INSTITUTE OF ADVANCED STUDIES IN EDUCATION
(DEEMED TO BE UNIVERSITY)

GANDHI VIDYA MANDIR, SARDARSHAHR
(CHURU) RAJASTHAN – 331403
Phone – 01564 – 220025, 223642, 223054
Web: www.iaseuniversity.org.in

IASE
(deemed to be university)
ज्ञानभानुर्भासताम्

SYLLABUS

SCHEME OF EXAMINATION AND COURSE OF STUDY

FACULTY OF HUMANITIES AND SOCIAL SCIENCES

PG Diploma in Geoinformatics

Session 2021-Onwards

Course Objectives:

To give the Exposure though Practical Learning in Geoinformatics, practical understanding of Geo-informatics applications of Real world. Our practical assignments and mapping projects are designed by industry experts to get the industry orientated exposure for developing the ability to perform basic analysis on Geospatial Spatial data set.

Learning Out comes: After completion of this course candidate will be hands on Geospatial technology as per industry requirements. Candidates would able to perform from the day first.

SCHEME OF EXAMINATION

Each theory paper	2Hrs.duration	Marks 50
Internal Marks		Marks50
Project Report		Marks 300

1. The number of paper and the maximum marks for each Internal Sessional shall be shown in the syllabus for the subject concerned. It will be necessary for a candidate to pass in the theory part as well as in the practical/Sessional part (Whenever prescribed) of a subject /paper separately.
2. A candidate for a pass of the examination shall be required to obtain at least 36% marks in the aggregate of all the papers prescribed for the examination.

First Division	60%	of the aggregate marks taken together
Second Division	48%	of the Previous and the Final Examination

   All the rest shall be declared to have passed the examination.

3. If a candidate clears any paper(s)-Internal(s)/Sessional prescribed at the Examination after a continues period of one year, then for the purpose of working out his division the minimum pass marks only viz 36% shall be taken into account in respect of such paper(s) Internal(s)/ Sessional are cleared after the expiry of the aforesaid period of 12 Month, provided that in case where a candidate requires more than 36% marks in order to reach the minimum aggregate as many marks out of those actually secured by him will be taken into account as would enable him to make the deficiency in the requisite minimum aggregate.
4. **Re-examination Policy:** The candidate will allowed maximum two chances for completion of the Diploma. The University reserves the right to change the rules and regulation according to need.
5. The list of text books/ recommended books/ Reference Books as approved by the Various BoS, are printed along with the English Version only.

IASE Deemed University, Sardarshahar, Churu
DEPARMENT OF GEOGRAPHY
FACULTY OF HUMANITIES AND SOCIAL SCIENCES
Post Graduate Diploma in Geoinformatics

Important points to be noted:

- The theory question paper will consist of Five Sections.
- Theory (External) – 50 Marks
- Internal Sessional Marks (Internal) – 50 Marks
  (Division of Sessional: Assignments – 10,Viva-10, Attendance - 10, Presentation-10, Co-curricular Activity- 10)
- Project Report (Internal) – 300 Marks
  (Field work – 50, Project report- 150, Viva- 50, Presentation-50)

Final Exam =
100 Marks (Theory-50 + Internal/Practical-50) X 6 = 600 Marks
Project Report - = 300 Marks
Total - = 900 Marks

(a) Attendance of Theory/Practical Classes - **10 marks**
(76%-84% - 05 mark)
(85%-93% - 07 marks)
(93%-100% - 10 marks)

(b) Co-curricular Activities - **10 marks**
Cultural &Literary (05 mark)
Games & Sharmdaan (05 mark)

- Total Marks –600 (Six Papers : 100 Marks Each Paper)
- Project Report Marks – 300
- Pass Marks – 36 percent.
- Mandatory to pass the Internal and External (Written Exam) separately, Obtaining 36 Percent Marks.
- Duration of Examination: 2 Hours for Each Paper.

