Geospatial technology use for mapping, impact assessment, forewarning, preparedness and mitigation of adverse effects.

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 and Forest Fires: Drought types and causes, delineation of drought vulnerable areas mapping, Use of RS and GIS in Meteorological, hydrological and agricultural drought severity mapping and monitoring. Forest fire causes, forest fire management using geospatial information system.

Module-3

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

Geological Disasters Management: Causes of earthquake, RS and GIS application for post-quake rehabilitation, micro-level seismic zonation, space technology applications for Tsunami disaster management, types of volcanoes, role of remote sensing in mapping and hazard assessment, landslide vulnerability mapping.

Module-5

Disaster Preparedness: Geo-informatics in crisis management, multi-hazard risk assessment and early warning systems, risk communication including through citizen science and crowd sourcing, The role of GIS and SDI as an integrated framework in emergency response and multi-agency coordination, Local preparedness, Relief management-Shelter, Sustainable recovery through build back better, Damage and Loss Assessment, climate change adaptation and disaster risk reduction, International Space Charter for Disasters and Sentinel Asia.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum mark. The minimum passing mark for SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- Three Unit Tests each of **20 Marks**
- Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks** to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- 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 a 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

Suggested Learning Resources:

Books

- Proceedings of International Conference on Remote Sensing for Disaster Management by Peddada Jagadeeswara Rao, Kakani Nageswara Rao, Sumiko Kubo Springer International Publishing 1stedition2019
- Global Changes and Natural Disaster Management: Geo-information Technologies by Saied Pirasteh, Jonathan Li (eds.) Springer International Publishing 1st edition 2017.
- Natural Disaster Management by Jon Ingleton (Editor), Leigh Trowbridge (Illustrator) Tudor RoseHoldings1999
- Disaster Management Handbook by Jack Pinkowski CRCPress1stedition2008
- Disasters in India can Remote Sensing Dosomething by VR Rao,L Lalitha, PP NageswaraRao1983.

Web links and Video Lectures (e-Resources):

- https://1lib.in/book/3574775/66d182?dsource=recommend

Skill Development Activities Suggested

- To get familiarized in applications on disaster management.
- To do projects on disaster management

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	To get familiarised to types and remote sensing use in disaster management.	I,II
CO2	To understand the concepts of drought and forest fire using RS technology.	II,III
CO3	To understand the concepts of cyclones and floods using RS and GIS.	II,III
CO4	To Develop database for the geological disaster in GIS platform.	IV,V
CO5	To Create recent spatial database for mobile GIS and emergency and learn soil erosion.	V,VI

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1								X				
CO2					X							
CO3					X							
CO4											X	
CO5		X				X	X					

Geoinformatics in Weather and Climate Studies (Professional Elective Course-4)			
Course Code	**22CGI332**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	03:00:00	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03.00

Course Learning objectives:

- To understand concepts of weather and climate studies.
- They have been exposed to geo-informatics in crop production, soil and water conservation techniques.
- To learn the management skill on climate change and integrated pest and meteorology applications.

Module-1

Elements of weather and Climate: 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, interdisciplinary nature of climate system.

Module-2

Basics of agro-meteorology, Weather-borne Disasters and their Impacts: Identification of critical weather variables affecting crop production, Vegetation indices for crop stress detection, Characteristics of agro-climatic zones of India and Karnataka. Weather in relationship to crop growth, productivity**,** crop water requirements, irrigation scheduling, soil and water conservation techniques.

Module-3

Integrated Pest management: 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, the role of geoinformatics in integrated pest management, Spatial information kiosks in the rural development. etc.

