University of Mumbai
Revised Syllabus w.e.f. Academic Year, 2018-19 (CBSGS)
T.Y.B.A. / T.Y.B.Sc. Geography, Semester – V, Paper – IX
Subject Title : GEOSPATIAL TECHNOLOGY
Course Code: Creadit-0 3

UNIT - I Remote Sensing – I
प्रकरण पहिले: दूर संवेदन: भाग १ **9**

1.1 Geospatial Technology: Concept, Components and Importance
१.१ भू-अ भक्षेत्रीय तंत्रज्ञान: संकल्पना, घटक आ ण महत्व

- **Concept of Geospatial technology - definition and explanation**
- **Components of GT : GIS, GPS and RST**
- **Importance of GT : Time , money, quality, quantity, synoptic view, accuracy, repetition and efficiency as well as environment management, disaster management, transport, defense, agriculture, watershed management, forest management, resources management, mining, revenue system, health, education, policies and developmental projects, research and development etc.**

1.2 Remote Sensing: Concept, Process and Geographical Applications
१.२ दूर संवेदन : संकल्पना, प्र क्रया आ ण भौगो लक उपयोग

- **Concept of RS technology - definition and explanation**
- **Process of RST - Illumination - transmission - interaction - recording - transmission - reception - processing - interpretation - analysis - application and decision making (diagram of process)**
- **Application of RST : environment management, disaster management (flood, cyclone, climate change, forest fire etc.), transport, defense, agriculture, watershed management, forest management, resources management, mining, revenue system, health, education, policies and developmental projects, research and development etc.**

1.3 Electromagnetic Energy, EMR and EMS - Spectral Reflectance and Spectral Signature or Curve - Platforms, Sensors and Resolution
१.३ वद्युतचुंबकीय ऊर्जा: वद्युतचुंबकीय उत्सर्जन, वद्युतचुंबकीय वर्णपट, वर्णपट परावर्तन आ ण वर्णपट वक्र, दूर संवेदन फलाट, संवेदक आ ण निग्रह .

- **Write definition and draw diagram of : Process of RS/ EMR / EMS / Spectral Reflectance Curve / Spectral Signature / platforms**
- **Platforms: (ground - aerial - space borne) ground, balloon, aircraft, satellite - sun synchronize and geostationary, space shuttle etc.**
- **Resolution - spatial, spectral, radiometric and temporal - high and low**
- **Sensors - active and passive - drone, camera, satellite, space shuttle, optical etc.**

1.4 Elements of Visual Image Interpretation - Mapping of Thematic Layers and Visual Image Interpretation of Physical and Manmade Features
१.४ दृश्य प्रतिमा वर्णनाचे घटक, - वषयक स्तरांचे नकाशीकरण आ ण प्राकृतिक व मानवनि र्मत घटकांचे वर्णन

- **Elements of visual image interpretation : shape, size, tone, texture, site, shadow, association and pattern (concept with example or diagram or image)**
- **Image interpretation:**
  Study the satellite image provided to you and answer the following.
  a. Explain about vegetation cover available in given image.

b. **Describe the transport pattern exist in given image.**
c. **Draw a map of transport network from the image. (Similar maps for single feature or all features together in one along with index, title, scale etc. of water bodies / drainage / forest /transport /settlement and any other features available in image) (on tracing paper).**

or

Study the satellite image and write interpretation of distribution and nature of the physical features and man-made features (Water bodies, drainage, vegetation, transport, settlement and any other features with suitable evidences and sketches).

- **<u>Thematic mapping</u> : Draw a thematic map of landuse landcover (Water bodies, drainage, forest, transport, settlement and any other features) from the given image on tracing paper with – Title, Scale, Frame, Index or Key or References, Data source, Marginal Information or Metadata etc.**

UNIT - II Remote Sensing – II **9**

प्रकरण दुसरे: दूर संवेदन: भाग २

2.1 Digital image analysis: landuse and landform classification, 3D view of DEM

२.१ उपग्रहीय प्रतिमांचे अंकात्मक वश्लेषण : भूमीउपयोजन आ ण भूरुपांचे वर्गीकरण, अंकात्मक उंची प्रतिमानाचे त्रि मतीय दृश्य

