DEPARTMENT OF CIVIL ENGINEERING

NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

COURSE PLAN – PART I			
Course Title	**Remote Sensing and GIS**		
Course Code	**CEOE10**	**No. of Credits**	**3**
Course Code of Pre-requisite subject(s)			
Session	**July/ Jan. 2018**	**Section (if, applicable)**	**B**
Name of Faculty	**Dr. S. Saravanan**	**Department**	**Civil Engineering**
Email	**ssaravanan@nitt.edu**	**Telephone No.**	**9489104248**
Name of Course Coordinator(s) (if, applicable)	**Dr. K. Muthukumaran**		
E-mail	**kmk@nitt.edu**	**Telephone No.**	
Course Type	☒ **Core course**	☐ **Elective course**	

Syllabus (approved in BoS)

Remote Sensing – Principle - Electro-magnetic energy, spectrum - EMR interaction with atmosphere – Atmospheric Windows and its Significance – EMR interaction with Earth Surface Materials – Spectral Signature and Spectral Signature curves for water, soil and Earth Surface.

Satellites - Classification – Satellite Sensors – satellite and sensor parameters - Resolution – Types of Remote Sensing - Visual Interpretation of Satellite Images – Digital Image processing – Characteristics of different platforms: Landsat, SPOT, IRS series, IKONOS, QUICKBIRD – Radar, LIDAR, SAR, MODIS, AMSRE, Sonar remote sensing systems introduction of GPS- data receiving mode- DTM generation- View shed analysis.

GIS - History of Development - Components of GIS – Hardware, Software and Organizational Context – Data – Spatial and Non-Spatial – Data Input Sources–DBMS – Data Output - Data models - Raster and Vector data structures – Data compression – Raster vs. vector comparison.

Analysis using Raster and Vector data – Operations – Overlaying - Buffering –Modelling in GIS - Digital Terrain Modelling, Analysis and application – Products of DEMs and their uses – Sources of errors in GIS and their elimination.

Applications of Remote Sensing and GIS – Advanced applications of GIS – Disaster management, Water resource, Landuse – Land cover – Urban planning – Intelligent Transport Systems - Development of Resources Information Systems.

References

1. Burrough P.A. and Rachel A. McDonell, Principles of Geographical Information Systems, Oxford Publication, 2004.
2. C.P. Lo and Albert K. W. Yeung, Concepts and Techniques of Geographical Information Systems, Prentice- Hall India, 2006.
3. Thomas. M. Lillesand and Ralph. W. Kiefer, Remote Sensing and Image Interpretation, John Wiley and Sons, 2003.

COURSE OBJECTIVES
To summarize the basic spectral mechanism behind remote sensing and GIS techniques To explain different software for data creation, analysis and modelling To understand geo database development and geo-spatial analysis for environmental applications To apply the image processing techniques for various environmental problems To provide the knowledge of RS and GIS to various disaster, water resource and environmental applications
COURSE OUTCOMES (CO) By the end of this course the students 1. Acquire the knowledge on pre and post processing of satellite images. 2. Incorporate the analytical abilities in the processing and retrieving information from the satellite images. 3. Acquire fundamentals of various geodata and its sources. 4. Understand the geospatial applications to various civil engineering problems. 5. Apply various projections and transform one coordinate system to other coordinate system

Course Outcomes	Aligned Programme Outcomes (PO)
1. Acquire the knowledge on pre and post processing of satellite images.	
2. Incorporate the analytical abilities in the processing and retrieving information from the satellite images.	
3. Acquire fundamentals of various geodata and its sources.	
4. Understand the geospatial applications to various civil engineering problems.	
5. Apply various projections and transform one coordinate system to other coordinate system	

COURSE PLAN – PART II

COURSE OVERVIEW

This course provides an introduction to the fundamentals of GIS and Remote sensing. The components of remote sensing and GIS will be helpful in the processing and retrieving information from the satellite images. Students will develop a strong understanding of the tools and techniques used to display, process, and analyze remotely sensed data. Upon completion of CEOE10 students will be able to develop analytical workflows to derive products and extract information from remotely sensed data for a broad range of applications.

COURSE TEACHING AND LEARNING ACTIVITIES

S.No.	Week/ Contact Hours	Topic	Mode of Delivery
1	Week 1	**Introduction to remote sensing:** Definition of Remote Sensing, types of remote sensing, remote sensing system and components, some examples and uses of remote sensing. **Physics behind remote sensing technique:** • EMR source characteristics, active & passive; Wave Radiation quantities - Radiant energy, radiation flux, irradiation, radiance, emissivity.	PPT & Black board