Module-4

Satellite Meteorology: Principles of meteorological remote sensing, characteristics of satellite sensors, Indian satellites/sensors for meteorology, weather systems observed in satellite imagery, Monitoring the progress of monsoons, tropical weather systems, extra- tropical weather systems, Interaction between tropical and mid-latitude systems**.**

Module-5

Climate Change Management: Causes of climate change, 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, geoinformatics inputs for climate change management.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum mark. The minimum passing mark for SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

3. Three Unit Tests each of **20 Marks**
4. Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks** to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

6. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
7. The question paper will have ten full questions carrying equal marks.
8. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
9. Each full question will have a sub-question covering all the topics under a module.
10. The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Books

- SatelliteMeteorologybyRRKelkarBSpublicationsSecondedition2017
- MonsoonPredictionbyRRKelakar,2008,B.S.Publications,Hyderabad
- Climate Change–A Holistic View, by RR Kelakar, 2010. B.S. Publications, Hyderabad
- Global Change studies ScientificresultsfromIGBPin1994
- Managing Weather and Climate Risks in Agriculture by Mannava V.K. Sivakumar, Raymond P.Motha Springer 1st edition 2007
- Weather and Climate by Encyclopaedia Britannica 2008

Web links and Video Lectures (e-Resources):

- https://1lib.in/s/Weather%20and%20Climate%20Studies%20in%20geoinformatics

Skill Development Activities Suggested

- To learn the skills on weather and climate application.

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	To understand concepts of Weather and Climate studies	I,II
CO2	To acquire knowledge about agro-meteorology, Weather borne disasters and their imapcts.	II,III
CO3	To get knowledge on creating spatial database for pest and diseases.	IV,V
CO4	To acquire knowledge about satellite meteorology	III,IV
CO5	To Create and develop the programs for climate change management.	V,VI

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1				X								
CO2					X							
CO3		X			X							
CO4											X	
CO5				X		X					X	

Geoinformatics in Water Resource Management (Professional Elective Course-4)			
Course Code	**22CGI333**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	03:00:00	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03.00

Course Learning objectives:

- This course will enable the students to use RS and GIS tools in the integrated water resource management, glaciology and watershed development.

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 resources cenario 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. Ground water quality assessment, ground water prospect zones mapping and ground water 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 inruralandurbanareas,geologicalandgeophysicalmethodsofgroundwater exploration

Water Quality Physical and chemical properties of water, quality criteria for different uses, groundwater quality provinces of India, Ground water contamination.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum mark. The minimum passing mark for SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

5. Three Unit Tests each of **20 Marks**
6. Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks** to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

11. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
12. The question paper will have ten full questions carrying equal marks.
13. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
14. Each full question will have a sub-question covering all the topics under a module.
15. The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Books

- GIS for Water Resources and Watershed Management-John GLyon
- Application of GIS in Hydrology and Water Resources Management-K. Kovar
- Geographic Information Systems in Water Resources Engineering-Lynn E. Johnson
- Introduction to Environmental Remote Sensing–Barrett EC
- Remote Sensing principles and interpretation –Sabins F.F
- Ground Water Assessment, Development and Management–K.R. Karanath–Tata McGraw Hill Publishing Co.Ltd.
- Groundwater–C.F. Tolman–McGraw-Hill Book Co. Inc.

Web links and Video Lectures (e-Resources):

- https://1lib.in/

Skill Development Activities Suggested

- To develop skill on water resources management practical in different software.
- To collect the filed data using DGPS and GPS.

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	To understand concepts of Water resource development and hydrological tools	II,III
CO2	To acquire knowledge about surface water and mapping	I,II
CO3	To get knowledge about irrigation and watershed management.	II
CO4	To understand ground water prospect mapping and information system	IV,V
CO5	To acquire skills on ground water development and management and water quality	V,VI

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**X**											
CO2					**X**							
CO3				**X**								
CO4						**X**	**X**					
CO5									**X**		**X**	

Project Phase-I			
Course Code	**22CGI34**	CIE Marks	100
Teaching Hours/Week (L:P:SDA)	00:06:00	SEE Marks	---
Credits	03	Exam Hours	---

Course Learning objectives:

- Support independent learning.
- Guide to select and utilize adequate information from varied resources maintaining ethics. •
- Guide to organize the work in the appropriate manner and present information (acknowledging the sources) clearly.
- Develop interactive, communication, organisation, time management, and presentation skills.
- Impart flexibility and adaptability.
- Inspire independent and team working.
- Expand intellectual capacity, credibility, judgement, intuition.
- Adhere to punctuality, setting and meeting deadlines.
- Instil responsibilities to one self and others.
- 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.

