

GEOSPATIAL TECHNOLOGY (818)
JOB ROLE: GIS OPERATOR
CLASS XI-XII (SESSION 2019-20)

1. COURSE OVERVIEW :

Geospatial technology is an umbrella phrase associated with a range of various technologies which include remote sensing, Global Positioning System (GPS), Geographic Information System (GIS), information technologies, and field sensors, that are intended to facilitate the process of capturing/storing/ processing/ displaying/ disseminating information tied to a location.

This present course curriculum offers an opportunity for the students to understand the basics of geospatial technology for developing an interest in the principles, practical uses, and resources related to geospatial technologies. With the exponential growth of Indian geospatial market, this initiative is intended to develop the pool of manpower trained in this subject. This course will enable the students to get an insight into the diverse geospatial database concepts, creating and implementing of the same, GIS theory and spatial analysis, supplemented by extensive practical exercises. Also, it will help the students to acquire skills for further studies and to enter the professional world.

2. OBJECTIVES OF THE COURSE:

In this course, the students will be introduced to the fundamental concepts of Geospatial Technology and the career opportunities available in this field. This vocational course offers professional education dealing with mapping and Geospatial production to ensure that students obtain insight into Geospatial database concepts, creating and implementing database, spatial analysis, developing GIS applications, through both theoretical concepts and supported by extensive practical exercise with hands-on training using Geomatica industry standard software.

Followings are the main objectives of this course:

- To provide knowledge to students to compile, analyze, and present geospatial data. Students will learn these basic geospatial concepts while working with Rolta's Geomatica software.
- To familiarize the students with various dimensions of Geospatial Technology and career opportunities available in these fields.
- To develop creative thinking among students and make them technology-savvy so that they could be ready to join the Geospatial industry.

SALIENT FEATURES OF GEOSPATIAL TECHNOLOGY:

- Geospatial technologies with proven capabilities for supporting decision making can effectively support governance, enable sustainable development, assist in better management of business process as well as bring location-based information closer to the people.
- Geographic information has application in practically all walks of human existence. In the present economic scenario, there is an increasing demand for cost effective solutions for decision making which is likely to propel the usage of this technology and professionals across sectors in the near future.
- Geospatial technology is perhaps the only technology that can provide a holistic approach to the understanding of the interactions and inter-linkages between the

earth's biophysical and social elements to strike an optimal balance between developmental and environmental goals.



4. Curriculum

This course is a planned sequence of instructions consisting of Units meant for developing employability and Skills competencies of students of Class XI and XII opting for Skill subject along with general education subjects.

Theory	60 marks
Practical	40 marks
Total Marks	100 marks

The unit-wise distribution of periods and marks for Class XI is as follows:

	Units	No. of Periods for Theory and Practical		Max. Marks for Theory and Practical
Part A	Employability Skills			
	Unit 1: Communication Skills-III	13		10
	Unit 2: Self-Management Skills-III	09		
	Unit 3: Information and Communication Technology Skills-III	06		
	Unit 4: Entrepreneurial Skills-III	16		
	Unit 5: Green Skills-III	06		
	Total	50		10
Part B	Vocational Skills	Theory	Practical	
	Unit 1: Geospatial Overview a. Familiarisation with GT software b. Familiarisation with the Data Sources	08	12	05
	Unit 2: Maps & Cartography	10	15	10
	Unit 3: Remote Sensing	25	25	15
	Unit 4: Geographic Information System (GIS)	25	25	15
	Unit 5: Global round Positioning System (GPS)	10	15	05
	Total		170	50
Part C	Practical Examination			
	Demonstration of Skill Competency			30
	Viva Voce			05
	Project Work/field Visit			05
	Total			40
	Grand Total		220	100

Part B: Vocational Skill

Chapter–1: Geospatial Overview

1. Introduction to Geospatial Technology.
2. Why to study Geospatial Technology.
3. Importance of Geospatial Technology.

Chapter–2: Maps & Cartography

1. What is Map & its Importance.
2. Map Scale and Types.
3. Elements of Map and Indexing.
4. Map Coordinate System.
5. Interpretation of Satellite Images.

Chapter–3: Remote Sensing

1. Overview on Remote Sensing Technology.
2. Fundamentals of Remote Sensing.
3. Physics of Electro Magnetic Energy.
4. Remote Sensing Platforms, Sensors and Data Products.
5. Remote Sensing Applications.
6. Indian Remote Sensing Systems.

