JADAVPUR UNIVERSITY

COMPUTER AIDED DESIGN CENTRE

Faculty Council of Engineering and Technology

Kolkata - 700 032

Certificate course on

Geospatial Technology

Geospatial Technology is a discipline that combines *Remote Sensing*, *Geographic Information System* (GIS) and *Global Navigation Satellite System* (GNSS). Remote sensing is basically the use of instruments or sensors to view the spectral and spatial relations of observable objects and materials at a distance. GNSS is the standard generic term for satellite navigation systems (such as GPS, GLONASS, etc.) that provide autonomous geospatial positioning information with global coverage. GIS is a computer-assisted information management system of geographically referenced data. The need for systems that monitor the changing land-use/land-cover, search and protect natural resources, and track interactions within the biosphere, atmosphere, hydrosphere, and geosphere has become a paramount concern to scientists, planners, managers, politicians, and the general citizens as well. The rapid progress and increased visibility of remote sensing, GNSS, and GIS since 1990s has been made possible by paradigm shift in the areas of computer technology, computer science, and software engineering, as well as airborne and space-borne earth observation technologies. As a result, a new field of study, namely *Geospatial Technology* or *Geoinformatics*, is now in its maturity.

This certificate course has been designed primarily for the research scholars, teachers, working persons, or others who want to learn Geospatial Technology in a very short duration. This course is very compact but provides comprehensive coverage. The course participants will be highly benefited if they follow regular classes.

The CAD Centre is the pioneer institute in the field of Geospatial Technology. It maintains a state-of-the-art infrastructure for its courses. The Centre has engaged highly experienced faculty members from academic sector as well as industry. Some of our faculty members are well known figures in the field of Geospatial Technology and have published huge number of books, monographs, and research articles internationally.

Course Duration: 6 months [3 days/week]

Class Duration: Theory classes: 2 hrs each; LAB classes: 3 hrs each

Eligibility: BE/BTech in Engineering or equivalent; BSc in any discipline; BA in Geography/Environmental Studies; 3-years Diploma in Engineering. All should have working ability with Windows, MS Word, and MS Excel.

Syllabus:

Topics	No. of Theory Classes	No. of LAB Classes	Total No. of Classes
Overview of GIS: Concept of spatial and attribute data, examples, definitions, components of GIS, Functions of GIS, advantages of GIS compare to similar technologies.	1	-	1
Spatial data model and process of GIS: Dimensions of GIS data, Conceptual (field/object) and logical (raster/vector/object oriented), Data sources, data capture (raster/vector/attribute), Raster and vector data processing.	2	-	2
Concepts on co-ordinate system: Map, scale, coordinate systems, sphere/spheroid, datums, projection, projection parameters.	1	-	1
GIS hands-on: *i)* Georeferencing image to image and image to ground, georeferencing using Google map. *ii)* Vector data creation, editing, and manipulation, attribute creation and data entering. Using Geocoding convert survey data to vector layer. *iii)* Add and join external data to vector layers, coordinate extraction, coordinate transformation etc.	6	6	12
Geospatial analysis: attribute and spatial query, proximity analysis, geoprocessing, Thematic map, chart, layout etc.	2	-	2
GIS hands-on: *i)* Attribute & spatial query, field calculation, Thematic map preparation. *ii)* Label, Graph, and layout/map preparation. *iii)* Proximity analysis and Geoprocessing analysis on vector layers	7	7	14
Concept on remote sensing, platforms and sensor characteristics: Definition, data (in situ / remote sensing), passive optical remote sensing, remote sensing platforms, passive/active, orbits, swath, nadir, sensor resolutions.	2	-	2
Photographic and digital optical imaging: Introduction, types of photographic Camera, types of photos, vantage point, digital image, digital sensor, detector, image acquisition, PAN, multispectral, hyperspectral, digital camera.	2	-	2
Visual interpretation of photographic images: Interpretation elements, interpretation of optical images, interpretation keys, mapping geographic features, practical	1	1	2
Digital image processing (enhancement): DIP system, digital image (data format, metadata), image display (RGB), image reduction/magnification, colour combinations, transact	1	-	1
Remote Sensing hands-on: *Visual interpretation of digital images:* Opening an image, zoom, pan, band combination, image info, pixel inquiry, multilayer arrangement, image co-ordinates, save as, etc.	1	1	2
DIP (pre-processing and enhancement): Georeferencing, RMS error, transformation and resampling, contrast enhancement, Image Mosaicing and subsetting	2	-	2

Remote Sensing hands-on: *i)* Image profile (choosing appropriate band/s), contrast enhancement. *ii)* Georeferencing (image to image, image to ground, image to map) *iii)* Mosaicking, AOI tools, subsetting (spatial and spectral).	3	3	6
***GNSS** Technology:* Introduction, concept of GNSS technology, three segments of GNSS, timing and ranging, calculating location, errors, differential GNSS, applications.	2	-	2
Field survey and mapping: *i)* Using a GNSS receiver, GCP collection (field survey) *ii)* Field survey with GNSS receiver. *iii)* Downloading the data from GNSS receiver, georeferencing a map, R2V conversion, Mapping with GNSS survey data.	-	3	3
DIP (transformation): concept of change detection, image indices/ratio, Principal Component transformation, image fusion.	1	-	1
Image transformation: change detection, index (iron oxide, NDVI), PC transformation, fusion	1	1	2
DIP (Classification): Information class, spectral class, supervised vs. unsupervised, decision rules for unsupervised classification, accuracy assessment	1	-	1
DIP (Classification): Decision rules for supervised classification, post-classification filtering	1	-	1
Remote Sensing hands-on: *i)* Unsupervised classification, accuracy assessment *ii)* Supervised classification, editing classified image *iii)* Unsupervised classification of NDVI image, post-classification filtering, post-classification vectorization *iv)* Layer stack, supervised classification using optical bands in addition to PC images and indexed image	4	4	8
Advanced geospatial analysis: Spatial Interpolation, Raster Overlay analysis, concept of 3D data, network analysis, surface analysis, watershed analysis.	3	-	3
GIS hands-on: *i)* Using Interpolation prepare continuous surface data, viewshed map, TIN surface creation and model 3D virtual world. *ii)* Raster Density and Distance analysis, Raster reclassification and weighted overlay analysis. *iii)* Network analysis like shortest path, closest facility and service area analysis *iv)* Watershed analysis to delineate Flow direction map, Flow Accumulation map, stream network and basin dataset.	4	4	8
Review practical session	-	2	2
Total	48	32	80

Examination: One theory test of 100 marks and one practical test of 100 marks at the end of the course. Pass marks is 40. The candidate requires securing 40 marks individually in theory and practical test.