

<b>Course Title: Solid Waste Management</b> As per Choice Based Credit System (CBCS) scheme] SEMESTER:VI			
Subject Code	15CV651	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
<b>CREDITS -03</b>		<b>Total Marks- 100</b>	
<b>Course objectives:</b> This course will enable students to <ol style="list-style-type: none"> <li>1. Study the present methods of solid waste management system and to analyze their draw backs comparing with statutory rules.</li> <li>2. Understand different elements of solid waste management from generation of solid waste to disposal.</li> <li>3. Analyze different processing technologies and to study conversion of municipal solid waste to compost or biogas.</li> <li>4. Evaluate landfill site and to study the sanitary landfill reactions.</li> </ol>			
Modules		Teaching Hours	Revised Bloom's Taxonomy (RBT) Level
<b>Module -1</b>			
Sources: Sources of Solid waste, Types of solid waste, Physical and Chemical composition of municipal solid waste. Generation rate, Numerical Problems. Collection: Collection of solid waste- services and systems, equipments, Transportation: Need of transfer operation, transfer station, transport means and methods, route optimization. Solid waste management 2000 rules with, 2016 amendments.		8 hours	L1,L2,L3
<b>Module -2</b>			
Processing techniques: Purpose of processing, Chemical volume reduction (incineration) – Process description, 3T's, principal components in the design of municipal incinerators, Air pollution control ,Mechanical volume reduction (compaction), Mechanical size reduction (shredding), component separation (manual and mechanical methods).		8 Hours	L1,L2,L3
<b>Module -3</b>			
Composting Aerobic and anaerobic method - process description, process microbiology, design consideration, Mechanical composting, Vermicomposting, Numerical Problems. Sanitary landfilling: Definition, advantages and disadvantages, site selection, methods, reaction occurring in landfill- Gas and Leachate movement, Control of gas and leachate movement, Design of sanitary landfill. Numerical Problems		8 Hours	L1,L2,L3
<b>Module -4</b>			
Sources, collection, treatment and disposal of :- Biomedical waste ,E-waste ,Hazardous waste and construction waste		8 Hours	L1,L2,L3
<b>Module -5</b>			
Incineration -3Ts factor affecting incineration ,types of incinerations , Pyrolysis ,design criteria for incineration Energy recovery technique from solid waste management		8 Hours	L1,L2,L3
<b>Course outcomes:</b> After studying this course, students will be able to: <ol style="list-style-type: none"> <li>1. Analyse existing solid waste management system and to identify their drawbacks.</li> <li>2. Evaluate different elements of solid waste management system.</li> <li>3. Suggest suitable scientific methods for solid waste management elements.</li> <li>4. Design suitable processing system and evaluate disposal sites.</li> </ol>			
<b>Program Objectives:</b> Engineering knowledge Problem analysis Interpretation of data			
<b>Question Paper Pattern:</b> 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. George Tchobanoglous, Hilary Theisen , Samuel A Vigil, "Integrated Solid Waste Management : Engineering principles and management issues", M/c Graw hill Education . Indian edition
2. Howard S Peavy, Donald R Rowe and George Tchobanoglous, "Environmental Engineering", Tata Mcgraw Hill Publishing Co ltd.,

**Reference Books:**

1. Municipal Solid Wastes (Management and Handling) Rules, 2000.Ministry of Environment and Forests Notification, New Delhi, the 25th September, 2000. Amendment – 1357(E) – 08-04-2016
2. Municipal Solid waste management manual, Part II published under Swachh Bharat Mission, Central Public Health And Environmental Engineering Organization (CPHEEO), 2016, Ministry of Urban Development, Government of India.
3. Handbook of Solidwaste management, second edition, George Tchobanoglous, Frank Kreith, published by M/c Graw hill Education, 2002, ISBN-13 978-0071356237 ISBN -10 0071356231

  
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1. Allen, D. T. and Shoemaker, 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
<b>Reference Books:</b>
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
<b>CREDITS – 03</b>		<b>Total Marks-100</b>	
<b>Course Objectives:</b> 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
<b>Module -1</b>			
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
<b>Module -2</b>			
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

