Unit 4	**Outlines of Python:** Introduction. Creating/Opening/Closing a net CDF file, Dimensions, Variables, attributes in a net CDF file. Writing and retrieving data from a net CDF file. Numpy, Scipy, Matplotlib modules/packages.	8 hrs
Unit 5	**Handling of Character strings:** Declaring and initializing string variables. C++ Programming: C++ Tokens, Expressions and Control Structure. Object oriented concepts: classes and objects, Functions: Defining Member functions Inheritance, Polymorphism, operator overloading, Constructors and Destructors, Control structures statements.	8 hrs
Unit 6	**JAVA:** Fundamentals of Objects- Oriented Programming. Overview of Java, Data types, Variables, Constants, Operators and Expressions Decision Making: Branching and looping statements, Classes, Objects and methods, multiple Inheritance, packages, multi-threaded programming, managing errors and exceptions, applets.	8 hrs

BIBLIOGRAPHY

1. Beekman, G. 1999. Computer Confluence: Exploring Tomorrow's Technology. Addison-Wesley, Reading, MA. (3rd Ed).
2. Willis H. Means 19087A content analysis of six introduction to computer science textbooks ACM New York, NY, USA, 403 - 413
3. Beekman, G. George Beckman, 2000. Tech Nation. Online. Internet. [March 14]. Available WWW:http://www.computerconfluence.com/about/tech.htm
4. Cheryl Schmidt Complete 1990. Computer Repair Textbook, Scott Jones, 22-408.
5. Dix, A., Finlay, J., Abowd, G., and Beale, R. 1999. Human-Computer Interaction. Prentice-5. Hall, Herts. UK. 67-089.
6. Goldberg, M. W. Web CT and First Year Computer Science June, 1997: Student Reaction to and Use of a Web-Based Resource in First Year Computer Science, in Proceedings of the ACM's ITiCSE Conference on Integrating Technology into Computer Science Education. ACM Press. 127-129.
7. E. Balaguruswamy, Programming in C++
8. E. Balaguruswamy, Programming in Java.

GIP 506: DIP AND COMPUTER PROGRAMMING (Lab S)

Skills, employability and entrepreneurship: In this course, students become proficient in the laboratory by using C++, Python, and Java which are commonly used in spatial analysis, modeling, mapping applications, and integrating GIS functions into web-based platforms. There are employment opportunities in private firms, MNCs and private companies. Students can start their own entrepreneurship.

	Digital Image Processing Lab
1.	ERDAS Imagine
2.	Geometric Correction
3.	Radiometric correction
4.	Histogram construction for digital data
5.	Outputs of linear and non-linear stretch
6.	Filtered outputs

7.	Ratio images
8.	Changed detection analysis
9.	Image classification based on digital values
10.	Unsupervised and Supervised classifications.
Computer Programming Lab	
1	Applications of C++ programming in Geoinformatics. Programs to illustrate use of classes, objects in processing/performing Geoinformatics related tasks.
2	HTML: Introduction to WEB and its Applications in Geoinformatics. Creation of web pages. Use of HTML text formatting tags, Hyperlinks, Image stags.
3	Application of Java to Geoinformatics data. Creation of Java programs and applets. Embedding applet tags in HTML.

GIP 507: RS AND GIS IN WATER AND MARINE RESOURCES (Lab S)

Skills, employability and entrepreneurship: In this course, students gain knowledge about river basins, their catchments, geomorphology and coastal management and modelling. Students will become expertise in mapping and monitoring of water resources and monitoring of coastal and marine environment in a sustainable manner using remote sensing and GIS techniques. Students who qualify this course will get opportunities to work in government organizations, several private companies and research institutes. Students can start their own entrepreneurship.

Water Resources Lab	
1	Delineation of river catchments on satellite image. Quantification of Lakes/Reservoirs, Water Bodies from satellite data and top sheets.
2	Evaluation of various drainage morphometric parameters for watershed characterization. Identification of Drainage Patterns, Computation of Stream Density, Stream Frequency, Ruggedness Number etc.
3	Creation of flow direction, flow length, flow accumulation in a watershed based on contours using Arc GIS.
4	Generation of Groundwater potential zone mapping, Isohyetal map generation and interpretation, Generation of Theissen polygons, Precipitation contours.
Marine Resources Lab	
1	Instrumentation in In-situ collection of Oceanographic Data: Secchi Disc, Water Samplers, Grab Samplers, Anemometers, D. O., Salinity, pH meter.
2	Construction of Chlorophyll-a, SST, Depth, Salinity, Biomass, Total /Suspended matter, using interpolation techniques in ArcGIS.
3	CRZ mapping using topographic sheets, Hydrographic charts, Air photographs, Digital data products.
4	Mapping of coastal features like riverine, beach, tidal flat, rocky and sandy shore environments from satellite images, topo-sheets and hydrographic charts. Identification & Interpretation of Oceansat, Modis, and other Oceanographic Satellite Images.