Scheme of Examination of Post Graduate Diploma in Geoinformatics

Examination

Paper No.	Nomenclature of the Paper	Paper Code	INTERNAL SESSIONAL	THEORY (WRITTEN EXAM)	Total Max. Marks
Paper I	Geographical Information System	PGDGI-101	50	50	100
Paper II	Digital Photogrammetry	PGDGI-102	50	50	100
Paper III	Fundamentals of Remote Sensing	PGDGI-103	50	50	100
Paper IV	Digital Image Processing	PGDGI-104	50	50	100
Paper V	Global Positioning System and Lidar	PGDGI-105	50	50	100
Paper VI	Unmanned aerial vehicle (UAV)	PGDGI-106	50	50	100
	Project Report		300	-	300
		Total Marks	600	300	900

Process of Evaluation

- ✓ Theory Exams
- ✓ Internal/Sessional/Practical's Exams
- ✓ Project Report

Geographical Information System

Core Course 01	**PGDGI : 101**
Max. Marks – 100	**Min. Pass Marks – 36**
Internal/Practical Max. Marks – 50	**Min. Pass Marks – 18**
Theory Marks – 50 Marks	**Min. Pass Marks – 18**

Unit I

Fundamentals of Geographical Information System

Concepts and introduction, Basic concepts about spatial information; concept of geo-informatics; historical development and definitions of GIS; components of GIS, manual vs automated GIS; hard ware and software requirement for GIS; terminology of GIS; GIS data formats.

Unit-II

Data Structure and Data Models

Types of data structure: spatial and non-spatial; vector data structure: point, line and area entities; raster data: image data; advantages and disadvantages of various data; data base management system (DBMS); data models: tabular, hierarchical, network, relational, object oriented.

Unit-III

Spatial Data Input

Methods of data capture; scanning and digitization of maps and satellite images; onscreen digitization; map projections; datum and ellipsoids; data registration; editing; cleaning and topology building; errors and accuracies in GIS; attribute generation; linking spatial and non-spatial data

Unit-IV

Data Storage

Data storage formats; data retrieval and compression techniques. Different applications of Compression and Decompression

Unit-V

Manipulation Analysis and Output

Different Data manipulation techniques; spatial data analysis: overlay operations buffering, interpolation methods, network analysis and suitability analysis. 3D GISDEM, DTM, DSM: query in GIS; factors and weights analysis; data output and presentation

GIS Practical's:

GIS Software's & data handling

Graphic user interface of GIS software's: Open source and commercial; software and hardware interface and limitations; data input: spatial and non-spatial; scanning digitizing and; data import and export; data registration and making GIS layers.

Data transformation

Topology building, data editing and cleaning; geo-referencing; projection and datum; coordinate transformation; linking spatial and no-spatial data; data base creation; attribute handling.

Data base creation & data analysis

Spatial analysis: overlay, buffer, proximity and network analysis; quarry building: site suitability analysis; digital elevation models (DEM), digital terrain models (DTM), determination of slope aspect and height; data interpolation: point and line data; output generation; layout. Creation of elevation models: contours, spot heights; 3 D modeling.

Selected Readings:

1. American Society of Photogrammetry, 1992 Manual of Remote Sensing, 2nd ed., Falls Publisher, New York.
2. American Society of Photogrammetry, 1996 Multilingual Dictionary of Remote Sensing.
3. H.M., Wilson, Topographic Surveying, John Wiley and Sons, New York.
4. Wolf, P.R. 1983.Elements of Photogrammetry, 2nd ed., McGraw-Hill, New York.
5. Rampal KK. 1996. Handbook of Aerial photography and Interpretation. Concept publishing company, New Delhi.

Digital Photogrammetry

Core Course 02 **PGDGI : 102**

Max. Marks – 100 **Min. Pass Marks – 36**

Internal/Practical Max. Marks – 50 **Min. Pass Marks – 18**

Theory Marks – 50 Marks **Min. Pass Marks – 18**

Unit-I

Basics of photogrammetry

Historical development of photogrammetry; definition, terms and limitations; types of aerial photographs; fundamental concepts of flight planning; acquisition of aerial photos seasons and time: digital photogrammetry

Unit-II

Geometry of aerial photographs

Projections and properties: parallel, central and orthogonal; tilt; swing; crab; flight line; fiducial marks and fiducial axis, Principal point, Exposure station, Flight line, Plumb line, Isocentre

Unit-III

Aerial cameras, **lens, films and aerial photos**

Aerial cameras difference between aerial and normal photo cameras; photographic lenses and types; aerial films; photo scale; development and printing of photographs.

Unit-IV

Stereo-Photogrammetry

Stereo-models: model points; model deformation; concept of orientation: interior and exterior orientations; absolute and relative orientation; aerial triangulation; rectification.

Unit-V

Application of Digital Photogrammetry

Application of Photogrammetric Products, Digital elevation Model, Digital terrain model, Digital surface model, triangulated irregular Network (TIN), Application of Surface Models, Photogrammetry for precision planning and decision making. Application of Digital Photogrammetry for 3D feature extraction and volumetric analysis.