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Management.			
4. Salter. R.I and Hounsell N.B, " Highway Traffic Analysis and design", Macmillan Press Ltd.1996.			
<b>Reference Books:</b>			
1. Fred L. Mannering, Scott S. Wasbbum and Walter P.Kilareski, Principles of Highway Engineering and Traffic Analysis, Wiley India Pvt. Ltd., New Delhi, 2011			
2. Garber and Hoel, "Principles of Traffic and Highway Engineering", CENGAGE Learning, New Delhi, 2010			
3. SP-43-1994, IRC Specification, "Guidelines on Low-cost Traffic Management Techniques" for Urban Areas, 1994			
4. John E Tyworth, "Traffic Management Planning, Operations and control", Addison Wesley Publishing Company, 1996			
5. Hebbs.F.D. "Traffic Planning and Engineering", University of Birmingham, Peragamon Press Ltd, 2005			
<b>Course Title: Sustainability Concepts in Engineering</b>			
<b>Open Elective I</b>			
[As per Choice Based Credit System (CBCS) scheme]			
SEMESTER:V			
Subject Code	15CV562	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
<b>CREDITS – 03</b>		<b>Total Marks-100</b>	
<b>Course Objectives:</b> This course will enable students to			
1. Learn about the principles, indicators and general concept of sustainability.			
2. Apprehend the local, regional and global impacts of unsustainable designs, products and processes.			
3. Student shall be able to apply the sustainability concepts in engineering			
4. Know built environment frameworks and their use			
5. Understand how building and design is judged and valued by clients and stakeholders and how to implement sustainability.			
<b>Modules</b>	<b>Teaching Hours</b>	<b>Revised Bloom's Taxonomy (RBT) Level</b>	
<b>Module -1</b>			
<b>Introduction:</b> Sustainability - Introduction, Need and concept of sustainability, Social-environmental and economic sustainability concepts. Sustainable development, Nexus between Technology and Sustainable development, Challenges for Sustainable Development. Multilateral environmental agreements and Protocols - Clean Development Mechanism (CDM), Environmental legislations in India - Water Act, Air Act.	8 hours	L1,L2,L3	
<b>Module -2</b>			
<b>Global Environmental Issue:</b> Resource degradation, Climate change, Regional and Local Environmental Issues. Carbon credits and carbon trading, carbon foot print Carbon sequestration – Carbon capture and storage (CCS). Environmental management standards, ISO 14000 series, Life Cycle Analysis (LCA) - Scope and	8 Hours	L1,L2,L3	

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Goal, Bio-mimicking		
<b>Module -3</b>		
<b>Sustainable Design:</b> Basic concepts of sustainable habitat, Green buildings, green materials for building construction, material selection for sustainable design, green building certification- GRIHA & IGBC Certification for buildings, Energy efficient building design- Passive solar design technique, Thermal storage, Cooling strategies, high performance insulation. Sustainable cities, Sustainable transport.	8 Hours	L1,L2,L3,L4
<b>Module -4</b>		
<b>Clean Technology and Energy:</b> Energy sources: Basic concepts-Conventional and non-conventional, solar energy, Fuel cells, Wind energy, Small hydro plants, bio-fuels, Energy derived from oceans, Geothermal energy. Rainwater harvesting.	8 Hours	L1,L2,L3
<b>Module -5</b>		
<b>Green Engineering:</b> Green Engineering concepts, Sustainable Urbanization, industrialization and poverty reduction; Social and technological change, Industrial Processes: Material selection, Pollution Prevention, Industrial Ecology, Industrial symbiosis.	8 Hours	L1,L2,L3
<p><b>Course Outcomes:</b> After studying this course, students will be able to:</p> <ol style="list-style-type: none"> <li>1. Learn the sustainability concepts, understand the role and responsibility of engineers in sustainable development</li> <li>2. Quantify sustainability, and resource availability, Rationalize the sustainability based on scientific merits</li> <li>3. Understand and apply sustainability concepts in construction practices, designs, product developments and processes across various engineering disciplines</li> <li>4. Make a decision in applying green engineering concepts and become a lifelong advocate of sustainability in society</li> </ol>		
<p><b>Program Objectives:</b></p> <ul style="list-style-type: none"> <li>• Engineering knowledge</li> <li>• Problem analysis</li> <li>• Interpretation of data</li> </ul>		
<p><b>Question Paper Pattern:</b></p> <ul style="list-style-type: none"> <li>• The question paper will have 5 modules comprising of ten questions. Each full question carrying 16 marks</li> <li>• There will be two full questions (with a maximum of three subdivisions, if necessary) from each module.</li> <li>• Each full question shall cover the topics as a module</li> <li>• 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.</li> </ul>		
<b>Text Books:</b>		

