



सत्यमेव जयते

Department of Science & Technology  
Govt. of India

# Winter School In Geospatial Science and Technology (Level 1)

**15 November-05 December 2021**  
**In Online Mode**

**Organized by**

Department of Geography,  
Gauhati University, Guwahati,  
Assam, India

**Supported by**

National Geospatial Program,  
Department of Science and  
Technology, Government of  
India, New Delhi

at  
**Department of Geography,  
Gauhati University, Guwahati,  
Assam, India**

## **Principal Investigator**

Dr . Anup Saikia, Professor, Department of Geography, Gauhati University, Guwahati, Assam

## **Co- Investigator**

Dr. Manash J. Nath, Assistant Professor, Gauhati University, Guwahati, Assam

## Gauhati University, Guwahati

Gauhati University is the oldest and one of the most renowned universities in North East India. It was established in 1948. It is a teaching-&-affiliating university accredited with grade "A" by National Assessment and Accreditation Council. Starting with 18 affiliated colleges and 8 Post Graduate Departments in 1948, Gauhati University, today, has 39 Post Graduate Departments, besides IDOL (Institute of Distance and Open Learning), a constituent Law and Engineering College. It has 341 affiliated colleges offering undergraduate and post graduate courses in the faculties of Arts, Science, Commerce, Law, and Engineering. Gauhati University is a member of the Association of Indian Universities and the Association of Commonwealth Universities. The alumni of this university have been able to make their mark not only within the state but at the national level as well. Visit us on: <https://www.gauhati.ac.in/>

## Department of Geography

Established in 1948, the Department of Geography, Gauhati University is one of the oldest geography departments of the country. India's north east, the initial hinterland of the department, continued to be a terra incognita even after the country's independence. Directed thus by the prevalent situation, curiosity and compulsion, the then faculties of the department decided to set a goal, rather a mission, towards understanding the geographical fabric of the region. The Department is actively involved in teaching, research and extension activities. It is engaged in providing regular courses in M.A./M.Sc., M.Phil. and Ph.D. The University Grants Commission has supported the Department of Geography under Special Assistance Programme (SAP) at DRS- III level for five years (2013-2018) with two thrust areas: Environmental Resources and Sustainable Development in N.E. India and Population and Development in N.E. India. The teaching and research programs of the Department have been reoriented as per the thrust areas identified under SAP. With a spirit of knowledge and information sharing, the Department has initiated inter-university collaborative work in the field of Climate Change and associated issues with Kagawa University, Japan. Visit us on: <https://www.gauhati.ac.in/academic/science/geography;>



## What is the Summer/Winter Schools (Level 1) Capacity Building Program in Geospatial Science and Technology

Recently knowledge has been identified as the most important driving factor for India's sustainable economic growth. India has adopted a new information regime for sustainable economic growth through its 'Digital India' program to support good governance, sustainable development goals and empowerment of its citizens. Over the last three decades, the widespread adoption of geospatial technologies into various sectors have proven to be an effective enabler to meet these challenges. The capacity building program initiatives of the National Geospatial Program (NGP) erstwhile Natural Resource Data Management System (NRDMS) Department of Science and Technology, Government of India to develop national capacity for geospatial science and technology development through diverse programs in collaboration with various partner organizations adaptation capacity of geospatial science and technology at across the country. The objective of the program is to build knowledge and various levels of governance in collaboration with academia and user agencies. The 21-day summer/winter school in Geospatial Science and Technology (Level 1) supported by the Natural Resource Data Management System of the Department of Science and Technology, Government of India focuses on developing knowledge and capacity building in geospatial technologies through the use of open source geospatial software. The three week Summer/ Winter School in Geospatial technology is being conducted at two levels– Level 1 and Level 2.

### Who can apply?

Faculty members, scientist, technologist, researchers from academia, national institutes of research, smart city cells, municipal corporations and other government departments, personnel from non government organizations are eligible to apply. Only 2-3 seats at each centre are reserved for research scholars.

### How to apply?

- Interested candidates should fill the online application form through the weblink available on <http://dst-iget.in>.
- Selected candidates will be informed by mail.
- For any further queries write to [dst-iget@bviier.edu.in](mailto:dst-iget@bviier.edu.in) or call on +91-20-24375684/24362155.
- Address all queries to PI through Email.