- **<u>Landform Classification</u> in SAGA software :**
  For data :(Use http://dst-iget.in/tutorials website **for downloading data / DEM, procedure and demo or download it from bhuvan.nrsc.gov.in -(Procedure : open the website – Category – Open data achieve free download – category (satellite / sensors) – subcategory (cartosat1) – Product (Carto DEM All Versions) – Area (Tiles) – Click start - select tile in map – click next – click download – Save tif or jpeg image in new folder)**
  Prepare landform classification map and histogram in SAGA software: Procedure: Open the SAGA software – open the raster image (DEM) clicking load – carry out preprocessing (refer the pdf file of Terrain analysis for procedure to follow)
  For Map : Go to Geoprocessing - Terrain analysis – Terrain Classification – TPI based landform classification – Set grid system and elevation – Okay – new map will be in data panel - double click on it – map will display –modify and compose – save it.
  For Histogram: right click on map file in data panel – click on histogram – histogram will display – save it.
- **<u>3-D DEM</u> : Download the Cartosat 1 DEM from the bhuvan.nrsc.gov.in or http: //dst-iget.in/tutorials website (You should login in website with your account to download the data), carry out required preprocesses and prepare 3D model in SAGA software (Open the software – load the image - select map window in data panel – Show 3-D view – set the grid system and elevation – Okay – click and drag the image and set the controls of exaggeration to the desirable 3-D image – Save as an image – Okay). or it can be prepared in Q-GIS software also (for procedure download video or pdf file of procedure from internet. (The tile should be belongs to the area of college location).**

  or

  Take a digital image (download it from http://dst-iget.in/tutorials or bhuvan.nrsc.gov.in), (*C**arry out required processes like georeferencing, enhancement, image classification, clipping, mosaicking, subsetting, use of filters etc. (*Only these processes not compulsory to teach as it is not part of syllabus. But if the students are willing to learn, then this can be introduced to students) and prepare a 3-D DEM in SAGA software or Q-GIS software. Also take print of composed (scale, title, index and grid) product (output) and attach it in journal as well as write procedure.**

2.2 Aerial Photographs: Concept, Process and Types

२.२ हवाई छाया चत्रे : संकल्पना, प्र क्रया आ ण प्रकार

- **<u>Concept of aerial photographs</u> - Definition and explanation**
- **<u>Processes</u> - planning, equipments and personal, photography, processing, analysis, interpretation, errors and applications.**
- **<u>Types</u> : Vertical and Oblique - high and low oblique (Explain with diagrams)**

2.3 Interpretation of Aerial Photographs

२.३ हवाई छाया चत्रांचे वर्णन

- **<u>Aerial photo interpretation</u> :**

  Study the aerial photograph provided to you and answers the following.

  i. **Explain about vegetation cover existing in given aerial photograph.**
  ii. **Describe the settlement pattern located in given aerial photograph.**
  iii. **Draw a map of (water bodies / drainage / forest /transport / settlement and any other features) available in given aerial photograph. (on tracing paper)**

  or

  Study the given aerial photograph and write interpretation of the physical features and man-made features with suitable evidences and sketches.

2.4 Advanced Remote Sensing Technology - Use of Bhuvan website

२.४ प्रगत दूर संवेदन तंत्रज्ञान- भुवन संकेतस्थळाचा वापर

- **<u>Advanced RST</u>: Hyper-spectral RS, Thermal RS, Microwave RS, RADAR, Lidar etc.**
- **<u>Use of Bhuvan website</u>: Download the required data from the website as and when required. You need to open the account and login in it before downloading the data. The can be downloaded by procedure e.g. open the website – click on open data achieve free download – category (satellite / sensors) – subcategory (cartosat1) – Product (Carto DEM All Versions) – Area (Tiles) – Click start - select tile in map – click next – click download – Save tif or jpeg image in new folder.**

UNIT - III Global Positioning System **9**

प्रकरण तिसरे: जागतिक स्थांननिश्चितीकरण प्रणाली ९

3.1 GPS: Concept, Segments, Applications

३.१ जागतिक स्थांननिश्चितीकरण प्रणाली: संकल्पना, घटक आ ण उपयोग

- **<u>Concept of GPS</u> with explanation**
- **<u>Segments of GPS</u> - space, control and user**
- **<u>Applications of GPS</u> : Survey (Geography, Geology, Architecture, Botany and Land use), Geotagging, Elevation and area measurement, disaster management (flood, cyclone, , forest fire etc.), transport (navigation and aviation - tracker, direction and distance, train control etc.), defense, agriculture, fishing, watershed management, forest management, resources management, mining, health, education, tourism, sports, construction, utility management etc.**