Chapter–4: Geographic Information System

1. Fundamentals of GIS.
2. Components of GIS.
3. GIS Acquisition of GIS.
4. Data Types of GIS.
5. Application of GIS.

Chapter–5: Global Positioning System (GPS)

1. Overview of GPS.
2. Functions of GPS.
3. Segments of GPS.
4. Accuracy of GPS.
5. Applications of GPS.

PRACTICAL

Marks: 40

Exercise No. 1:

5

1. To map School building and surrounding environment.

Exercise No. 2:

5

1. To display various types of thematic geological, political. Meteorological and cadastral maps subject to availability
2. To read the maps and identify Map features.
3. To learn usage of Maps.

Exercise No. 3:

10

1. To display two different scales of Toposheets of same area.
2. To read Toposheet index and identify adjacent Toposheets.
3. To understand the small and large scale concepts.
4. To compare the same area coverage by two different scaled Toposheets.
5. To identify different types of point's line and polygon features.
6. To identify the map elements.
7. To know the four coordinates of Toposheets.
8. To learn finding out location of any point.

Exercise No. 4:

10

1. To display the satellite imagery and Toposheet of same area.
2. To identify the same features from Toposheet and Satellite image.
3. Compare the identified features with toposheet and satellite image.

Exercise No. 5:

5

1. To understand the GIS environment for example open file, Display images and operate various functions such as zoom in, zoom out, open attribute table and reading them, overlay, etc.

Exercise No. 6:

5

1. To Understand GPS data collection and map them.
2. Prepare table of coordinates and elevation of all points collected.
3. Compare the results on Google map.

Part B: Vocational Skill

Chapter–1: Geospatial Overview

4. Introduction to Geospatial Technology.
5. Why to study Geospatial Technology.
6. Importance of Geospatial Technology.

Chapter–2: Maps & Cartography

6. What is Map & its Importance.
7. Map Scale and Types.
8. Elements of Map and Indexing.
9. Map Coordinate System.
10. Interpretation of Satellite Images.

Chapter–3: Remote Sensing

7. Overview on Remote Sensing Technology.
8. Fundamentals of Remote Sensing.
9. Physics of Electro Magnetic Energy.
10. Remote Sensing Platforms, Sensors and Data Products.
11. Remote Sensing Applications.
12. Indian Remote Sensing Systems.

Chapter–4: Geographic Information System

6. Fundamentals of GIS.
7. Components of GIS.
8. GIS Acquisition of GIS.
9. Data Types of GIS.
10. Application of GIS.

Chapter–5: Global Positioning System (GPS)

6. Overview of GPS.
7. Functions of GPS.
8. Segments of GPS.
9. Accuracy of GPS.
10. Applications of GPS.

PRACTICAL

Marks: 40

Exercise No. 1:

5

2. To map School building and surrounding environment.

Exercise No. 2:

5

4. To display various types of thematic geological, political. Meteorological and cadastral maps subject to availability
5. To read the maps and identify Map features.
6. To learn usage of Maps.

Exercise No. 3:

10

9. To display two different scales of Toposheets of same area.
10. To read Toposheet index and identify adjacent Toposheets.
11. To understand the small and large scale concepts.
12. To compare the same area coverage by two different scaled Toposheets.
13. To identify different types of point's line and polygon features.
14. To identify the map elements.
15. To know the four coordinates of Toposheets.
16. To learn finding out location of any point.

Exercise No. 4:

10

4. To display the satellite imagery and Toposheet of same area.
5. To identify the same features from Toposheet and Satellite image.
6. Compare the identified features with toposheet and satellite image.

Exercise No. 5:

5

2. To understand the GIS environment for example open file, Display images and operate various functions such as zoom in, zoom out, open attribute table and reading them, overlay, etc.

Exercise No. 6:

5

4. To Understand GPS data collection and map them.
5. Prepare table of coordinates and elevation of all points collected.
6. Compare the results on Google map.