Course Title: Environmental Protection and Management As per Choice Based Credit System (CBCS) scheme) SEMESTER:VI			
Subject Code	15CV662	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
<b>CREDITS -03</b>		<b>Total Marks- 100</b>	
<b>Course objectives:</b> This course will enable students to gain knowledge in Environmental protection and Management systems			
Modules		Teaching Hours	Revised Bloom's Taxonomy (RBT) Level
<b>Module -1 Environmental Management Standards</b>			
Unique Characteristics of Environmental Problems - Systems approach to Corporate environmental management - Classification of Environmental Impact Reduction Efforts -Business Charter for Sustainable Production and Consumption - Tools, Business strategy drivers and Barriers - Evolution of Environmental Stewardship. Environmental Management Principles - National policies on environment, abatement of pollution and conservation of resources - Charter on Corporate responsibility for Environmental protection.		8 hours	L1,L2,L3
<b>Module -2 Environmental Management Objectives</b>			
Environmental quality objectives - Rationale of Environmental standards: Concentration and Mass standards, Effluent and stream standards, Emission and ambient standards, Minimum national standards, environmental performance evaluation: Indicators, benchmarking. Pollution control Vs Pollution Prevention - Opportunities and Barriers - Cleaner production and Clean technology, closing the loops, zero discharge technologies		8 Hours	L1,L2,L3
<b>Module -3 Environmental Management System</b>			
EMAS, ISO 14000 - EMS as per ISO 14001- benefits and barriers of EMS - Concept of continual improvement and pollution prevention - environmental policy - initial environmental review - environmental aspect and impact analysis - legal and other requirements- objectives and targets - environmental management programs - structure and responsibility - training awareness and competence- communication - documentation and document control - operational control - monitoring and measurement - management review.		8 Hours	L1,L2,L3
<b>Module -4 Environmental Audit</b>			
Environmental management system audits as per ISO 19011- - Roles and qualifications of auditors - Environmental performance indicators and their evaluation - Non conformance - Corrective and preventive actions -compliance audits - waste audits and waste minimization planning - Environmental statement (form V) - Due diligence audit		8 Hours	L1,L2,L3
<b>Module -5 Applications</b>			
Applications of EMS , Waste Audits and Pollution Prevention opportunities in Textile , Sugar, Pulp & Paper, Electroplating, , Tanning industry, Dairy, Cement, Chemical industries, etc. Trans boundary movement, disposal, procedures, of hazardous wastes.		8 Hours	L1,L2,L3
<b>Course outcomes:</b> After studying this course, students will be able to:			
1. Appreciate the elements of Corporate Environmental Management systems complying to international environmental management system standards			
2. Lead pollution prevention assessment team and implement waste minimization options			
3. Develop, implement, maintain and Audit Environmental Management systems for Organisations			
<b>Program Objectives:</b>			
Engineering knowledge			
Problem analysis			
Interpretation of data			
<b>Question paper pattern:</b>			
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.

**Reference Books:**

1. Christopher Sheldon and Mark Yoxon, "Installing Environmental management Systems – a step by step guide" Earthscan Publications Ltd, London, 1999.
2. ISO 14001/14004: Environmental management systems – Requirements and Guidelines – International Organisation for Standardisation, 2004
3. ISO 19011: 2002, "Guidelines for quality and/or Environmental Management System auditing, Bureau of Indian Standards, New Delhi, 2002
4. Paul L Bishop „Pollution Prevention: Fundamentals and Practice , McGraw- Hill International, Boston, 2000.
5. Environmental Management Systems: An Implementation Guide for Small and Medium-Sized Organizations, Second Edition, NSF International, Ann Arbor, Michigan, January 2001.

  
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**TITLE OF THE COURSE: SUSTAINABILITY CONCEPTS IN ENGINEERING**  
**B.E., V Semester, Civil Engineering**  
**[As per Choice Based Credit System (CBCS) scheme]**

<b>Course Code</b>	<b>17 CV562</b>	<b>CIE Marks</b>	<b>40</b>
<b>Number of Lecture Hours/Week</b>	<b>03</b>	<b>SEE Marks</b>	<b>60</b>
<b>Total Number of Lecture Hours</b>	<b>40 (8 Hours per Module)</b>	<b>Exam Hours</b>	<b>03</b>

**Credits - 03**

**Course Objectives:** This course will enable students to

1. Learn about the principles, indicators and general concept of sustainability.
2. Apprehend the local, regional and global impacts of unsustainable designs, products and processes.
3. Student shall be able to apply the sustainability concepts in engineering
4. Know built environment frameworks and their use
5. Understand how building and design is judged and valued by clients and stakeholders and how to implement sustainability.