## Important Information

**Last date for registration :** 30 September 2021

**Dates of the program:** 15 November-05 December 2021

**Mode of conduct:** Online

**Number of seats:** 25-30

**Registration Fees:** Nil

**Principal Investigator:** Dr . Anup Saikia, Professor,  
Department of Geography, Gauhati University, Guwahati, Assam

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**Co-Investigator:** Dr. Manash J. Nath, Assistant Professor,  
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### For any queries contact:

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781014,Guwahati, Assam

## Grading and Certification

Participants will be assessed based on assignments completed during the course, a mini project are expected to complete, active participation during the training program as well as attendance.

**Note:** Participants must ensure that they have a laptop and a strong internet connection. purposes.

## Infrastructure at Department of Geography

Gauhati University The Department has two laboratories with modern sophisticated instruments.

Geoinformatics Laboratory: Established with funds provided by the DST under FIST, UGC under SAP and Govt. of Assam. This Lab is equipped with Remote Sensing, GIS and GPS facilities including instruments, softwares and spatial data. Fluvial Geomorphology Laboratory: Equipped with some modern instruments for soil and fluvio-geomorphological analysis. The department has 10 permanent faculty members with four members possessing expertise in GIS and Remote sensing.



**Fig 1. Department of Geography**



**Fig 2. Well equipped state of art laboratories**

## Program schedule for 21 Days Winter School (Level 1) in Geospatial Science and Technology (15 November-05 December, 2021)

Sl No.	Topic	Time (Hours)		Resource Person
		Theory	Practical	
<b>WEEK 1</b>				
<b>Day -1 Date : 15/11/2021 Monday</b>				
1	<b>Introduction to geospatial science and technology: What, why, how</b> <ul style="list-style-type: none"> <li>• Introduction to the concept of geospatial science and technology</li> <li>• Introduction to UNGGIM / geospatial SDG indicators</li> <li>• Applications in diverse fields such as environmental sciences, ecology, social sciences, political science, physical and economic geography, biodiversity, livelihood, natural resource management, urban planning, watershed management, marine sciences, disaster management</li> <li>• Advances in geospatial technology: big data analytics, AI, drones, IoT</li> </ul> <p>This session will use case studies, videos to introduce the applications</p>	4 hrs		Video & PPT from DST, Gol, New Delhi
2.	<b>Introduction to data types in geospatial sciences</b> <ul style="list-style-type: none"> <li>• Spatial and non spatial data types (aerial photos, remote sensing, toposheets, databases, drones, etc.)</li> <li>• Data sources (spatial and non spatial) and secondary data acquisition</li> <li>• Assessing quality of data</li> </ul>	2 hrs		Dr. A.K.Bora Geography Dept., Gauhati University
<b>Day -2 Date : 16/11/2021 Tuesday</b>				
3	<b>Hands on session 1</b> Acquisition of free satellite data from Bhuvan, USGS, ESA, acquiring toposheets from SOI, ordering of IRS data  A. Introduction to QGIS interface and functions		4 hrs	Dr. D. Sahariah Geography Dept., Gauhati University

4.	<b>Basic geodesy</b> <ul style="list-style-type: none"> <li>• Spherical, ellipsoidal and geoidal earth, geographical co-ordinates, Co-ordinate systems: Plane co-ordinate system, Geographic co-ordinate system</li> <li>• Map projections: Scale factor and transformation, distortions resulting from map transformations, properties of map projections, classification of map projections, aspects of map projections, some commonly used projections (UTM,LCC), selection of a particular projection, geo-referencing, relationship between co-ordinate systems and map projections</li> <li>• Geodetic datum-concept and types</li> </ul>	3 hrs		Dr. B. K. Kar Geography Dept., Gauhati University
<b>Day -3 Date : 17/11/2021 Wednesday</b>				
5.	<b>Hands-on Session 2</b> Working with projections using QGIS (use IGET_GIS_002) <ul style="list-style-type: none"> <li>• Using existing projection</li> <li>• Making a new projection</li> <li>• Importing a projection</li> </ul>		2 hrs	Dr. M.J. Nath Geography Dept., Gauhati University
6.	<b>Data Quality</b> Understanding data quality <ul style="list-style-type: none"> <li>• Elements of data quality</li> <li>• Sources and types of errors in geospatial data building</li> <li>• Importance of metadata</li> <li>• Measures of accuracy</li> </ul>		2 hrs	Dr. A. Saikia Geography Dept., Gauhati University
7.	<b>Hands-on Session 3</b> Georeferencing ( Use IGET_GIS_003 )		3 hrs	Dr. D. Sahariah Geography Dept., Gauhati University
<b>Day -4 Date : 18/11/2021 Thursday</b>				
8.	<b>Hands-on Session 4</b> Extracting data (Use IGET_GIS_004)		3 hrs	Dr. A. Saikia Geography Dept., Gauhati University



