M.A./M.Sc. (Two Years Degree Program)	
Second Semester	
Subject-Geography	
Code of the Course	GEG8002P
Title of the Course	BASICS OF REMOTE SENSING AND GEOGRAPHICAL INFORMATION SYSTEM
Qualification Level of the Course	NHEQF Level 6.5
Credit of the course	4
Type of the course	Discipline Centric Core Practical Course in Geography
Delivery type of the Course	Practical (80+40). The 80 hours for content delivery include hands-on exercises, and 40 hours of diagnostic assessment, formative assessment, and subject/ class activity, problem solving.
Prerequisites	Fundamental understanding of geographical concepts & phenomena
Co-requisites	Basic computer knowledge
Objectives of the course	To develop fundamental understanding of geospatial technology by providing conceptual learning and technical skills in the fields of remote sensing, photogrammetry, digital cartography and GIS through open source and proprietary softwares.
Learning outcomes	• To develop basic understanding of Geospatial Technology. • To develop basic working geospatial skills. • To develop skill for use of aerial photographic techniques and instruments. • To understand various aspects of digital images acquired from satellites. • To create a strong foundation for students planning to opt for employment as GIS analyst and consultancy as their career.
Syllabus पाठ्यक्रम	
UNIT - I	*Fundamentals of Remote Sensing* Remote Sensing Process and Principles, Electromagnetic Radiation (EMR) Spectrum, Laws of radiation, EMR interaction with earth's surface and Atmosphere. Spectral Signature. Spectral reflectance curves of vegetation, soil and water. Resolutions:

	Spatial, Spectral, Radiometric, Temporal. Visualization of multiband data – color composites: TCC, FCC, Pseudo color composite.
	सुदूर संवेदन के आधारभूत सिद्धांत सुदूर संवेदन प्रक्रिया एवं नियम, विद्युत चुम्बकीय विकिरण (ई.एम.आर.) स्पेक्ट्रम, विकिरण के नियम। ऊर्जा अन्योन्यक्रिया: वायुमंडलीय स्तर एवं पृथ्वी पर। स्पेक्ट्रल सिग्नेचर। वनस्पति, मिट्टी एवं पानी के स्पेक्ट्रल परावर्तन वक्र। विभेदन: धरातलीय, स्पेक्ट्रल, रेडियोमेट्रिक एवं कालिक। मल्टीबैंड डेटा का दृश्यांकन - रंग कंपोजिट: टी.सी.सी., एफ.सी.सी. एवं छद्म-रंग कंपोजिट।
UNIT - II	*Fundamentals of Aerial Photography* Concept and Development of aerial photography. Types of aerial photographs. Factors affecting quality of aerial photographs. Aerial photographs versus maps. Pocket stereoscope and mirror stereoscope. Geometry of aerial photographs, Stereogram, stereo triplet and mosaic. Photographic scale, measuring height of object, Relief displacement. **वायु चित्रों के आधारभूत सिद्धांत** वायु फोटोग्राफी की अवधारणा एवं विकास। वायु चित्रों के प्रकार। वायु चित्रों की गुणवत्ता को प्रभावित करने वाले कारक। वायु चित्र एवं मानचित्र। पॉकेट स्टीरियोस्कोप एवं मिरर स्टीरियोस्कोप। वायु चित्रों की ज्यामिति, स्टीरियोग्राम, स्टीरियो ट्रिपलेट एवं मोज़ेक। फोटोग्राफिक मापनी, वस्तु की ऊंचाई मापन, उच्चावच विस्थापन।
UNIT - III	Satellite orbits & platforms: geo-synchronous and polar satellites, active and passive systems. Sensor types: Along Track, Across Track. Major satellite programs - Sensor specifications: NOAA, Landsat, IRS, SPOT, SENTINEL and World-View satellite systems. Selection and acquisition of satellite data (USGS and Bhuvan NRSC). Basic introduction to thermal, hyperspectral and microwave remote sensing. उपग्रह कक्षाएँ एवं प्लेटफ़ॉर्म: भू-स्थैतिक उपग्रह एवं ध्रुव कक्षीय उपग्रह, सक्रिय एवं निष्क्रिय संवेदक। सेंसर प्रकार: ट्रैक के अनुरूप, क्रॉस-ट्रैक। प्रमुख उपग्रह कार्यक्रम - सेंसर विनिर्देश: नोवा, लैंडसैट, आईआरएस, स्पॉट, सेंटिनल एवं वर्ल्ड-व्यू उपग्रह सिस्टम। उपग्रह डेटा का चयन एवं अधिग्रहण (यूएसजीएस एवं भुवन एनआरएससी)। तापीय, हाइपरस्पेक्ट्रल एवं माइक्रोवेव सुदूर संवेदन का परिचय।
UNIT - IV	*Fundamentals of GIS* Definition, evolution and components of GIS. Data models: raster and vector data models. Datums, ellipsoid, geoid. Projected and Geographic Coordinate Systems, UTM coordinate system. Geometric rectification (Georeferencing). Attribute data input and management: data types, data entry, joining and relating tables. Attribute data manipulation. Thematic Data modeling. Spatial data