		• EMR propagation through medium, Role of atmosphere, Atmospheric windows. • Physics of EMR interaction with objects, BRDF, Spectral signature concepts. • EMR (optical and microwave) interaction with vegetation. EMR interaction with soil and water.	
2	**Week 2**	**Satellite orbits:** • Terminology, characteristics of ideal and actual orbit, equations governing satellite orbits. • Geostationary orbit and its design. • Sun-synchronous orbit, characteristics, and design.Global Positioning System (GPS) • Collection and errors in GPS data, Exactly repeating orbits and their use. • Orbital sub-cycles, designing orbits with sub-cycles and benefit.	PPT & Black board
3	**Week 3**	**Digital image and sensor characteristics:** • Concept of digital image, terminology used and CCD. • Sensor characteristics: various resolutions. • FOV, IFOV, point spread function. • Push broom, whisk broom, side looking sensors. • PAN, MS, SLAR; image recording formats. • Various operational satellites and their data products.	PPT & Black board
		Assignment 1	
4	**Week 4**	**Digital image processing concepts:** • Colour representations and transformations • Image histogram and histogram manipulation. • Geometric transformation; Geo-referencing technique • Histogram manipulation for image enhancement. • Image convolution, low pass filters, averaging, median and adaptive filters. • High pass filters, first and second derivatives of image, directional and non-directional filters and their effect.	PPT & Black board
5	**Week 5**	**Preprocessing of remotely sensed data:** • Distortion in remotely sensed data: Geometric and radiometric. • Geo-referencing and GCPs, accuracy indices. • Need of resampling and its methods. • Atmospheric attenuation in data, models for removal of atmospheric errors. • Image registration and ortho-rectification	PPT & Black board
		Assignment 2	
6	**Week 6**	**Assessment- I**	

7	**Week 7**	**Interpretation of satellite data:** • Interpretation elements, manual versus digital interpretation. • Algorithms in image classification • Image fusion and mosaic of images • Introduction to image classification, unsupervised and supervised, Training data sets • Hyperspectral image analysis	PPT & Black board
8	**Week 8**	**Introduction to Geographical Information System and Geodata** • Data type: Raster and vector data • Raster Data formats and vector data formats • Cartography concepts and creation of maps • Digitization techniques and topology • Raster to vector conversion and vice versa	PPT & Black board
9	**Week 9**	**Projection and Transformation for geographical data:** • Datum, Scales and Coordinate system • Geo-referencing and GCPs • Geographic and Projected coordinate system • Types of projection, accuracy indices. • Need of resampling and resampling methods.	PPT & Black board
		Assignment 3	
10	**Week 10**	**Geo Spatial analysis** • Raster Data analysis: Local, neighbourhood and regional operations • Vector Data analysis: Topological analysis, Proximity analysis, non-topological analysis	PPT & Black board
11	**Week 11**	**Geo Spatial analysis** • Buffer and Thiessen polygon • Attribute data analysis: Concepts of SQL • Surface analysis	PPT & Black board
		Assessment - II	
12	**Week 12**	**Applications of Remote sensing and GIS** • Landuse land cover modeling • Derivation of various Vegetation Index • Crop water modeling using GIS	PPT & Black board
		Assignment 4	
13	**Week 13**	**Applications of Remote sensing and GIS** • Coastal applications • Water Resource applications • Disaster applications	PPT & Black board
14	**Week 14**	**Final Assessment**	

COURSE ASSESSMENT METHODS (shall range from 4 to 6)

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	Assessment-I	6thWeek	1 hr	15 marks
2	Assessment-II	11th Week	1 hr	15 marks

3	Assessment III (Assignment 1,2,3 and 4)	3rd, 5th , 9th, 12th Week	1 week time	5 X 4= 20 marks
CPA	Compensation Assessment*	13th Week	1 week time	15 marks
4	Final Assessment *	14th	3 hour	50 marks
Total				**100 marks**

***mandatory; refer to guidelines on page 4**

COURSE EXIT SURVEY (mention the ways in which the feedback about the course shall be assessed)

1. Class committee meetings.
2. Online - Feedback forms submission through MIS.

COURSE POLICY (preferred mode of correspondence with students, policy on attendance, compensation assessment, , academic honesty and plagiarism etc.)

MODE OF CORRESPONDENCE (email/ phone etc)

Email or Phone

ATTENDANCE

Minimum 75% attendance is compulsory for attending the final examination.

COMPENSATION ASSESSMENT

Will be conducted on 13th week covering assessment I and II syllabus.

ACADEMIC HONESTY & PLAGIARISM

Maintain Class Room Decorum and Discipline is highly important.

ADDITIONAL INFORMATION

The Course Faculty Details: Room No.:**201 (Civil- Annexure Building)**
Timings: **10 am - 5 pm.**
Email ID: **ssaravanan@nitt.edu**
Telephone No.: **0431-250-3175**

FOR APPROVAL

Course Faculty _____ **CC-Chairperson** _____ **HOD** _____

Guidelines:

a) The number of assessments for a course shall range from 4 to 6.

b) **Every course shall have a final assessment on the entire syllabus with at least 30% weightage.**