9.	<b>Digital Cartography</b> <ul style="list-style-type: none"> <li>• Cartographic evolution</li> <li>• Map classification</li> <li>• Map elements</li> <li>• Principles of map design</li> </ul> <p>Exercise: Analysis of good and bad maps</p>	2 hrs		Dr. B. K. Kar Geography Dept., Gauhati University
10	<b>Hands-on Session 5</b> Map preparation (Use IGET_GIS_006)		3 hrs	Dr. M.J. Nath Geography Dept., Gauhati University

**Day -5 Date : 19/11/2021 Friday**

11.	<b>Database</b> <ul style="list-style-type: none"> <li>• Introduction to database and database management systems, importance of databases in GIS</li> <li>• Database structures</li> <li>• Database data models: Hierarchical model, network model, relational database model, object oriented data model</li> <li>• Database creation, linking spatial and attribute data, GIS database applications</li> <li>• Challenges in database creation</li> </ul>	1.5 hrs		Dr. A. Saikia Geography Dept., Gauhati University
	<b>Geospatial technologies and SDGs</b> The role of geospatial science and technology in the context of the SDGs and India's steps in this direction	1.5 hrs		(Resource person to be decided)
12	<b>Hands-on Session 6</b> Data exploration (Use IGET_GIS_007)/ Working with tables (use IGET_GIS_008)		3 hrs	Dr. U.D. Baruah Geography Dept., Gauhati University
13	<b>Spatial Analysis</b> <ul style="list-style-type: none"> <li>• Measurements</li> <li>• Queries</li> <li>• Buffering and neighbourhood functions</li> <li>• Map overlay</li> <li>• Spatial analysis</li> <li>• Multicriteria analysis</li> <li>• Network Analysis</li> </ul>	3 hrs		Dr. D. Sahariah Geography Dept., Gauhati University

**Day -6 Date : 20/11/2021 Saturday**

14	<b>Hands-on Session 8</b> Working with queries (use IGET_GIS_009)		3 hrs	Dr. U.D. Baruah Geography Dept. Pragjyotish College
15	<b>Introduction to Global Navigation Satellite Systems (GNSS)</b> <ul style="list-style-type: none"> <li>• Introduction, GNSS segments, GNSS satellite generations, current GNSS satellite constellation working principle</li> <li>• GNSS working principle, GNSS signal structure, types of GNSS receivers, pseudo range measurements, carrier phase measurements, cycle slips</li> <li>• GNSS errors and biases</li> <li>• Methods of GNSS observations</li> <li>• GNSS applications</li> </ul>	3 hrs		Dr. D.Deka Geography Dept., Gauhati University
16	<b>Hands-on Session 10</b> Field exercise for collecting points using a hand held system Importing location data into QGIS (Use IGET_GIS_011)		3 hrs	Dr. M.J. Nath Geography Dept., Gauhati University
<b>Day -7 Date : 21/11/2021 Sunday</b>				
17.	<b>Initiation of project topic selection</b>			Dr. A. Saikia Geography Dept., Gauhati University
<b>WEEK 2</b>				
<b>Day -8 Date : 22/11/2021 Monday</b>				
18	<b>Introduction</b> <ul style="list-style-type: none"> <li>• Definition and concept of remote sensing; Components of remote sensing, natural remote sensing, artificial remote sensing, passive and active remote sensing</li> <li>• Platforms of remote sensing-aircraft,satellites</li> <li>• Remote sensing data collection: The remote sensing process-statement of the problem, identification of in-situ and remote sensing data requirements.</li> <li>• Applications of remote sensing in various fields such as forestry, mining, watershed, urban planning, agriculture and advantages and limitations of remote sensing</li> <li>• Introduction to Earth Resource Satellites operating: LANDSAT Series, IRS series,</li> </ul>	3 hrs		Dr. A. K. Bora Geography Dept., Gauhati University