Project Phase-1 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.

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

- Present the seminar on the selected project 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.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum mark. The minimum passing mark for SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

1.

Course outcome (Course Skill Set)

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

- Demonstrate a sound technical knowledge of their selected project topic.
- Undertake problem identification, formulation, and solution.
- Design engineering solutions to complex problems utilising a systems approach.
- Communicate with engineers and the community at large in written an oral forms.
- Demonstrate the knowledge, skills and attitudes of a professional engineer.

Societal Project			
Course Code	**22CGI35**	CIE Marks	100
Teaching Hours/Week (L:P:SDA)	00:06:00	SEE Marks	---
Credits	03	Exam Hours	---

Course Learning objectives:

- Support independent learning.
- Guide to select and utilize adequate information from varied resources maintaining ethics.
- Guide to organize the work in the appropriate manner and present information (acknowledging the sources) clearly.
- Develop interactive, communication, organisation, time management, and presentation skills.
- Impart flexibility and adaptability.
- Inspire independent and team working.
- Expand intellectual capacity, credibility, judgement, intuition.
- Adhere to punctuality, setting and meeting deadlines.
- Instil responsibilities to one self and others.
- 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

Project Phase-1 Students in consultation with the guide/s shall carry out literature survey/ visit industries to finalize the topic of the societal 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.

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

- Present the seminar on the selected societal project 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.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum mark. The minimum passing mark for SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

1.

Course outcome (Course Skill Set)

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

- Demonstrate a sound technical knowledge of their selected societal project topic.
- Undertake problem identification, formulation, and solution.
- Design engineering solutions to complex problems utilising a systems approach.
- Communicate with engineers and the community at large in written an oral forms.
- Demonstrate the knowledge, skills and attitudes of a professional engineer.

Internship			
Course Code	**22CGII36**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	00:06:00	SEE Marks	50
Credits	06	Exam Hours	03

Course Learning objectives:

Internship 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,

- 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, research, client interaction, input of ideas, and confidentiality.
- To identify personal strengths and weaknesses.
- To develop the initiative and motivation to be a self-starter and work independently.

Internship/Professional practice: 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.

Seminar: Each student is required to

• Present the seminar on the internship orally and/or through power point slides.

• Answer the queries and involve in debate/discussion.

• Submit the report duly certified by the external guide.

• 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.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum mark. The minimum passing mark for SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

2.

Course outcome (Course Skill Set)

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

- Gain practical experience within industry in which the internship is done.
- Acquire knowledge of the industry in which the internship is done.
- Apply knowledge and skills learned to classroom work.
- Develop a greater understanding about career options while more clearly defining personal career goals.
- Experience the activities and functions of professionals.
- Develop and refine oral and written communication skills.
- Identify areas for future knowledge and skill development.
- Expand intellectual capacity, credibility, judgment, intuition.
- Acquire the knowledge of administration, marketing, finance and economics.

Project Phase-II			
Course Code	**22CGI41**	CIE Marks	100
Teaching Hours/Week (L:P:SDA)	00:06:00	SEE Marks	100
Credits	18	Exam Hours	03

Course Learning objectives:

- To support independent learning.
- To guide to select and utilize adequate information from varied resources maintaining ethics.
- To guide to organize the work in the appropriate manner and present information (acknowledging the sources) clearly.
- To develop interactive, communication, organisation, time management, and presentation skills.
- To impart flexibility and adaptability.
- To inspire independent and team working.
- To expand intellectual capacity, credibility, judgement, intuition.
- To adhere to punctuality, setting and meeting deadlines.
- To instil responsibilities to oneself and others.
- 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.

Project Work Phase - II: 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.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum mark. The minimum passing mark for SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

2.

Course outcome (Course Skill Set)

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

• Present the project and be able to defend it.

• 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.

• Habituated to critical thinking and use problem solving skills

• Communicate effectively and to present ideas clearly and coherently in both the written and oral forms.

• Work in a team to achieve common goal.

• Learn on their own, reflect on their learning and take appropriate actions to improve it.