**Module-1**

**Introduction:** Sustainability - Introduction, Need and concept of sustainability, Social-environmental and economic sustainability concepts. Sustainable development, Nexus between Technology and Sustainable development, Challenges for Sustainable Development. Multilateral environmental agreements and Protocols - Clean Development Mechanism (CDM), Environmental legislations in India - Water Act, Air Act

**L1,L2,L3**

**Module-2**

**Global Environmental Issue:** Resource degradation, Climate change, Regional and Local Environmental Issues. Carbon credits and carbon trading, carbon foot print Carbon sequestration - Carbon capture and storage (CCS). Environmental management standards, ISO 14000 series, Life Cycle Analysis (LCA) - Scope and Goal, Bio-mimicking

**L1,L2,L3**

**Module-3**

**Sustainable Design:** Basic concepts of sustainable habitat, Green buildings, green materials for building construction, material selection for sustainable design, green building certification- GRIHA & IGBC Certification for buildings, Energy efficient building design- Passive solar design technique, Thermal storage, Cooling strategies, high performance insulation. Sustainable cities, Sustainable transport.

**L1,L2,L3,L4**

**Module-4**

**Clean Technology and Energy:** Energy sources: Basic concepts-Conventional and non-conventional, solar energy, Fuel cells, Wind energy, Small hydro plants, bio-fuels, Energy derived from oceans, Geothermal energy. Rainwater harvesting.

**L1,L2,L3**

**Module-5**

**Green Engineering:** Green Engineering concepts, Sustainable Urbanization, industrialization and poverty reduction; Social and technological change, Industrial Processes: Material selection, Pollution Prevention, Industrial Ecology, Industrial symbiosis

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

1. Learn the sustainability concepts; understand the role and responsibility of engineers in sustainable development.
2. Quantify sustainability, and resource availability, Rationalize the sustainability based on scientific merits.
3. Understand and apply sustainability concepts in construction practices, designs, product developments and processes across various engineering disciplines.
5. Make a decision in applying green engineering concepts and become a lifelong advocate of sustainability in society.

**Text Books:**

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

  
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**TITLE OF THE COURSE: OCCUPATIONAL HEALTH AND SAFETY**  
**B.E., V Semester, Civil Engineering**  
**[As per Choice Based Credit System (CBCS) scheme]**

<b>Course Code</b>	<b>17CV564</b>	<b>CIE Marks</b>	<b>40</b>
<b>Number of Lecture Hours/Week</b>	<b>03</b>	<b>SEE Marks</b>	<b>60</b>
<b>Total Number of Lecture Hours</b>	<b>40 (8 Hours per Module)</b>	<b>Exam Hours</b>	<b>03</b>

**Credits - 03**

**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

**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

**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 considerations

**L2,L3,L4,L5**

**Module-3**

Fire Prevention and Protection: Fire Triangle, Fire Development and its severity, Effect of Enclosures, early detection of Fire, Classification of fire and Fire Extinguishers.

Electrical Safety, Product Safety: Technical Requirements of Product safety.

**L2,L3,L4,L5**

**Module-4**

Health Considerations at Work Place: types of diseases and their spread, Health Emergency. Personal Protective Equipment (PPE) - types and advantages, effects of exposure and treatment for engineering industries, municipal solid waste. Environment management plans (EMP) for safety and sustainability

**L2,L3,L4,L5**

**Module-5**

Occupational Health and Safety Considerations: Water and wastewater treatment plants, Handling of chemical and safety measures in water and wastewater treatment plants and labs, Construction material manufacturing industries like cement plants, RMC Plants, precast plants and construction sites. Policies, roles and responsibilities of workers, managers and supervisors

**L3,L4,L5,L6**

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

1. Identify hazards in the workplace that pose a danger or threat to their safety or health, or that of others.
2. Control unsafe or unhealthy hazards and propose methods to eliminate the hazard.
3. Present a coherent analysis of a potential safety or health hazard both verbally and in writing, citing the occupational Health and Safety Regulations as well as supported legislation.
4. Discuss the role of health and safety in the workplace pertaining to the responsibilities of workers, managers, supervisors.
5. Identify the decisions required to maintain protection of the environment, workplace as well as personal health and safety.

**Text Books:**

1. Goetsch D.L., (1999), "Occupational Safety and Health for Technologists, Engineers and Managers", Prentice Hall.
2. Heinrich H.W., (2007), "Industrial Accident Prevention - A Scientific Approach", McGraw-Hill Book Company National Safety Council and Associate (Data) Publishers Pvt. Ltd., (1991),
3. "Industrial Safety and Pollution Control Handbook

**Reference Books:**

1. Colling D.A., (1990), "Industrial Safety Management and Technology", Prentice Hall, New Delhi.
2. Della D.E., and Giustina, (1996), "Safety and Environmental Management", Van Nostrand Reinhold International Thomson Publishing Inc.