	Meteorological satellites, Ocean monitoring satellite			
19.	<p><b>Physics of remote sensing</b></p> <ul style="list-style-type: none"> <li>• Electro radiation models (Wave model of electromagnetic energy, the Particle Model- Radiation from atomic structures);</li> <li>• Energy-matter interactions in the atmosphere (Refraction, scattering and absorption, reflectance)</li> <li>• Atmospheric windows and types of remote sensing systems</li> <li>• Energy matter interactions with the terrain (hemispherical reflectance, absorptance and transmittance, spectral reflectance of vegetation, water body and soil spectral response patterns)</li> <li>• Radiant Flux Density (Irradiance and radiance exitance)</li> </ul>	3 hrs		Dr. D. Deka Geography Dept., Gauhati University
<b>Day -9 Date : 23/11/2021 Tuesday</b>				
20.	<p><b>Elements of visual interpretation</b></p> <p>Factors governing the interpretability, elements of image interpretation with examples</p> <p>Methods of search: Use of collateral information, convergence of evidence, the multi concept</p> <p><b>Image Quality Assessment and Statistical Evaluation</b></p> <ul style="list-style-type: none"> <li>• Significance of the histogram in digital image processing</li> <li>• Univariate descriptive image statistics: measures of central tendency, measure of dispersion, skewness</li> </ul> <p>Multivariate image statistics: covariance in multiple bands, correlation between multiple bands</p>	3 hrs		Dr. D. Sahariah Geography Dept., Gauhati University
21	<p><b>Hands-on Session 12</b></p> <p>Intro to SAGA (Use IGET_RS_001)</p> <p>mage interpretation (Use IGET_RS_002)</p>		3 hrs	Dr. Krishna Das Pragjyotish College Guwahati

22	<p><b>Hands-on Session 14</b></p> <p>Understanding the image (histogram) (Use IGET_RS_003)</p> <p>Ex: Image registration (use IGET_RS_0004)</p>	3 hrs	Dr. Krishna Das Pragjyotish College Guwahati
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**Day -10 Date : 24/11/2021 Wednesday**

23	<p><b>Image rectification and restoration</b></p> <ul style="list-style-type: none"> <li>• Radiometric correction: random bad pixels, line or column drop-outs, partial line or column dropouts, line start problems, n-line stripping</li> <li>• Atmospheric effects and correction</li> <li>• Geometric correction: Internal and external geometric error, types of geometric correction- image to map rectification, image to image registration, hybrid approach to image rectification/registration</li> <li>• Intensity interpolation: nearest neighbour, bilinear interpolation</li> </ul>	3 hrs	Dr. D. Sahariah Geography Dept., Gauhati University
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24	<p><b>Introduction to image enhancements</b></p> <ul style="list-style-type: none"> <li>• Contrast enhancements</li> <li>• Band rationing</li> <li>• Spatial filtering</li> <li>• Principal Components Analysis</li> <li>• Vegetation Indices (NDVI, SAVI, NBR,mNDWI)</li> </ul>	2 hrs	Dr. A. Saikia Geography Dept., Gauhati University
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25	<p><b>Hands-on Session 16</b></p> <p>Working with images – subsetting and mosaicking (Use IGET_RS_005)</p> <p><b>Hands-on Session 17</b></p> <p>Using enhancements (use IGET_RS_006 )</p>	3 hrs	Namita Sharma, Geography Dept., Gauhati University
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**Day -11 Date : 25/11/2021 Thursday**