	editing: generation of vector layers. Data visualization. **जीआईएस के आधारभूत सिद्धांत** जीआईएस की परिभाषा, विकास एवं घटक। डेटा मॉडल: रास्टर एवं वेक्टर डेटा मॉडल। डेटम्स, गोलाभ, जियोइड। प्रक्षेपित एवं भौगोलिक निर्देशांक प्रणाली, यूटीएम निर्देशांक प्रणाली। ज्यामितीय परिवर्तन (जियोरेफरेंसिंग)। लक्षण आंकड़े प्रविष्टि एवं प्रबंधन: आंकड़ों के प्रकार, आंकड़े प्रविष्टि, तालिका जोड़ना एवं सम्बंधित करना। विषयगत आँकड़ा प्रतिरूप। लक्षण आंकड़ा परिचालन। स्थानिक डेटा संपादन: वेक्टर परतों को उत्पादन। डेटा दृश्यांकन।
UNIT - V	Image Enhancement techniques: Linear stretching and histogram equalization. Elements of visual image interpretation. Applications of RS GIS: LULC Change, Forest change, Urban sprawl, facility distribution. Thematic map generation using digital/ analog satellite image, aerial photographs. Map composition in QGIS. इमेज उच्चीकरण तकनीकें: रेखीय प्रसरन एवं हिस्टोग्राम प्रसामन्यीकरण। दृश्य इमेज विश्लेषण के तत्व। आरएस-जीआईएस के अनुप्रयोग: एल.यू.एल.सी. परिवर्तन, वन परिवर्तन, नगरीय प्रसार, सुविधा वितरण। डिजिटल/ एनालॉग उपग्रह चित्र, वायु चित्र एवं मानचित्र संरचना का उपयोग। मानचित्र निर्माण।
Practical Exercises	1. Data acquisition & accessing satellite data of area of interest. *(02 exercises)* 2. Data import and subset. *(02 exercises)* 3. Observation and identification of earth's features in various spectral bands and different types of images (PAN/ multi-spectral). *(01 exercise)* 4. Image display – Grey scale, pseudo color, TCC, FCC. *(04 exercises)* 5. Observation of spectral profiles of water, soil and vegetation. *(01 exercise)* 6. Image enhancement: Linear stretching, Histogram Equalization and interpretation of results. *(02 exercises)* 7. Stereo test using Pocket Stereoscope. *(01 exercise)* 8. Object identification using mirror stereoscope. *(01 exercise)* 9. Calculation of photo base & flight line in aerial photo. *(01 exercise)* 10. Determination of aerial photo scale. *(01 exercise)* 11. Georeferencing of toposheet. *(01 exercise)* 12. Generation of thematic maps of natural and cultural landscape using QGIS and Google Earth. *(02 exercises)* 13. Generation of thematic maps of natural and cultural landscape using analog/ digital satellite image/ aerial photographs. *(02 exercises)*

	14. Computation of area. *(01 exercise)*
	One local field trip of Udaipur city or neighboring area for ground truthing of earth features on satellite image & aerial photographs and collection of geocoded information for map generation.
	Suggested Reading **सहायक ग्रन्थ / सामग्री**
Text Books	• Lillesand, T.M. and Kiefer, R.W., 2015. *Remote Sensing and Image Interpretation*. 7th Edition, Wiley, New York. • Chang, Kang-tsung, 2003. *Introduction to Geographical Information Systems*. Tata McGraw Hill Publ. Co., New Delhi • Chauniyal, D.D., 2004. *Remote Sensing and Geographical Information Systems* (**in Hindi)**, Sharda Pustak Bhawan, Allahabad • American Society of photogrammetry: Manual of remote sensing, ASP, Falls Church, VA, 1983.
Reference Books	• Jensen, J.R., 2005. *Introductory Digital Image Processing: A Remote Sensing Perspective*. 3rd Edition, Prentice Hall, Upper Saddle River, 505-512. • Lo, C.P. and Yeung, Albert K. W., 2002. *Concepts and Techniques of Geographic Information Systems*. Prentice Hall of India, New Delhi. • Longley, P., Goodchild, M.F., Maguire, D. and Rhind, D., 1999. *Geographic Information Systems. Principles, Techniques, Management, Applications*. John Wiley, New York. • Reddy, M. Anji, 2001. *Textbook of Remote Sensing and Geographic Information Systems*. B. S. Publs., Hyderabad. • Vyas P.R., 2014. *Remote Sensing and Geographical Information System: Basics and Applications*, Rawat Publications, Jaipur.
Suggested E-resources	• *Ebook on Remote Sensing Applications,* www.**nrsc**.gov.in/Learning_Centre_**EBook**.html • *E-Tutorial on Fundamentals of Remote Sensing*, Canada Centre for Mapping and Earth Observation, Natural Resources Canada, accessible at http://www.nrcan.gc.ca/earth-sciences/geomatics • www.qgistutorials.com • http://www.pasda.psu.edu/tutorials/gisbasics.asp • https://earth.google.com • bhuvan.nrsc.gov.in • india-wris.nrsc.gov.in • https://openstreetmap.org • http://openstreetmap.in