1. Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall.
2. Bradley. A.S; Adebayo,A.O., Maria, P. Engineering applications in sustainable design and development, Cengage learning

Reference Books:

1. Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication
2. ECBC Code 2007, Bureau of Energy Efficiency, New Delhi Bureau of Energy Efficiency Publications-Rating System, TERI Publications - GRIHA Rating System
3. Ni bin Chang, Systems Analysis for Sustainable Engineering: Theory and Applications, McGraw-Hill Professional.
4. Twidell, J. W. and Weir, A. D., Renewable Energy Resources, English Language Book Society (ELBS).
5. Malcolm Dowden, Climate Change and Sustainable Development: Law, Policy and Practice
6. Daniel A. Vallero and Chris Brasier, " Sustainable Design: The Science of Sustainability and Green Engineering", Wiley-Blackwell
7. Sustainable Engineering Practice: An Introduction, Committee on Sustainability, American Society of Civil Engineers

Course Title: Remote Sensing and GIS

Open Elective 1

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER:V

Subject Code	15CV563	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
	CREDITS – 03	**Total Marks-100**	

Course Objectives: This course will enable students to

1. Understand the basic concepts of remote sensing

2. Analyze satellite imagery and extract the required units.

3. Extract the GIS data and prepare the thematic maps

4. Use the thematic maps for various applications

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Level
Module -1		
Remote Sensing: Basic concept of Remote sensing, Data and Information, Remote sensing data collection, Remote sensing advantages & Limitations, Remote Sensing process. Electromagnetic Spectrum, Energy interactions with atmosphere and with earth surface features (soil, water, and vegetation), Resolution, image registration and Image and False color composite, elements of visual interpretation techniques.	8 hours	L1, L2,L3
Module -2		
Remote Sensing Platforms and Sensors: Indian Satellites and Sensors characteristics, Remote Sensing Platforms, Sensors and Properties of Digital Data, Data Formats: Introduction, platforms- IRS, Landsat, SPOT, Cartosat, Ikonos, Envisat etc. sensors, sensor resolutions (spatial, spectral, radiometric and	8 Hours	L2,L3,L4

temporal). Basics of digital image processing- introduction to digital data, systematic errors(Scan Skew, Mirror-Scan Velocity, Panoramic Distortion, Platform Velocity , Earth Rotation) and non-systematic [random] errors(Altitude, Attitude), Image enhancements(Gray Level Thresholding, level slicing, contrast stretching),image filtering.

Module -3		
Geographic Information System: Introduction to GIS; components of a GIS; Geographically Referenced Data, Spatial Data- Attribute data-Joining Spatial and attribute data, GIS Operations: Spatial Data Input – Attribute data Management, Geographic coordinate System, Datum; Map Projections: Types of Map Projections, Projected coordinate Systems. UTM Zones.	8 Hours	L2,L3,L4
Module -4		
Data Models: Vector data model: Representation of simple features – Topology and its importance; coverage and its data structure, Shape file; Relational Database, Raster Data Model: Elements of the Raster data model, Types of Raster Data, Raster Data Structure, Data conversion.	8 Hours	L3,L4,L5
Module -5		
Integrated Applications of Remote sensing and GIS: Applications in land use land cover analysis, change detection, water resources, urban planning, environmental planning, Natural resource management and Traffic management. Location Based Services And Its Applications.	8 Hours	L3,L4,L5,L6

Course outcomes: After studying this course, students will be able to:

1. Collect data and delineate various elements from the satellite imagery using their spectral signature.

2. Analyze different features of ground information to create raster or vector data.

3. Perform digital classification and create different thematic maps for solving specific problems

4. Make decision based on the GIS analysis on thematic maps.

Program Objectives:

*   Engineering knowledge

*   Problem analysis

*   Interpretation of data

Question paper pattern:

*   The question paper will have 5 modules comprising of ten questions. Each full question carrying 16 marks

*   There will be two full questions (with a maximum of three subdivisions, if necessary) from each module.

*   Each full question shall cover the topics as a module

*   The students shall answer five full questions, selecting one full question from each module. If more than one question is answered in modules, best answer will be considered for the award of marks limiting one full question answer in each module.

Text Books:
1. Narayan Panigrahi, **"Geographical Information Science"**, ISBN 10: 8173716285 / ISBN 13: 9788173716287, University Press 2008.
2. Basudeb Bhatta, **"Remote sensing and GIS"**, ISBN:9780198072393, Oxford University Press 2011
3. Kang – Tsurg Chang, **"Introduction to Geographic Information System".** Tata McGraw Hill Eduction Private Limited 2015.
4. Lillesand, Kiefer, Chipman, "Remote Sensing and Image Interpretation", Wiley 2011.

Reference Books:
1. Chor Pang Lo and Albert K.W Yeung, "Concepts & Techniques of GIS", PHI, 2006
2. John R. Jensen, "Remote sensing of the environment", An earth resources perspective – 2nd edition – by Pearson Education 2007.
3. Anji Reddy M., "Remote sensing and Geograperhical information system", B.S. Publications 2008.
4. Peter A. Burrough, Rachael A. McDonnell, and Christopher D. Lloyd, "Principals of Geo physical Information system", Oxford Publications 2004.
5. S Kumar, "Basics of remote sensing & GIS", Laxmi publications 2005.

Course Title: Occupational Health and Safety

Open Elective 1

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER:V

Subject Code	15CV564	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
	CREDITS – 03	**Total Marks-100**	

Course Objectives: This course will enable students to

1. Gain an historical, economic, and organizational perspective of occupational safety and health;

2. Investigate current occupational safety and health problems and solutions.

3. Identify the forces that influence occupational safety and health.

4. Demonstrate the knowledge and skills needed to identify workplace problems and safe work practice

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Level
Module -1		
Occupational Hazard and Control Principles: Safety, History and development, National Safety Policy. Occupational safety and Health Act (OSHA), Occupational Health and Safety administration - Laws governing OSHA and right to know. **Accident –** causation, investigation, investigation plan, Methods of acquiring accident facts, Supervisory role in accident investigation	8 hours	L1,L2,L3
Module -2		
Ergonomics at Work Place: Ergonomics Task analysis, Preventing Ergonomic Hazards, Work space Envelops, Visual Ergonomics, Ergonomic Standards, Ergonomic Programs. **Hazard cognition and Analysis,** Human Error Analysis – Fault Tree Analysis – Emergency Response - Decision for action – purpose and	8 Hours	L2,L3,L4,L5