Mafatlal Gagalbhai Science Institute (Autonomous)
(M. G. Science Institute), Ahmedabad
Accredited "A" level by NAAC (3rd Cycle)

Managed by The Ahmedabad Education Society

Affiliated to
Gujarat University
(Recognized by University Grants Commission)

SYLLABUS

(As per the guidelines of UGC)
(Outcome Based Education Pattern)

for

Diploma Semester - I & II

in

GEOINFORMATICS

(In force from June, 2025)

One year – two semester studies leading to certificate of Diploma

Submitted by

Geology Department
M. G. Science Institute
Navrangpura
Ahmedabad – 380 009.

PROGRAM SPECIFIC OUTCOMES (PSOs)

On completion of the course the learner will be able to

PSO 1: Academic Skills

Gain foundation knowledge of geospatial technologies—including GIS, remote sensing, and GPS—to understand spatial concepts, data structures, and their theoretical understandings.

PSO 2: Laboratory Skills

Demonstrate practical abilities in spatial data collection, geoprocessing, and cartographic design using tools like Arc GIS, QGIS, ERDAS Imagine, and GPS instruments.

PSO 3: Personal Skills

Develop critical thinking and problem-solving abilities by applying geoinformatics techniques to address real-world challenges in environment, urban planning, and resource management.

PSO 4: Social Skills

Effectively communicate geospatial analyses through maps, reports, and visual media to diverse audiences, contributing to team-based projects and community solutions.

PSO 5: Employability Skills

Gain industry-relevant, entry-level technical abilities required for career in geospatial data analysis, GIS application development, and remote sensing operations.

M. G. Science Institute (Autonomous)

Design and structure of Geoinformatics for Diploma Courses

Department	Semester	Course		No. of Hours per week			Course credits
		No.	Name	Lectures	Practicals	Total	
Geology	I	GI 101	Computer Basics and Statistics	4	4	8	6
		GI 102	Principles of satellite remote sensing and digital image processing	4	4	8	6
			Total	**8**	**8**	**16**	**12**
	II	GI 103	Advanced Computer Concepts	4	4	8	6
		GI 104	Geographic information system, statistical methods and computer programming	4	4	8	6
			Total	**8**	**8**	**16**	**12**

COURSE OUTCOMES (COs):

On completion of the course, students will be able to

CO 1: Gain foundational knowledge of computers, operating systems, and MS Office tools, along with skills in basic programming and biostatistics.

CO 2: Comprehend the principles of remote sensing and electromagnetic radiation, and perform digital image processing techniques such as radiometric and geometric corrections.

CO 3: Perform basic satellite data processing, histogram analysis, and data conversions. Apply practical skills in MS Office, programming, operating systems, and fundamental biostatistics.

CO 4: Develop computer fundamentals with programming skills in Python, web design using HTML, and database management using MySQL.

CO 5: Understand conceptual and practical knowledge of GIS and GPS systems, data input/output, and database structures. They will also gain expertise in statistical methods and modeling relevant to geoinformatics applications.

CO 6: Execute GIS tasks such as digitization, shapefile creation, symbology, and map layout. Apply basic skills in GPS handling, Python programming, HTML design, and MySQL database management.

PSO–CO Mapping Table

Course Outcomes (COs)	PSO 1 (Academic)	PSO 2 (Lab)	PSO 3 (Personal)	PSO 4 (Social)	PSO 5 (Employability)
CO 1	3	2	2	-	2
CO 2	3	2	-	-	2
CO 3	2	3	2	-	3
CO 4	3	2	2	-	3
CO 5	3	2	2	2	3
CO 6	2	3	2	2	3

Attainment Level

(-) – Not Attained

1 – Low

2 – Moderately attained

3 – Strongly attained

Diploma Semester I

Geoinformatics THEORY and PRACTICALS

Course-wise detail syllabus

GI 101: Computer Basics and Statistics

Unit	Subject	Credit
Unit - 1	Introduction Computer: History, hardware and softwares, internet basics.	**1**
Unit - 2	MS Office (Word, Excel, PowerPoint, Notepad & Access)	**1**
Unit - 3	Operating systems (DOS, LINUX), Basic programming	**1**
Unit - 4	Biostatistics: Introduction, Presentation of Data Measures of Central Tendency: Mean, Median, Mode (for unorganized and grouped data with examples), Regression analysis, Probability	**1**
PR	**Computer Practicals & Assignments**	**02**
	Total	**06**