Photogrammetry Practical's:

Types of aerial photographs; border information of aerial photographs; study of black &white, black & white IR and color IR photographs; determination of height using single, vertical aerial photographs; determination photo scale; preparation of photo index; numerical problem on aerial photographs: determination of number of strips and no. of photographs; preparation of base map from aerial photographs; identification of features/ objects on different band aerial photographs.

Determination of heights and slope and Height. With the help of Digital Photogrammetric work station

Unit-III Interpretation of aerial photographs, preparation of land use land cover maps With the help of Photogrammetric Workstation, Large and Small scale Mapping. 3D (DTM,DEM and DSM) feature extraction from Satellite images and Aerial Photographs.

Selected Readings:

1. American Society of Photogrammetry, 1992 Manual of Remote Sensing, 2nd ed., Falls Publisher, New York.
2. American Society of Photogrammetry, 1996 Multilingual Dictionary of Remote Sensing.
3. H.M., Wilson, Topographic Surveying, John Wiley and Sons, New York.
4. Wolf, P.R. 1983.Elements of Photogrammetry, 2nd ed., McGraw-Hill, New York
5. Rampal KK. 1996. Handbook of Aerial photography and Interpretation. Concept publishing company, New Delhi

Fundamentals of Remote Sensing

Core Course 03 **PGDGI : 103**

Max. Marks – 100 **Min. Pass Marks – 36**

Internal/Practical Max. Marks – 50 **Min. Pass Marks – 18**

Theory Marks – 50 Marks **Min. Pass Marks – 18**

Unit-I

Basics of Remote Sensing

Definition and scope; satellite remote sensing vs aerial photography; data acquisition; stages of remote sensing; historical development of remote sensing, Remote sensing data.

Unit-II

Physics of Remote Sensing and EMR Interactions

Electromagnetic radiation (EMR); electromagnetic spectrum; EMR quantities: energy, radiant flux, irradiance, existence, solid angle, radiant intensity, radiance, quantities; radiation laws: Planck's, Stefan's Boltzmann and Kirchoff's laws. Iwith atmosphere: atmospheric haze, scattering and contrast reduction; interaction with earth surface; spectral signature, hemispheric reflectance, transmittance.

Unit-III

Platforms and Sensors and Resolutions

Platforms: ground base, air borne, space borne; sensors: definitions and CCDs; types of sensors: optical, thermal and microwave; sensor systems: whiskbroom and push broom sensors used in IRS; Landsat; SPOT satellites; resolutions: spatial, spectral, temporal and radiometric

Unit-IV

Earth resource satellites

Definitions and characteristics, Sun-synchronous and geostationary satellites, Indian Remote Sensing Satellites (IRS) series, LANDSAT series, SPOT series, IKONOS and Quick bird etc.; satellite data types: FCC and PAN

Unit V

Image Interpretation

Image interpretation, manual interpretation Vs digital image processing; elements of image interpretation; factors affecting image interpretation; image interpretation keys; multispectral concept in image interpretation

Remote sensing Practical's:

Interpretation of remote sensing data ,Study of PAN and FCC satellite imagery; study of thermal satellite data and interpretation of different objects; study of RADAR & SAR (Microwave) imagery interpretation of physical and cultural details from different satellite imageries: (IRS,LANDSAT & SPOT),

Resolution merging, Temperature mapping with satellite Images, Working with Low and High resolution Satellite Images. Study of Multispectral, Super spectral and Hyperspectral Images.

Selected Readings:

1. American Society of Photogrammetry.1992.
2. Manual of Remote Sensing, 2nd ed., Falls Church, Va., 1983
3. American Society of Photogrammetry, Multilingual Dictionary of Remote Sensing and Photogrammetry, Falls Church, Va., 1984.
4. Lillesand T M & Keifer R W 2000. Remote sensing and Image Interpretation, 5th Eds. John Wiley & Sons, New York
5. Joseph George 2003. Fundamentals of Remote Sensing, University press. Hyderabad.
6. Sabins, F F. 1986, Remote Sensing: Principles and Interpretation, Freeman, New York.
7. Rashid S M & Mazhar A K, 1993 Dictionary of remote sensing, Manak Publishing House, Delhi

Digital Image Processing

Core Course 04 **PGDGI : 104**

Max. Marks – 100 **Min. Pass Marks – 36**

Internal/Practical Max. Marks – 50 **Min. Pass Marks – 18**

Theory Marks – 50 Marks **Min. Pass Marks – 18**

Unit-I

Introduction to digital image preprocessing

Introduction: Terms and definitions; digital images; analogue & digital signals; analogue
images: differences, advantages and disadvantages

Unit-II

Image Restoration

Introduction Display of digital images; digital data formats: band sequential format (BSQ), band interleaved by line (BIL) and band interleaved by pixel (BIP) color composites; data conversion: analogue to digital; ground control points (GCPs); geometric, radiometric and atmospheric corrections.

