ADAMAS UNIVERSITY

SCHOOL OF SCIENCE

Draft Course Structure and Syllabus

COURSE NAME: Post Graduate Diploma in Geoinformatics

(Syllabus introduced as per Departmental Council (DC) Committee Meeting held on 23.03.2018)

Semester-I

Paper Type	Paper Name	No of theory classes	No of lab classes
THEORY	Fundamentals of remote sensing and photogrammetry	10	-
	Digital cartography, GIS and GNSS	8	
	Advanced quantitative technique	8	
PRACTICAL	Basics of remote sensing and photogrammetry	1	8
	Introduction to geographical information systems and GNSS	1	6
	Advanced quantitative technique	1	10
PROJECT	Minor project		14

Semester-II

Subject Type	Papers	No of theory classes	No of lab classes
THEORY	Digital image processing	8	
	Applied remote sensing and GIS	6	
	Research skill development	6	
PRACTICAL	Digital image processing and advanced GIS analysis	-	18
	Programming for geospatial application and data visualization	-	16
PROJECT	Dissertation	-	20

Semester-I

Paper	Topics
THEORY	
Fundamentals of Remote Sensing and Photogrammetry	**Basic Principles of Remote Sensing**: EMR, spectral signature and resolution, sensor and platforms, multispectral and hyperspectral remote sensing (RS), thermal and microwave RS
	Remote Sensing Satellite and Applications: Types and characteristics of satellites, various satellite missions and sensor types, application of RS in water resource management, agriculture, forestry, urban studies, disaster management
	Aerial Photography and Photogrammetry: Fundamentals of aerial photography, stereo photogrammetry, digital photogrammetry, photo interpretation key
Digital Cartography, GIS and GNSS	**Cartography and Map Visualization:** Cartographic techniques, map layout and designing, interpretation of topographic maps
	Map Projection: Types of map projections, projection transformation, geoid and datum, datum transformation
	Geographical Information Systems: Fundamentals of GIS, GIS integration, open source GIS, Database management system, data types and structure, spatial analysis and model building, DEM and drainage analysis
	Global navigation satellite system: Introduction to GNSS, GNSS segments, GNSS operation, applications of GNSS, data collection and accuracy assessment
Advanced quantitative technique	**Fundamentals of Probability and Statistics:** Concept of probability, normal distribution, types of data, frequency distribution, histogram, mean, median, mode, partition values, skewness, kurtosis.
	Sampling and Hypothesis Testing: Basics of sampling, types of sampling, formulation of hypothesis, null hypothesis, parametric and non-parametric test, normal, t-test, Chi square, F distribution.
	Correlation and Regression: Bivariate correlation, method of least square, residual, multiple regression, partial least square regression, principle component analysis.
PRACTICAL	
Basics of remote sensing and photogrammetry	**Introduction to satellite images:** Spectral bands, band combination, band ratio, image registration and georeferencing
	Visual Interpretation of Satellite Imageries: image interpretation keys using FCC, land use mapping, interpretation of physical and cultural features
	Photogrammetry: Determination of photo scale, fusion of stereo-pair under mirror stereoscope, identification and mapping of geomorphological units and land use

Introduction to Geographical Information Systems and GNSS	**Introduction to GIS and Database Management**: Computer basics, geo-referencing and projection, spatial data base creation, linking of spatial data with non-spatial data sets, , digitization, raster-vector conversion, topology and geometry of vector data, spatial analysis
	Hydrology and geomorphology operations: DEM creation, drainage basin analysis, watershed prioritization, geomorphological mapping.
	Introduction to GNSS: Point data collection using GNSS, post processing of the GNSS data, GNSS and GIS integrations output preparation

Advanced quantitative technique	**Fundamentals of Statistics:** Frequency distribution, histogram, mean, median, mode, partition values, skewness, kurtosis; trend analysis of time series data
	Sampling and Hypothesis Testing: Parametric and non-parametric test, normal, t-Test, Chi square, F distribution.
	Correlation and Regression: Bivariate correlation, method of least square, residual, multiple regression, partial least square regression, principle component analysis.
PROJECT	
Minor Project	A two weeks project based on the lessons learned from the whole semester