The unit-wise distribution of periods and marks for Class XII is as follows:

	Units	No. of Periods for Theory and Practical		Max. Marks for Theory and Practical 100
Part A	Employability Skills			10
	Unit 1: Communication Skills-IV	13		
	Unit 2: Self-Management Skills-IV	09		
	Unit 3: Information and Communication Technology Skills-IV	06		
	Unit 4: Entrepreneurial Skills-IV	16		
	Unit 5: Green Skills-IV	06		
	Total	50		10
Part B	Vocational Skills	Theory	Practical	
	Chapter 1: Remote Sensing (RS)	30	10	18
	Chapter 2: Geographic Information System (GIS)	30	10	17
	Chapter 3: Global Positioning System (GPS)	20	10	05
	Chapter 4: Trends in Geospatial Technology	20	10	05
	Chapter 5: Applications of Geospatial Technology	20	10	05
		Total	170	
Part C	Practical Work			10
	Written Test			05
	Viva Voce			05
	Project Work/field Visit			10
	Practical File/Student Portfolio			10
		Total		
	Grand Total	220		100

Part B: Vocational Skills

Chapter–1: Remote Sensing (RS)

- Spectral Reflectance Signature.
- Digital Image Processing.
- Visual Interpretation of Satellite data.
- Aerial Photo and Its Interpretation.
- Advanced Remote Sensing Technologies.
- Advantages and Benefits of RS.

Chapter–2: Geographic Information System (GIS)

- GIS Data Element and Data Structure.
- Fundamentals of Database Concept.
- Data Input to GIS System.
- GIS Data Editing.
- Attribute Data Linking.
- Spatial and Non-Spatial data Analysis.
- Map Projection and Coordinate System.
- Digital Cartography.
- Advantages and Benefits of GIS.

Chapter–3: Global Positioning System (GPS)

- Introduction.
- GPS Accuracy and Accuracy factors.
- Types of GPS.
- List of Global Navigation System.
- GPS Today & Limitations of GPS.
- Uses of GPS Technology.

Chapter–4: Trends in Geospatial Technology

- Introduction.
- Remote Sensing Trends & Technology.
- GIS Trends & Technology.
 - (i) Web Based GIS.
 - (ii) Enterprise GIS.
 - (iii) Mobile GIS.
 - (iv) 3-D Visualization and Fly through.
 - (v) Open GIS.
- GPS Trends & Technology.

Chapter–5: Applications of Geospatial Technology

- Flood Studies.
- Ground water Studies.
- Health Issues.
- Utility Studies.
- Security and Defense Studies.
- Urban and infrastructure Studies.

PRACTICAL

Time: 2 Hours

Marks: 40

- | | | |
|-----------|---|-----------|
| 1. | Projection of Data | 5 |
| | <ul style="list-style-type: none">• Georeferencing.• Coordinating System and components.• Image to map registration.• Image to image registration. | |
| 2. | Digitization | 5 |
| | <ul style="list-style-type: none">• Building Topology. | |
| 3. | Digital Image Processing | 5 |
| | <ul style="list-style-type: none">• Image enhancement.• Unsupervised classification.• Supervised classification. | |
| 4. | Geospatial Data Creation and Editing | 5 |
| | <ul style="list-style-type: none">• Querying (Location parameters, graphics etc.).• Projection data.• Building geo database. | |
| 5. | Spatial Analysis & Thematic Mapping | 5 |
| | <ul style="list-style-type: none">• Overlay analysis• Geoprocessing of data intersection, union dissolve, merge, clip.• Functional attribute and expression.• Statistics and Report generation. | |
| 6. | Symbology & Layouts | 5 |
| | <ul style="list-style-type: none">• Map surfing.• Preparing map and its layout.• Indexing.• Scale and annotation.• Preparing maps for presentation. | |
| 7. | On Job Training | 10 |
| | <ul style="list-style-type: none">• Preparation of maps for.• Environment analysis.• Urban area.• Water bodies.• Agriculture and Forest Collecting ground truth with GPS Overlaying of different maps in GIS. | |

5. **LIST OF EQUIPMENT AND MATERIALS**

- Computers
- Rolta Geomatica Software (Provided by CBSE)
- Internet connectivity
- LCD Projector (optional)
- Projector Screen (optional)

6. **PRACTICAL GUIDELINES**

A. **Practical Guidelines of Class XI**

1. **MINIMUM PASS MARKS**

The Minimum number of marks required to pass as per the **Examination Cell Guidelines**.

2. **Marks for record, Viva Project etc., in respect of Senior Secondary School Curriculum OF School Certificate Examination:**

Marks allotted for laboratory Record, Viva Voice etc., should separately stated in the answer book (if answer-Books are used) and added to the marks given for other items. The projects and the practical records, duly punched should be returned to the students concerned immediately after evaluation.