GI 102 Principles of satellite remote sensing and digital image processing

Unit	Subject	Credit
Unit - 1	**Introduction To Remote Sensing:** History and Concepts - Advantages of Remote Sensing over Conventional Surveys - Aerial versus Satellite Remote Sensing. **Electromagnetic Radiation:** Physics of Remote Sensing - Energy Sources - Radiation Principles - Energy Interaction with Atmosphere - (Atmospheric Windows, Scattering, Absorption) – Energy interaction with earth surface features - (Absorption, Transmission, Scattering and Reflection).	**1**
Unit - 2	**Spectral Response Patterns:** Spectral Reflectance of Earth Surface Features in Different Wave Length Regions of EMR.	**1**
Unit - 3	**Principles of Image Processing:** Image Data Encoding and Decoding - Digital Image Formats (Band Sequential, Band Inter Leaved and Its characteristics). **Image Processing System:** Software and Hardware Components – (Input - Output Devices - Array Processor) - Software Documentation – (Menu drives and Command Drives) - Raster and Vector Files.	**1**
Unit - 4	**Radiometric Corrections in Image Processing:** Need for Correction - Error Models and Corrections (Due to Sensor, Haze, Sun Angle, Skylight) - Data Accuracy. **Geometric Corrections in Image Processing:** Earth Curvature and Projection Methods - Satellite Pass System and Image Warpening - Skew Corrections -Resampling Interpolation Methods - Panoramic Distortion - Error Accumulation and Corrections - Data Accuracy.	**1**
PR	**Digital Image Processing Practicals and Assignment** Identification of data according to various applications. Downloading and management of datasets. Understanding of various properties of data (Swath, Path, Row, resolutions, etc) Conversions of raw data to processed data Histogram Generation / Equalization (Using Calculator).	**02**
	Total	**06**

Diploma Semester II

Geoinformatics THEORY and PRACTICALS

Course-wise detail syllabus

GI 103: Advanced Computer Concepts

Unit	Subject	Credit
Unit - 1	Introduction to Programming	**1**
Unit - 2	Basics of Python with their functions	**1**
Unit - 3	HTML and Web design	**1**
Unit - 4	Introduction to database management, MySQL	**1**
PR	**Computer Practicals & Assignments**	**02**
	Total	**06**

GI-104 Geographic information system, statistical methods and computer programming

Unit No.	Subject	Credit
1.	**Introduction to GIS:** Meaning and Usefulness of GIS - Components of GIS - Computer Hardware, Software Modules and Organisational Context of GIS. **Data Structure:** Data Structure in GIS, Type of Data (Points, Lines and Polygons)-Data Base Structures - Raster Data Structures and Vector data Structures - Data Conversion, (Vector to Raster and Raster to Vector).	1
2.	**Data Input, Verification, Storage and Output:** Data Input Processes and Devices -Different Types of Entering Spatial and Non-spatial Data - Data Verification -Correction - Storage - Data output processes and devices. **GPS:** Concepts of GPS - GPS Instruments - Applications of GPS.	1
3.	**Basic Statistics:** Frequency Distributions, Cumulative Frequency distributions and Frequency Curves, Measures of Central Tendencies – (Mean, Median and Mode) - Measures of Dispersion – (Range, Variance and Standard Deviation). **Regression Analysis:** Linear Correlation Coefficient - Linear Regression - Non-Linear Regression - Multiple Correlation and Multiple Regression, Factor and Factor Varimax analysis.	1
4.	**Sampling:** Theory of Sampling - Population and Sample - Sampling Survey Methods - Estimation of Mean and Proportion in Simple Random Sampling. **Statistical Inference:** Testing of Hypothesis and Tests of Significance for Mean, Proportion and Variance. **Concept of Modelling:** Fundamentals of Modelling - Types of Modelling – (Parametric - Stochastic - Predictive types and Illustrations).	1
PR	**Geographical Information System Practicals and Assignment** Raster to vector of dataset Creation of Shape files. Digitization of point, polygon and polyline of features. Attribute input for vector data. Symbology creation. Grid creation and basic map layout preparation. Hands-on in GPS.	02
	Total	06

Reference Books:

(1) Curran, P. 1985: Principles of Remote Sensing, Longman, London.

(2) Sabbins, F.F. 1985: Remote Sensing - Principles and Applications. Freeman.

(3) Lo.C.P. 1986: Applied Remote Sensing, Longman, London.

(4) Rao, D. P. (Editor) 1999: Remote Sensing for Earth Resources, Association of Exploration Geophysicists, Hyderabad, India.

(5) Drury, S. A. 1987: Image Interpretation in Geology, Allen & Unwin, London.

(6) Jensen, J.R 1986: Introductory Digital Image Processing: A Remote Sensing Perspective, Prentice-Hall, New York.

(7) P. Nag & M. Kndrat: Digital Remote Sensing, Concept publishing.

(8) M. Anji Reddy. 2008: Text book of Remote Sensing and Geographic Information System, BS publications.

(9) Ian Heywood, Sarah Cornelius and Steve Carver. 2003: An Introduction to Geographical Information Systems, Pearson Education.

(10) Burrough, P.A. 1986: Principles of Geographical Information Systems for Land Resources Assessment, Clarandone Press, Oxford.

(11) Graeme F. & Bonham – Carter: Geographic Information Systems for Geoscientists; Modelling with GIS, Pergamon.