26	<b>Image classification</b> <ul style="list-style-type: none"> <li>• Introduction: Parametric and non-parametric method</li> <li>• Supervised classification: LULC classification levels, Stage involved in classification, Maximum Likelihood Classifier, neural networks, and random forests etc.</li> <li>• Unsupervised classification methods, K-means clustering and ISODATA</li> <li>• Hybrid classification and Knowledge based classification by incorporating ancillary data in the classification process</li> <li>• Validation of classification: Error matrix and Kappa statistics</li> </ul>	3 hrs		Dr. A. Saikia Geography Dept., Gauhati University
27	<b>Hands-on Session 18</b> Extracting information for satellite image using unsupervised classification (Use IGET_RS_007)		3 hrs	Dr. M.J. Nath Geography Dept., Gauhati University
28	<b>Hands-on Session 19</b> Ex: Extracting information for satellite image using supervised classification (Use IGET_RS_008)		3 hrs	Dr. M.J. Nath Geography Dept., Gauhati University
<b>Day -12 Date : 26/11/2021 Friday</b>				
29	<b>Hands-on Session 20</b> Ex: Accuracy assessment (Use IGET_RS_009)		2 hrs	Dr. C.Prakasam Geography Dept., Assam University
30	<b>Digital change detection</b> Steps required to perform change detection, change detection algorithms	2 hrs		Dr. A. Saikia Geography Dept., Gauhati University
31	<b>Hands-on Session 21</b> Ex: Change detection with SAGA (use IGET_RS_011)		3 hrs	Dr. K. Bungnamei Geography Dept., Gauhati University
<b>Day -13 Date : 27/11/2021 Saturday</b>				
32	<b>Introduction to Google earth engine</b> Introduction, Code editor, Accessing EO datasets, Visualization and analysis of remote sensing images	3 hrs		Resource person from NESAC, DoS Shillong (to be finalised)

33	<b>Understanding Terrain Data</b> Introduction to DEM, DTM, DSM Satellite images and applications	2 hrs		Dr. S. Ojha Nagaon Girls' College
34	<b>Hands-on Session 22</b> Ex: Terrain analysis (Use IGET_RS_010)		2 hrs	Dr. S. Ojha Nagaon Girls' College
<b>Day -14 Date : 28/11/2021 Sunday</b>				
35	<b>Project Work</b> Discussion of possible minor projects to be done by the participants. Institutions to give projects according to data available with them or using data that can be generated easily.		3 hrs	
<b>WEEK 3</b>				
<b>Day -15 Date : 29/11/2021 Monday</b>				
36	<b>Hands-on Session 23</b> Exercise on spatial data analysis (Use IGET_SA_001)		3 hrs	Dr. Krishna Das Pragjyotish College
37	<b>GIS and Biodiversity</b> <ul style="list-style-type: none"> <li>• What is biodiversity and its spatial ramifications</li> <li>• Species distribution and displaying biodiversity data</li> <li>• Climate change effects on different species</li> </ul>	3 hrs		Dr. A. Saikia Geography Dept., Gauhati University
<b>Day -16 Date : 30/11/2021 Tuesday</b>				
38	<b>Hands on Session 24</b> Species distribution mapping and assessment using DIVA-GIS, Bioclim and Ecocrop		3 hrs	Dr. A. Saikia Geography Dept., Gauhati University

39	<b>Applications of geospatial technologies</b> <ul style="list-style-type: none"> <li>• Applications on RS/GIS in planning (urban/rural) with specific case studies highlighting detailed methodology(advanced)</li> <li>• Applications of RS/GIS in natural resource management (forest, wildlife/agriculture/watershed) with specific case studies highlighting detailed methodology (advanced)</li> <li>• Applications of RS/GIS in climate studies with specific case studies highlighting detailed methodology(advanced)</li> <li>• Advances inRS/GIS</li> <li>• Use of RS/GIS in SDGs, social sector, development of geospatial indicators</li> <li>• Introduction to the work of the UNGGIM</li> </ul>	5 hrs		(To be finalized)
<b>Day -17 Date : 01/12/2021 Wednesday</b>				
40	<b>Working on projects</b>		6 hrs	
<b>Day -18 Date : 02/12/2021 Thursday</b>				
41	<b>Working on projects</b>		6 hrs	
<b>Day -19 Date : 03/12/2021 Friday</b>				
42	<b>Working on projects</b>		6 hrs	
<b>Day -20 Date : 04/12/2021 Saturday</b>				
43	<b>Final project presentation by participants (group wise)</b>		4 hrs	
44	<b>Evaluation of participants by a Test</b> Multiple Choice Question: 30 Marks Hands on practical session: 20 marks		2 hrs	

**Day -21 Date : 05/12/2021 Sunday**

<b>45</b>	<b>Feedback and Valedictory</b>			
	<b>Total Hours</b>	54 hrs	79 hrs	