3. **Assessment of performance.**

- The **internal examiner**, assigned for the conduct and assessment of Practical Examination in **Senior Secondary School Curriculum**. Question for the viva examinations should be conducted by the examiner. Question to be more of General nature, project work or the curriculum. Investigatory Project especially those that show considerable amount of effort and originality, on the part of the student, should get suitable high marks, while project of a routine or stereotyped nature should only receive MEDIOCRE marks.
- In the assessment and award of marks, follow strictly the marking Scheme which is given in the list of practical.
- Marks awarded for Project / Practical activities, for viva, for project and for Practical files must be separately shown on the answer-book as the total.

4. **Procedure for Assessment of practical project work in Geospatial. (Total 40 marks)**

The examiner will indicate separately marks of practical examination on the title page of the answer-books under the following heads:-

The subject Teacher in charge of conducting practical may assign practical activities to the students so as to generate interest in students in the subject. Project may be based on Geospatial Syllabus.

Project for the final practical's is given below: -

Project - 5 marks

Students should make a project file. The marks can be allocated based on the quality of work done by the students as per the Curriculum

Any one of the following: -

1. (i) Prepare a sketch map of the School building and surrounding environment - A top view.
 (ii) Features needs to be shown in the sketch map - School Building, Playground, Parking Area, Tree Lines, Access Road and Principal's Room.

Or

2. (i) Collect four corner coordinates - Administrative Block of School Building.
 (ii) Display them in the GIS Environment.
 (iii) Load a Google Image of the Administrative Block of School Building using collected coordinates.

Viva based on Project - 5 marks

The teacher conducting the final practical examination may ask verbal questions related to the project, if any, done by the student. Alternatively, if no project has been assigned to the students, viva may be based on questions of practical nature from the field of subject as per the Curriculum.

Demonstration of skill competency via Lab Activities - 30 marks

Activity question to be created by examiner, to be conducted on the practical day - 30 minutes.

Exercise No. 1

Marks: 05

Tasks	Marks
Open File - Raster and Vector	02
Basic GIS Functions : Zoom in, Zoom out, attribute table display and reading, display of maps in overlay window, Coordinate readout and distance Measurement	03

Exercise No. 2**Marks: 05**

Tasks	Marks
Display of various maps in GIS environment - Physical, Geological, Political, Metrological and Cadastral Map	02
Identification of Map features from different maps	02
Uses of different maps	01

Exercise No. 3**Marks: 10**

Tasks	Marks
Display of two different scales of Toposheets of the same area in GIS Environment	01
Identification of adjacent Toposheets using Toposheet Index	01
Identification of large and small scale from a given set of maps	01
Comparison of identical area using different scale Toposheets	01
Identification of point, line and polygon features	2.5
Leveling of map elements	2.5
Find out the location of any point using GIS software	01

Exercise No. 4**Marks: 10**

Tasks	Marks
Display of Satellite imagery and Toposheets of the same area in GIS Environment	02
Identification of identical features in Toposheets and Satellite imagery - Road, Railway lines, Shadows, Buildings, Water bodies, River, Forest area, Open space, Play ground, Airports etc	05
Comparison of identified features with Toposheets and Satellite imagery of different resolution	03

B. Practical Guidelines of Class XII

1. MINIMUM PASS MARKS

The Minimum number of marks required to pass as per the **Examination Cell Guidelines**.

2. Marks for record, Viva Project etc., in respect of Senior Secondary School Curriculum OF School Certificate Examination:

Marks allotted for laboratory Record, Viva Voice etc., should separately stated in the answer book (if answer-Books are used) and added to the marks given for other items. The projects and the practical records, duly punched should be returned to the students concerned immediately after evaluation.

3. Assessment of performance.

- The two examiners, **one internal and the other external**, assigned for the conduct and assessment of Practical Examinations each in **Senior Secondary School Curriculum**. Question for the viva examinations should be conducted by both the examiners. Question to be more of General nature, project work or the curriculum. Investigatory Project especially those that show considerable amount of effort and originality, on the part of the student, should get suitable high marks, while project of a routine or stereotyped nature should only receive MEDIOCRE marks.
- In the assessment and award of marks, follow strictly the marking Scheme which is given in the list of practical i.e. provided to the Examiners/Schools at the time of Examination.
- Every effort should be made to reach a consensus on the marks to be awarded to individual candidates. If a difference of one or two marks still persists even after discussion the average marks should be awarded.
- Marks awarded for Project / Practical activities, for viva, for project and for Practical files must be separately shown on the answer-book as the total.
- If irregularities are perceived by either examiner in the conduct of the Practical Examination these should be included in the examiner's report and should be sent to the Asstt. Secretary (A.B. Cell) within three days after the end of practical examination.
- The external examiner should assume responsibility of deposit of answer books & award list to the Board.
- Award lists should be signed by both the examiners and should be sent separately through messenger/personally in a double sealed cover and not mixed with the Answer-books. The answer-books can be delivered personally in the Board's office.
- The related material will be collected by the external examiner from the allotted schools.
- In other subject involving practical's, there will be only an external examiner.

