

# GUJARAT TECHNOLOGICAL UNIVERSITY

## COMPUTER ENGINEERING (SOFTWARE ENGINEERING) (02)

GLOBAL INFORMATION & POSITIONING SYSTEM

SUBJECT CODE: 2720210

SEMESTER: II

**Type of course:** Regular

**Prerequisite:** None

**Rationale:** NA

**Teaching and Examination Scheme:**

Teaching Scheme			Credits C	Examination Marks						Total Marks
L	T	P		Theory Marks		Practical Marks				
			ESE (E)	PA (M)	ESE (V)		PA (I)			
					ESE	OEP	PA	RP		
3	2#	2	5	70	30	20	10	10	10	150

**Content:**

Sr. No.	Content	Total Hrs	Weightage %
1	<p><b>Introduction To Remote Sensing:</b>  <b>Concept and scope of Remote Sensing (RS):</b> Definitions, Physical basis, process and characteristics of RS, History, Advantages and limitations  <b>Concept of Electromagnetic Radiation (EMR):</b> Wavelength-frequency-energy relationship of EMR, EMR Spectrum , Atmospheric windows, Interaction of EMR with matter, Spectral signatures , Electromagnetic Energy, Energy flow in sensors  <b>Basics of Optical,Thermal and Microwave RS, RS Scenario in Indian Context,</b>  <b>Sensors:</b> Imaging and non-imaging sensors, Active and passive sensors, Resolution of Sensors - Spectral, Spatial, Radiometric &amp; Temporal, Scale, Mapping unit, Multi-band concepts and False Colour Composites  <b>Remote Sensor Platforms and Satellite Orbits:</b> Ground, Airborne and Space borne Platforms, Orbital Characteristics – Coverage, Passes, Pointing Accuracy, Geostationary, Sun synchronous, shuttle orbit. Semisynchronous orbit (Molniya orbit) and Quasi-zenith satellite orbit  <b>Satellite Basics:</b> Kepler’s laws, Major-Semimajor axis &amp; Eccentricity, Velocity, Period (<b>Numerical problems</b>), Launch Vehicle, Escape Velocity  <b>Space Imaging Satellites:</b> Multispectral and Hyperspectral sensors, Radar, Lidar; Specification of some popular satellites – IRS,Landsat, ERS and SPOT series; High resolution satellites – IKONOS, Cartosat, Quickbird, OrbView, GeoEye, Pléiades, WorldView;</p>	08	15
2	<p><b>Digital Image Analysis:</b>                      Digital image processing fundamentals, Geometric corrections, Digital image clasifications,integration of multispectral and multi temporal images,image transformations, ground truth verification and data collection</p>	3	05
3	<p><b>Fundamentals of Geographic Information System (GIS):</b></p>	12	30

	<p><b>Basic Concepts:</b> definition of GIS, Components of GIS, Variables - points, lines, polygon, Functionality of GIS, Areas of GIS application, Advantage and Limitation of GIS</p> <p><b>GIS Data:</b> Spatial , Non spatial and Attribute Data, Information Organization and Data Structures -Raster and Vector data structures, Data file and database</p> <p><b>Creating GIS Database:</b> GIS Softwares, file organization and formats, Geo-database, Rectification, Digitization and Map Composition</p> <p><b>GIS Data Input:</b> Nature and Source of data, Method of spatial data capture - Primary and Secondary, digitization and scanning method, Techniques and procedure for digitizing, Errors of Digitization, Attribute data capture</p> <p><b>Data Editing:</b> Detecting and correcting errors, Re-projection, Transformation and Generalization, Edge matching and Rubber sheeting, Topology, Conversion from Other Digital Sources ,</p> <p><b>GIS and Digital Cartography:</b> Concept of Digital Cartography, Advantages and Disadvantages of Digital Cartography</p> <p><b>Geo- referencing and Geo- coding, GIS and Image processing software</b></p>		
4	<p><b>Introduction to Global Positioning System (GPS):</b> Introduction, Basics knowledge of GPS mapping and softwares, Satellite constellation, GPS signals and data, Geopositioning basic Concepts, NAVSTAR, GLONASS, Indian Regional Navigational Satellite System (IRNSS),</p> <p><b>GPS segments :</b> Control Segment, Space Segments, User Segment;</p> <p><b>GPS Positioning Types:</b> Absolute Positioning, Differential positioning;</p> <p><b>Working Principle of GPS:</b> Simple navigation- Satellite ranging; Calculating distance to the satellites- error sources; Differentially corrected position- reference receiver- rover receiver</p> <p><b>Geodetic Aspects:</b> GPS coordinate system- local coordinate system- map projection and plane coordinates- the universal traverse Mercator Projector</p> <p><b>GPS Surveying Methods and Accuracy:</b> Topographical maps, interpretation of topographical maps, Types of survey of India ( SOI) Topographical maps, Methods-Static &amp; Rapid Static, Kinematic-Real Time Kinematic Survey- DGPS-GPS Data Processing and Accuracy, Factors Affecting GPS Accuracy</p> <p><b>Reference Station:</b> Selection of reference station, reference station Equipment, Radio and its types, Radio Antenna</p> <p><b>Mobile Mapping and GPS Applications:</b> Mobile Mapping basic concepts and Applications , GPS Application in Surveying and Mapping</p>	12	30
5	<p><b>Application of RS, GIS and GPS:</b> Coastal zone management, Landform studies, Land use/cover mapping, Tracking water resources ( Surface and underground Water mapping), Weather monitoring, Snow and glacier studies, Mineral resources and mining impact studies;</p> <p><b>Use of RS and GIS for Rural development:</b> Agriculture and watershed management, Socio economic analysis, Agricultural Information System- Land Holdings,- Irrigation, Land used, Land reforms, Village Information system and planning;</p> <p><b>Web GIS:</b> Vehicle Tracking System, Mobile mapping, Location based services, Intelligent Transportation Systems, Urban planning, Resource management, Real Estate</p> <p><b>GPS Applications in different fields, Integration of GPS and GIS- Role of GPS and GIS in remote sensing</b></p>	10	20