Semester-II

Paper	Topic
	THEORY
Digital Image Processing	**Image Pre-processing Operations:** Digital image, digital data format, image restoration; noise reduction; radiometric correction of data; geometric correction of data; linear and non-linear transformations for geometric corrections; histogram significance
	Image Enhancements: Radiometric enhancement; spatial enhancements; contrast stretching—linear and non-linear methods; multi-band enhancement techniques—band ratios, vegetation indices, PCA, spatial filtering; image fusion
	Image Classification: Multi-spectral patterns; spectral discrimination and signature bank; parametric and non-parametric classifiers; supervised and unsupervised classification methods; class editing, accuracy assessment, multi-date data analysis and change detection processes
Applied Remote Sensing and GIS	**Remote Sensing Applications**: Natural resource mapping; environmental monitoring, geomorphic and geological mapping, land use mapping; water resources management and mapping; flood hazard mapping, disease and stress detection; soil erosion and salinity mapping; crop stress and crop yield estimations
	GIS Applications: Infrastructure mapping, resource and utility mapping, rural and urban information system; migration and population dynamics, GIS in planning; GIS in health services and tourism; solid waste management; wild life habitat suitability studies
Research skill development	**Fundamentals of Research:** Basic concept of research, objectives, motivation and significance of research, types of research, deductive and inductive approach, theories and laws, criteria of good research, plagiarisms and its prevalence
	Research Problem and Literature Review: Identification of research problem, significance of literature review, writing literature review, referencing
	Research Design and Sampling: Types of research design and methods, hypothesis-testing, steps in sampling design, types of sampling and their applications in research, collection of spatial and temporal data
	Theoretical Background: Fundamental theory on special field opted by the student for project work

PRACTICAL	
Digital Image Processing and Advanced GIS Analysis	**Advanced Remote Sensing**: • Preprocessing techniques: Geometric and atmospheric correction, image enhancement and filtering • Indices: Soil, vegetation, built-up, snow and water indices from multi-spectral band • Image classification techniques: supervised and unsupervised image classification, post-classification processing, accuracy assessment, raster calculation, model making • Image fusion and hybrid classification • Free data downloading and processing
	Advanced GIS Application: • Database creation and editing, select and query in vector layers, managing attribute table, spatial-nonspatial data linking • Map layout, thematic mapping, charts and diagrams generation, • Remote sensing data integration and overlay analysis, raster-vector conversion, multiple-criteria decision analysis, interpolation • Raster calculator, GIS-based models, network analysis, artificial neural network, neighborhood analysis
Programming for geospatial application and data visualization	**R package for Statistical Analysis and Data Visualization:** • Introduction to R language, R library • Statistical analysis using R: Data and image statistics, trend analysis, linear and multiple regression, partial least squares regression, PCA, • Data visualization: Introduction to ggplot2. Graph plot: histogram, pie charts, box-and-whisker plot, multiple-window plot, multiple axis plot, smoothers, text level plot, visualizing spatial data in R.
	Python Programming for Spatial Data Processing: • Introduction to programming concept: Programming using concepts of variables, operators, Programming using control structures, Programming using functions and arrays, Programming using strings, Programming using data structure, Programming using file handling, Creation of forms and using control variables • Python scripting for statistical analysis • Handling raster data: Merging ESRI shapefiles, convert images format to GeoTIFF, change projection, reading image headers, convert no data values, band maths, raster layer calculator, calculate NDVI and other indices.

PROJECT	
Dissertation	Project work on selected specialized field* * **Specialization in:** *i)* Geomorphology and hydrology *ii)* Agriculture and forestry *iii)* Environmental management *iv)* Disaster management *v)* Demography and urban studies *vi)* Transport and tourism

Examination:

Semester-I

Paper Type	Paper Name	Total Marks
THEORY	Fundamentals of remote sensing and photogrammetry	**50**
	Digital cartography, GIS and GNSS	**50**
	Advanced quantitative technique	**40**
PRACTICAL	Basics of remote sensing and photogrammetry	**50**
	Introduction to geographical information systems and GNSS	**50**
	Advanced Quantitative Technique	**40**
PROJECT	Minor Project	**20**
TOTAL		**300**

Semester-II

Subject Type	Papers	Total Marks
THEORY	Digital image processing	**50**
	Applied remote sensing and GIS	**50**
	Research skill development	**50**
PRACTICAL	Digital image processing and advanced GIS analysis	**50**
	Programming for geospatial application and data visualization	**50**
PROJECT	Dissertation	**50**
TOTAL		**300**