Unit-III

Image Enhancement

Image filtering: high pass and low pass filter; contrast stretching: linear and non-linear; factors for low contrast; image smoothing; histogram equalization; density slicing; image convolution; principal component analysis (PCA); resolution merge techniques

Unit-IV

Image Classification

Spectral signatures; training sets; signature bank; supervised and unsupervised classification: advantages and disadvantages: classification algorithm: parallelepiped, minimum distance to mean and maximum likelihood; classification accuracies: producer user, over and kappa; change detection techniques.

Unit V

Accuracy Assessment

Thematic Accuracy; Location Accuracy; Producer Accuracy; User Accuracy; Accuracy
Test, Thematic Accuracy; Location Accuracy; Producer Accuracy; User Accuracy; Accuracy Test

Digital Image Processing Practical's:

Image classification and indices Image classification: unsupervised and supervised techniques; generation of attribute, table and calculation of area; classification algorithm: maximum likelihood, minimum to mean distance and nearest neighborhood; training sets for image classification; ground validation of classified data; vegetation indices: vegetation index (VI), normalized differential vegetation index (NDVI); water indices: water index (WI) and normalized differential water index NDWI.

Selected Readings:

1. American Society of Photogrammetry, 2008.
2. Manual of Photogrammetry, 4h ed. Falls Church, Va., 1980.
3. Brock, G.C., The Physical Aspects of Aerial Photography, Dover, New York, 1967.
4. Wolf, P.R., Elements of Photogrammetry, 2 e-Ed., McGraw-Hill, New York1983.
5. Perspective, 2nd Eds. Prentice Hall, New Jersey 5th Eds. John Wiley & Sons, New York.
6. Jeneson J R, Introductory Digital Image Processing A Remote Sensing. Lille sand T M & Keifer R W 2000.
7. Remote sensing and Image Interpretation,

Global Positioning System & and Lidar

Core Course 05 **PGDGI : 105**

Max. Marks – 100 **Min. Pass Marks – 36**

Internal/Practical Max. Marks – 50 **Min. Pass Marks – 18**

Theory Marks – 50 Marks **Min. Pass Marks – 18**

Unit I

Fundamental of GPS

Introduction of Global Positioning System, Satellite constellation, GPS signals and data, Geo-Positioning, Basic concept of NAVSTAR and GLONAS

Unit II

Geodesy and Surveying

Basic geodesy, Geoid/datum/Ellipsoid, definition and basic concepts, Coordinate system, Map Scale, Scale factors, historical evolution and need for Control Segment, Space Segments, User Segment, GPS Positioning Types, Absolute Station Equipment: GPS receiver, GPs antenna. Radio and its types, Radio Antenna Cables

Unit III

GPS Accuracy & Affecting Factors

Satellites, Multi path, ionosphere, Troposphere, Satellite Geometry, Satellite signals and its strength, Distance from the reference receiver, Radio frequency (RF) Loss of Radio Transmission from base.

Unit IV

GPS Applications

Surveying and Mapping, Navigation, Integrating GPS with Remote Sensing and GIS Military, L.B (Location Based Service) Mobile Mapping. Vehicle tracking, Seismic application Crystal deformation and tectonic movements

Unit V

LiDAR Technology

Introduction and objectives of LiDAR technology, Lidar platforms and classification (aerial, Terrestrial and Space borne). Principal of LiDAR technology, kind of LiDAR data, Basics concept of Air borne lidar, Scanning of mechanism Lidar scanners. Swath and scanning line of LIdarsensors. Components of LiDAR System. Architecture of LiDAR System. LiDAR data Processing (pre and post processing. LiDAR processing software. Some other application of LiDAR data. Products of Lidar technology. Source of Error in LiDAR Data. Application of LiDAR data.

GPS Practical's:

Global positioning system

Familiarization of different types of (GPS) Global positioning receivers; checking of existing map coordinates using single GPS receivers, collection of ground control points using single point receivers and relative point receivers; calculation of coordinates and removal of errors in observation; transferring data from GPS receiver to PC: plotting of GCPs on image and maps, Importing coordinates in to MAP, Use of MAPINR.