4. Procedure for Record of Marks in the Practical answer-books.
(Total 40 marks)

The examiner will indicate separately marks of practical examination on the title page of the answer-books under the following heads:

The subject Teacher in charge of conducting practical may assign practical activities to the students to generate interest in students in the subject. Project may be based on Geospatial Syllabus.

Project for the final practical's is given below: -

Project - 5 marks

Students should make a project file. The marks can be allocated based on the quality of work done by the students as per the Curriculum.

Any one of the following: -

1. Geo-referencing of the given Toposheet (1:50,000 scale).

Or

2. Classification of the provided Satellite Imagery
 - (i) Unsupervised Classification
 - (ii) Supervised Classification

Viva based on Project - 5 marks

The teacher conducting the final practical examination may ask verbal questions related to the project, if any, done by the student. Alternatively, if no project has been assigned to the students, viva may be based on questions of practical nature from the field of subject as per the Curriculum.

Demonstration of skill Competency via Lab Activities – 30 marks

Activity question to be created by internal examiner, to be conducted on the practical day - 30 minutes

Exercise No. 1

Marks: 05

Projection of Data	
Tasks	Marks
Re-projection of the given data	2.5
Subset Creation - Raster Image	2.5

Exercise No. 2**Marks: 05**

Digital Image Processing	
Tasks	Marks
Histogram Analysis	01
Image Enhancement	2.5
Apply of Filter	1.5

Exercise No. 3**Marks: 10**

Creation of Vector Data	
Tasks	Marks
Extraction of Point, Line and Polygon Features from the given geo-referenced satellite image	05
Building Topology	02
Preparation of Thematic Map	03

Exercise No. 4**Marks: 05**

Tasks	Marks
Building of Geo database	2.5
Building Query Attribute based query Spatial query	2.5

Exercise No. 5**Marks: 05**

Creation of Map Layout	
Tasks	Marks
Preparation of hybrid map in GIS Environment	05

7. CAREER OPPORTUNITIES :

Geospatial technology is ubiquitous and the expanse of its reach in multiple fields is growing rapidly. Most technologies require a spatial component and it is one of the pillars of emerging technologies. Be it our day-to-day activities or cutting-edge futuristic research, none can be visualized without geospatial information. A vast range of career opportunities are available in this field. Following are just few of them-

- Geospatial Data Technician
- Geospatial Scientist
- Image Scientist/ Analyst
- Geospatial Developer
- Geospatial Programmer
- Geospatial Database Engineer
- Forensic Analyst
- Criminal Intelligence Analyst

VERTICAL MOBILITY

- GIS Operator -----GIS Assistant or Technician -----GIS Specialist ----- GIS Analyst ----- Senior GIS Analyst ----- GIS Coordinator ----- GIS Scientist/ Manager.

➤ **OCCUPATIONS USING GEOSPATIAL TECHNOLOGY:**

- Agriculture
- Archeology
- Banking and Financial Services
- Business
- Census
- Conservation
- Criminal Justice
- Defense and Intelligence
- Disaster Management
- Education
- Economic Development
- Education Administration
- Education and Research
- Elections
- Emergency Response
- Energy
- Engineering
- Environmental Health
- Environmental Law
- Environmental Planning
- Epidemiology
- Fire Science Forestry

- Geography
- Government
- Geology
- Hazard and Risk Analysis
- Health Care Delivery and Policy
- History
- Homeland Security
- Hydrology
- Insurance
- Land Records and Cadastral
- Law Enforcement
- Libraries
- Location Based Services
- Mapping and Cartography
- Marine and Coastal Ecology
- Media and Press
- Military
- Mining
- Museums
- Oceanography
- Oil and Gas Pipelines
- Political Science
- Real Estate
- Social Services
- Surveying
- Sustainable Development
- Transportation and Logistics
- Travel and Tourism
- Urban & Rural Planning
- Utilities (gas, electric, water, sewer)