## Reference Books:

1. Joseph, George. 2005, Fundamentals of Remote sensing, 2<sup>nd</sup> edition, University Press India
2. LO, C.P. and K.W. Yeung. 2009, Concept and Technologies of Geographic Information Systems, 2<sup>nd</sup> edition PHI Learning
3. C.S. and Garg P.K. 2000, Remote Sensing, A. H. Wheeler and Co. Ltd.
4. Roy P.S. , Geographical Information Scienc, Reference material, Volume I , IIRS 2000
5. Burrough P. A. , Mac Donneli R.A., Principle of Geographical Information Systems, Oxford University press 2000
6. Lerica , Introduction to GPS
7. Essentials of GPS by N.K. Agarwal

## Course Outcome:

To introduce the student to the physical principles of Remote Sensing, Image Processing, Satellite data acquisition and analysis, GIS, GPS and their applications

## List of Experiments:

1. Interpretation of satellite Imageries:
  - Reading and Displaying satellite data from BIL, BSQ and BIP Formats
  - Supervised and Un-supervised classification: Study of Visual image interpretaion tools and techniques
2. Study of Open Source Remote Sensing software (Eg: ILWIS, OSSIM, ORFEO, OpenEV)
3. Study of latest Space Imaging Satellites
4. Study of Open source GIS software
5. Study of Open source Mobile GIS software and prepare case study for Geospatial web services for mobile GIS
6. Study of Web GIS tools and prepare case study
7. Study of Desktop systems (Grass, gvSIG, QGIS and SAGA)
8. Study of Spatial Referencing and Rectification of Scanned Map
9. Study of Database creation for GIS applications
10. Study of Hand held GPS
11. Study of Geodetic GPS

## Open Ended Problems:

1. **Interpretation of satellite Imageries:**
  - Reading and Displaying satellite data from BIL, BSQ and BIP Formats
  - Supervised and Un-supervised classification: Study of Visual image interpretaion tools and Techniques
2. **Map reading of Survey of India topo sheets.**

Visual interpretation of different satellite data and aerial photographs for the preparation of Following;

  - Land use/land cover map.
  - Water / Vegetation/ Soil portion
3. Digitize a roads map of Any College/ Institute in Arc GIS containing major roads. The roads should not have dangles and properly connected end points.

## List of learning website:

- [www.gpsworld.com](http://www.gpsworld.com)
- [www.gpssociety.com](http://www.gpssociety.com)
- [www.esri.com](http://www.esri.com)

**Review Presentation (RP):** The concerned faculty member shall provide the list of peer reviewed Journals and Tier-I and Tier-II Conferences relating to the subject (or relating to the area of thesis for seminar) to the students in the beginning of the semester. The same list will be uploaded on GTU website during the first two weeks of the start of the semester. Every student or a group of students shall critically study 2 papers, integrate the details and make presentation in the last two weeks of the semester. The GTU marks entry portal will allow entry of marks only after uploading of the best 3 presentations. A unique id number will be generated only after uploading the presentations. Thereafter the entry of marks will be allowed. The best 3 presentations of each college will be uploaded on GTU website.