3.2 Types of GPS – GPS Data Accuracy and Errors

३.२ जागतिक स्थांननिश्चितीकरण प्रणालीचे प्रकार- तथ्य अचूकता आ ण त्रुटी

- **<u>Types of GPS</u> : DGPS, mapping, survey, handheld (Gramin - Ertex 10, 20, 40 and 80), sports, recreational, outdoor, tracker (mobile, personal, vehicle) and cell phone, apps**

- **<u>GPS Data Accuracy and Errors</u> : Signal strength, radio frequency, health of satellite, device accuracy, orbital errors, troposphere, ionosphere, satellite geometry, multipath reflection, cloud cover, clock error, noise etc.**

3.3 Factors Affecting GPS Data - Global Navigation System

३.३ जागतिक स्थांननिश्चितीकरण प्रणाली तथ्यांवर परिणाम करणारे घटक- जागतिक ने वगेशन प्रणाली

- **<u>Factors Affecting GPS Data</u> : accuracy of GPS device, atmospheric conditions, error, drift, noise, selective availability and multipath**
- **<u>Global Navigation Systems</u> : NAVSTAR, GLONASS AND GALILEO**

3.4 Ground Survey and Demarcation of Point, Line and Polygon Features with GPS Device – Transfer GPS Data to Computer with Softwares like Easy GPS

३.४ भू-सर्वेक्षण आ ण जी.पी.एस. यंत्राच्या सहाय्याने बिंदू, रेषा आ ण बहुभुजाकृती यांचे सर्वेक्षण - जागतिक स्थांननिश्चितीकरण प्रणाली सर्वेक्षण तथ्यांचे संगणकात हस्तांतरण – Easy GPS or Q-GIS etc..

- **<u>GPS survey and mapping</u>: Take a reading of latitude, longitude and elevation of any five points / one track / one area and transfer the data in software (Q-GIS or GRASS or Easy GPS or Google Earth Pro etc.)**

or

- **Take a reading of any five points / one track / one area and transfer the data in software (Q-GIS or GRASS or Easy GPS or Google Earth Pro etc.) and prepare a suitable map if possible (Use http://dst-iget.in/tutorials for procedure and demo)**

UNIT - IV Geographic Information System – I **9**

प्रकरण चौथे: भौगो लक माहिती प्रणाली- भाग १ ९

4.1 GIS : Concept, Components and Applications - Map Projection and Coordinate System

४.१ भौगो लक माहिती प्रणाली: संकल्पना, घटक आ ण उपयोग- नकाशा प्रक्षेपण आ ण भौगो लक वृ–तजाळी प्रणाली

- **<u>Concept of GIS</u> with explanation**
- **<u>Components of GIS</u> : hardware, software, data, methods, output, people, applications etc.**
- **<u>Applications of GIS</u> : town planning, defense and safety, utility services, town planning, infrastructure planning, transport planning, drainage and garbage, disaster management (fire, cyclone, droughts and floods), forest management, environment conservation, watershed management, morphometry studies, agricultural planning, irrigation, transport, defense services etc.**
- **<u>Map Projection and Coordinate System</u> - latitude, longitude, time zones, geographic grids, geodesy - spheroid, obliged and geoid (WGS and UTM) and use and choice of type of projection.**

4.2 GIS Data Acquisition and Types

४.२ भौगो लक माहिती प्रणाली तथ्यांचे संकलन आ ण प्रकार

- **<u>Data Acquisition</u> : Remote sensing data, GPS data, printed paper maps, Scanned drawings, digital data, statistical data**
- **<u>Data types</u> : Raster and Vector as well as Spatial and Non-spatial (meaning, characteristics and differences)**

4.3 Importing Image into GIS Software and Geo-referencing

४.३ भौगो लक माहिती प्रणाली संहतीमध्ये उपग्रहीय प्रतिमा आयात आ ण भू-संदर्भीकरण

- **Georeferencing - Georeference the given toposheet in Q-GIS / SAGA / GRASS or any GIS software. Take print out of composed map with GCP table or coordinate points on map to attach journal and write procedure.**

  or

  Georeference the given district map in Q-GIS / SAGA / GRASS or any GIS software. Take print out of composed map with GCP table or coordinate points on map to attach in journal and write procedure
  (Use http://dst-iget.in/tutorials for downloading data as well as procedure and demo or refer pdf file send on georeferencing).

