GUJARAT TECHNOLOGICAL UNIVERSITY

CIVIL AND INFRASTRUCTURE ENGINEERING
GIS & REMOTE SENSING FOR INFRASTRUCTURE
SUBJECT CODE: 2164009
B.E. 6th SEMESTER

Type of Course: Departmental Elective

Prerequisite: Elements of Civil Engineering, Geomatics Engineering.

Rationale:

GIS & Remote Sensing for Infrastructure is providing conceptual understanding and applications of GIS platform for infrastructure sector. With the help of this knowledge students may be able:

1. To develop understanding about Photogrammetry, remote sensing system, Global Navigation Satellite System (GNSS) and GIS.
2. To make measurements using photogrammetric technique, to carryout analysis of remotely sensed data and extract information from it.
3. To conversant with data collection using GNSS systems and Differential GPS.
4. To prepare thematic maps and carryout analysis using GIS technique for an Infrastructure planning project
5. To learn different applications of Photogrammetry, remote sensing system, Global Navigation Satellite System (GNSS) and GIS.

Teaching and Examination Scheme:

Contents:

Sr.No.	Topics	Hrs.	% Weightage
1	**Module-I** **INTRODUCTION:** Introduction to geo-informatics. Conventional methods of mapping. Advanced methods of mapping. Comparison of methods.	4	10%
2	**Module-II** **REMOTE SENSING:** Introduction to Aerial Photogrammetry, Introduction to Electromagnetic Spectrum (EMR), interaction of EMR with atmosphere and target, Resolutions: Spatial, temporal, spectral and radiometric, sensor characteristics, satellite data products, digital imaging, digital image processing, visual image interpretation and microwave remote sensing.	9	20%

3	**Module-III** GNSS and SCANNERS: Global Navigation Satellite System (GNSS) basic concepts, GPS (NAVSTAR), Galileo, GLONASS and Indian Regional Navigation Satellite System (IRNSS). Functional segments of GPS and components. Working principle, factors affecting, GPS setup and accessories, satellites & receivers, Differential GPS (DGPS), Applications of GNSS. Scanners: Introduction, Classification, Principle and Application.	**9**	**20%**
4	**Module-IV** GIS: Structure of GIS: Cartography, Geographic mapping process, GIS data models, database management systems, Raster data representation, Vector data representation, transformations, map projections, Geographic Data Representation, Storage, Quality and Standards, Assessment of data quality, Managing data errors, Geographic data standards. GIS Data Processing, Analysis and Modeling: Raster based GIS data processing – Vector based GIS data processing – Queries – Spatial analysis – Descriptive statistics – Spatial autocorrelation–Quadrant counts, and nearest neighbor analysis – Network analysis – Surface modeling – DEM.	**10**	**20%**
5	**Module-V** **Application of Geoinformatics in Infrastructure projects:** Case studies of applications of geo-informatics to following areas: a. Environmental Impact Assessment b. Water Resources Management c. Transportation (Traffic evaluation, Intelligent Transportation System, Traffic management System). d. Town Planning. e. Geology (Site identification for an Infrastructure project) f. Disaster Management.	**12**	**30%**
	Total	**44**	**100**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20	**20**	**25**	**20**	**15**	**0**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above

Reference Books:

1. M.Anji Reddy (2006), "Remote Sensing and Geographical Information systems", 3rd Edition, B.S.Publications.
2. A.M. Chandra (2007), S.K. Ghosh, "Remote Sensing and Geographical Information System", Narosa Publishing house, 1st Edition, 2007.
3. Kang-tsung Chang (2008), Introduction to Geographic Information Systems, fourth Indian edition, Mc Graw Hill Education (India) Private Limited, New Delhi.
4. Lo, C.P. and A.K.W., Yeung. [2007]. Concepts and Techniques in Geographic Information Systems. 2nd, Upper Saddle River, Prentice Hall (ISBN 0-13-149502-X)

5. Longley, P.A., M.F. Goodchild, D.J. Maguire and D.W. Rhind. [2007]. Geographic Information Systems and Science. 2nd, John Wiley & Sons (ISBN 978-0-470-87001).
6. Lillesand and Kiefer (2008), "Remote Sensing and Image Interpretation", 5th Edition, published by John Wiley and Sons.
7. B. Bhatta, Remote Sensing and GIS, 2nd Edition, Oxford University Press, New Delhi
8. J.R. Jensen, Introductory Digital Image Processing, Prentice-Hall, New Jersey
9. J.R. Jensen, Remote Sensing of Environment: An Earth Perspective, Pearson Education, Delhi, 2004
10. P.A. Burrough and R.A. McDonnell, Principles of Geographical Information Systems, 2nd ed. Oxford, England, Oxford University Press.
11. George Joseph, Fundamentals of Remote Sensing, Universities Press, India, 2005
12. Micheal N Demers, "Fundamental of GIS", 3rd Edition, John Wiley & Sons, 2008.

Course Outcome:

1. Ability to develop Orthographic and Contour maps using aerial photographs and Remote sensing Images
2. Ability to develop maps using Total Station, GIS, GPS, IRNSS and Scanners
3. Ability to create GIS application referencing Spatial features with Attribute data

List of Experiments/Tutorials:

1. Photo interpretation and Photogrammetry
2. Image Registration and Georeferencing
3. Image Interpretation
4. Image classification
5. Application of GIS and GPS
6. Creation of thematic maps
7. Overlay analysis
8. Digital Elevation Modeling
9. Geospatial analysis and Map based Queries

Design based Problems (DP)/Open Ended Problem:

Faculty may give any open ended problem related to image interpretation and analysis, GPS use, digitization, overlay analysis, map based query, spatial analysis and term project from any of the topic's enlisted in module V.

List of Open Source Software/learning website:

https://www.itc.nl;
http://52north.org/ilwis
http://nptel.ac.in/courses/105108077/24
http://nptel.ac.in/courses/105102015/

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.