Lidar Practical's: Working with Lidar software and lass files, Handling tera tools, vectorization of Geographical features with the help of Point cloud files. Making topographic (DTM) Maps with Lidar data. Ground and above and Above ground feature extraction from Point cloud data (Point Cloud Classification)

Selected Readings:

1. American Society of Photogrammetry,1992 Manual of Remote Sensing, 2nd ed., Falls Publisher, New York.
2. American Society of Photogrammetry,1996 Multilingual Dictionary of Remote Sensing.
3. H.M., Wilson, 1958 Topographic Surveying, John Wiley and Sons, New York.
4. Wolf, P.R. 1983.Elements of Photogrammetry, 2nd ed., McGraw-Hill, New York
5. Rampal KK. 1996. Handbook of Aerial photography and Interpretation. Concept publishing company, New Delhi

Unmanned Aerial Vehicle (UAV)

Core Course 06 **PGDGI : 106**

Max. Marks – 100 **Min. Pass Marks – 36**

Internal/Practical Max. Marks – 50 **Min. Pass Marks – 18**

Theory Marks – 50 Marks **Min. Pass Marks – 18**

Unit I

Basics of UAV:

UAV basics, aerodynamics, Technology, UAV Regulatory, Guidelines, Simulator flying, Flight Modes,& Functions Flight Planning.Types of Drone, Principle of Drone technology.

Unit II

Drone Components:

Drone Camera and its specification, Quality of aerial camera, Wings, Motors, Drone body, Drone maintenance.

Unit III

Flight Planning:

Flight line, flight path, overlapping, GCP planning, Risk assessment and emergency handling. Photo and mapping scale.

Unit IV

Data Processing:

Data Check & Geo tagging, Workflow Processing, Hardware software requirement for Drone data processing.

Unit V

Application of Drone Products:

Data processing, Data Check & Geo tagging, Applications, Aerial Imaging/Photography, Surveying/Mapping, Agriculture, Delivery/Logistic, site Inspection, Search and Rescue, Wildlife/Biome Monitoring, Security and Surveillance. Drone applications for defense.

Drone practical's:

Hands on experience on DJI Drones to start outdoor flying exercise, Onsite data capture, Geospatial data analysis. Orthophoto Production, flying for assignment, Introduction to DGPS processing and correction, Preparing for Report and presentation

Selected Readings:

1. American Society of Photogrammetry (1992), Manual of Remote Sensing, 2nd ed., Falls Publisher, New York.
2. American Society of Photogrammetry, 1996 Multilingual Dictionary of Remote H.M., Wilson, Topographic Surveying.
3. John Wiley and Sons (1983) Sensing and Photogrammetry, New York.
4. VA Wolf, P.R. (1983), Elements of Photogrammetry, 2nd ed., McGraw-Hill, New York.
5. Rampal KK. (1996), Handbook of Aerial photography and Interpretation. Concept Publishing Company, New Delhi.

Assignments PGPDGI

1. **GIS Assignment**
   - (I) Base Map preparation from open source data
   - (II) Thematic mapping with the help of Census data
   - (III) Village Map preparation of native place
   - (IV) Smart city Model Dwarka new Delhi
   - (V) MINOR PROJECT ON LULC
2. **Photogrammetry Assignment**
   - (I) Feature database file of point of sharp and medium undulation
   - (II) Regular interval Mass points, 50 and 100 by name
   - (III) Hard break lines and soft break lines on sharp and medium undulation
   - (IV) DTM feature extraction photogrammetric techniques
   - (V) Complete DTM and Planimetry Model preparation
3. **Remote sensing Assignments**
   - (I) Preparation of Data Input for RS based LULC
   - (II) Image classification by unsupervised method
   - (III) LULC cover Map preparation by supervised techniques
   - (IV) Vegetation health monitoring by NDVI techniques
   - (V) Spatiotemporal analysis with the help of RS technology
4. **DIP Assignments**
   - (I) Radiometric corrections of Satellite data
   - (II) Geometric corrections of Satellite data
   - (III) Image enhancements techniques
   - (IV) Band Rationing
   - (V) PCA and Image filtering, Image contrast stretch
5. **LiDAR/GPS Assignments**
   - (I) Coordinate collection from MAP INR
   - (II) Map composition from Map INR
   - (III) Data collection by 500 radios
   - (IV) Point data classification-Planimetry (Building, Power pole)
   - (V) Vectorization of Road feature by using LASS data.
6. **UAV Assignments**
   - (I) Making Flight plan
   - (II) Making GCP plan
   - (III) Flying Drone and capture Data
   - (IV) Processing of Drone data