4.4 Creating Layers by Digitization of Point, Line and Polygon Features

४.४ डजिटायजेशन च्या सहाय्याने बिंदू, रेषा आ ण बहुभूजाकृतीचे स्तर तयार करणे

- **Digitization - Digitize the eight point features / four line features / two area features from given Toposheet by using point, line and polygon symbols in Q-GIS software and write procedure. Take print out of composed map to attach it (output) in journal and write procedure.**

  or

  Vectorise the district map with polygon (Tahsil boundary, forest area, irrigated area etc), line (District boundary, roads, railway lines, rivers etc) and point symbols (District headquarters, wells, schools, dispensaries etc.) from raster data provided (Use http://dst-iget.in/tutorials for downloading data, procedure and demo).
- **Layering - Raster / Vector - Create a desirable output from selected layer / layers, print the output and write procedure**
  (Use http://dst-iget.in/tutorials for downloading data, procedure and demo or pdf sent with this on georeferencing).

UNIT V Geographic Information System – II **9**

प्रकरण पाचवे: भौगो लक माहिती प्रणाली- भाग २ ९

5.1 Functions of Database Creation – Input, Editing and Linking

५.१ डाटाबेस नि र्मतीची कार्ये: इनपुट, संपादन आण दुवा

- **Data base creation : Create non-spatial data base (edit / link / input) with spatial data of district map print and attach the output in journal and write procedure - Use available Census data (Use http://dst-iget.in/tutorials for downloading data, procedure and demo).**

5.2 Spatial Database Analysis: Overlay, Merge, Query

५.२ अ भक्षेत्रीय डाटाबेस वश्लेषण: स्तर आच्छादन, स्तर वलीनीकरण, पृच्छक

- **Spatial Data Analysis : Use the functions of overlay / merge layers / spatial or non-spatial query and display the suitable output, print and attach the output in journal and write procedure (Use http://dst-iget.in/tutorials for downloading data, procedure and demo).**

5.3 Using Map-Composer for Map Layout and Design

५.३ नकाशा आरेखन आ ण मांडणी

- **Map layout and design : map, title, index, scale, grid reference, direction etc. in map composer widow.**

5.4 Preparation of Thematic Maps

५.४ उद्देशात्मक नकाश तयार करण

- **<u>Prepare the district thematic maps</u> where the college is located or any other district while working for practical. (Use http://dst-iget.in/tutorials for downloading data, procedure and demo). Write interpretation of it. Arrange it in sequence and try to find out some research oriented results / findings from it. Write a report based on these thematic maps. It should provide glimpses and ideas to the students how to use the Geospatial Technology for the geographical research and analysis. (it should be based on any one theme for which census or any other authentic Tahsil wise data is available e.g. Demography, Agriculture, Irrigation, Services etc.). Refer https://mahades.maharashtra.gov.in/home.do?lang=en or censusindia.gov.in websites for socio-economic data**

Journal (HARD COPY) : Title page, certificate, index, and exercises (aim, procedure, requirements and output) with sequence.

Note :

Following exercises to be carried out with help of Q-GIS software:

- Georeferencing
- Digitization
- Data joining
- Thematic mapping
- Query
- Map composition

Following exercises to be carried out with help of SAGA software:

- **Georeferencing**
- **3-D DEM**
- **Landform classification**

Following websites to be useful to down load data and manual:

- http://dst-iget.in/tutorials
- bhuvan.nrsc.gov.in

Paper – IX : GEOSPATIAL TECHNOLOGY
Question Paper Pattern

Q. 1	Unit –I	16 marks
Q. 2	Unit –II	16 marks
Q. 3	Unit –III	16 marks
Q.4	Unit –IV	16 marks
Q. 5	Unit –V	16 marks
Q. 6 Preparation Thematic Maps by using Geospatial Technology Tools		10 marks
Q. 7 Journal and Viva		10 marks
	Total	100 marks

Paper – IX : GEOSPATIAL TECHNOLOGY

Tentative Question Paper Pattern and Question Bank

Q. 1 Unit –I **16**

Q1.A. Answer the following. **08**

i. Write a note on (any one out of two) **04**

Concept of Geospatial technology / Components of GT / Importance of GT / concept of RS technology / Process of RST / Application of GT / platforms / Resolution / Sensors

ii. Draw a diagram of (any one out of two) **04**

Process of RS/ EMR / EMS / Spectral Reflectance / Spectral Signature

Q1.B. Study the satellite image provided to you and answer the following (Appendix I). **08**

i. Explain about vegetation available in image. **02**

ii. Describe the drainage pattern located in image. **02**

iii. Draw a map of Transport network availablein image (on tracing paper). **04**

OR

Study the satellite image provided to you and write interpretation of the physical features or man-made features (Water bodies / drainage / forest /transport / settlement and any other features with suitable evidences and sketches). **08**

OR

Draw a thematic map of landuse landcover from the image provided to you on tracing paper(Water bodies / drainage / forest /transport / settlement and any other features) – (any two). **08**

Q. 2 Unit –II **16**

Q2.A. Download the Cartosat 1 DEM from the Bhuvan website and prepare 3D model in GRASS software and write procedure in your answer book. (The tile should be belongs to the area of college location or given for practicals) and write procedure in your answer book. **08**

or

Prepare a landform classification histogram / map of given DEM in GRASS software and write procedure in your answer book. **08**

Q2.B. Study the aerial photograph provided to you and answers the following (Appendix II). **08**

i. Explain about vegetation cover available in thephotograph. **02**

ii. Describe the settlement pattern located in given photograph. **02**

iii. Draw a map of (Water bodies / drainage / forest /transport / settlement and any other features) available in given aerial photograph (any one - on tracing paper) **04**

or

Study the aerial photograph provided to you and write interpretation of the physical features / man-made features with suitable evidences or sketches. **08**

Q. 3 Unit –III **16**

Q3.A. Answer the following (any two out of three). **08**

Write a note on: Concept of GPS / GPS Segments / Applications of GPS / Types of GPS / GPS Data Accuracy and Errors / Factors Affecting GPS Data / Global Navigation Systems

Q3.B. Survey given five points / one track / one area with the help of available GPS device and write the data of latitude, longitude and elevation in answer sheet. **08**

or

Survey any five points / one track / one area with the help of available GPS device **08**

and transfer the data in software (Q-GIS or GRASS or Easy GPS or Google Earth Pro etc.) and prepare a suitable map.

or

Transfer the data from GPS device to the software (Q-GIS or GRASS or Easy GPS or Google Earth Pro etc.) and prepare a suitable map. **08**

Q. 4 Unit –IV **16**

Q4.A.1. Write a note on (any one out of two). **04**

Concept of GIS / Components of GIS / Applications of GIS / Map Projection and Coordinate System / Data types

2. Write note on (any one out of two). **04**

Georeferencing / digitization / Layering / Raster / Vectorization

or

Georeferencing the given toposheet in Q-GIS software. **04**

Q4.B. Digitize the four point features / two line features / one polygon features from given Toposheet in Q-GIS software (Write procedure in answer sheet). **08**

Q. 5 Unit –V **16**

Q5.A. Create non-spatial data base (edit / link / input) of given district map (spatial data) (Provide shape file and data) and write procedure. **08**

or

Use the function of overlay / merge layers/ spatial query and display the suitable output (Provide data in shape files of different land use) and write procedure. **08**

Q5.B. Prepare thematic map of given theme and compose with title, scale, index and direction. (Provide shape file with joined data for the given theme) **08**

Q. 6. Preparation of Thematic Maps by using Geospatial Technology Tools. **10**

Prepare the district thematic maps where college is located or any other district while working for practical and it should be based on any one theme and census data is available. Prepare a report on it with interpretation and attach it with journal.

Q. 7 Journal and Viva **10**

Important References

1. कारेकर, श्रीकांत (२००६): भौगोलरकमादषतीप्रणारी, डाय मंडप्रकाळन, पुणे.
2. कारेकर, श्रीकांत (२०१२): दूर शंळेदन, डाय मंडप्रकाळन, पुणे.
3. Bhatia (2016): Remote Sensing and GIS, Oxford University Press, New Delhi.
4. Bhatia, S. C. (2008): Fundamentals of Remote Sensing, Atlantic Publishers andDistributors (P) Limited, New Delhi.
5. Bhatta Basudeb 2016: Remote Sensing and GIS, Oxford University Press, New Delhi
6.Training Module of Capacity Building Training Programme in Geospatial Technologysponsored by Department of Science and Technology, Government of India incollaboration of Himachal Pradesh University.
7. Tutorials from the - http://dst-iget.in/tutorials
8. bhuvan.nrsc.gov.in
9. CBSE (NCERT) Board, class XI and XII textbook of Geospatial Technologies.