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17CV564

<b>TITLE OF THE COURSE: REMOTE SENSING AND GIS</b> <b>B.E., V Semester, Civil Engineering</b> <b>[As per Choice Based Credit System (CBCS) scheme]</b>			
<b>Course Code</b>	<b>17CV563</b>	<b>CIE Marks</b>	<b>40</b>
<b>Number of Lecture Hours/Week</b>	<b>03</b>	<b>SEE Marks</b>	<b>60</b>
<b>Total Number of Lecture Hours</b>	<b>40 (8 Hours per Module)</b>	<b>Exam Hours</b>	<b>03</b>
<b>Credits - 03</b>			
<b>Course Objectives:</b> This course will enable students to <ol style="list-style-type: none"> <li>1. Understand the basic concepts of remote sensing.</li> <li>2. Analyze satellite imagery and extract the required units.</li> <li>3. Extract the GIS data and prepare the thematic maps.</li> <li>4. Use the thematic maps for various applications.</li> </ol>			
<b>Module-1</b>			
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. <p style="text-align: right;"><b>L1,L2,L3</b></p>			
<b>Module-2</b>			
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 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. <p style="text-align: right;"><b>L2,L3,L4</b></p>			
<b>Module-3</b>			
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. <p style="text-align: right;"><b>L2,L3,L4</b></p>			
<b>Module-4</b>			
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. <p style="text-align: right;"><b>L3,L4,L5</b></p>			
<b>Module-5</b>			
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.

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.

**Text Books:**

1. Narayan Panigrahi, "Geographical Information Science", and ISBN 10: 8173716285 / ISBN 13: 9788173716287, University Press 2008.
2. Basudeb Bhatta, "Remote sensing and GIS" , ISBN:9780198072393, Oxford University Press 2011
3. Kang - Tsurug Chang, "Introduction to Geographic Information System". Tata McGraw Hill Education Private Limited 2015.
- 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 Geographical 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.

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<b>Course Title: SOLID WASTE MANAGEMENT</b> <b>As per Choice Based Credit System (CBCS) scheme]</b> <b>SEMESTER:VI</b>			
<b>Subject Code</b>	<b>17CV651</b>	<b>IA Marks</b>	<b>40</b>
<b>Number of Lecture Hours/Week</b>	<b>03</b>	<b>Exam Marks</b>	<b>60</b>
<b>Total Number of Lecture Hours</b>	<b>40</b>	<b>Exam Hours</b>	<b>03</b>
<b>CREDITS -03</b>		<b>Total Marks- 100</b>	
<b>Course objectives:</b> This course will enable students to <ol style="list-style-type: none"> <li>1. Study the present methods of solid waste management system and to analyze their draw backs comparing with statutory rules.</li> <li>2. Understand different elements of solid waste management from generation of solid waste to disposal.</li> <li>3. Analyze different processing technologies and to study conversion of municipal solid waste to compost or biogas.</li> <li>4. Evaluate landfill site and to study the sanitary landfill reactions.</li> </ol>			
<b>Module -1</b>			
Sources: Sources of Solid waste, Types of solid waste, Physical and Chemical composition of municipal solid waste. Generation rate, Numerical Problems. Collection: Collection of solid waste- services and systems, equipments, Transportation: Need of transfer operation, transfer station, transport means and methods, route optimization. Solid waste management 2000 rules with, 2016 amendments.			
<b>L1,L2,L3</b>			
<b>Module -2</b>			
Processing techniques: Purpose of processing, Chemical volume reduction (incineration) – Process description, 3T's, principal components in the design of municipal incinerators, Air pollution control, Mechanical volume reduction (compaction), Mechanical size reduction (shredding), component separation (manual and mechanical methods).			
<b>L1,L2,L3</b>			
<b>Module -3</b>			
Composting Aerobic and anaerobic method - process description, process microbiology, design consideration, Mechanical composting, Vermicomposting, Numerical Problems. Sanitary landfilling: Definition, advantages and disadvantages, site selection, methods, reaction occurring in landfill- Gas and Leachate movement, Control of gas and leachate movement, Design of sanitary landfill. Numerical Problems			
<b>L1,L2,L3</b>			
<b>Module -4</b>			
Sources, collection, treatment and disposal of :- Biomedical waste ,E-waste ,Hazardous waste and construction waste			
<b>L1,L2,L3</b>			
<b>Module -5</b>			
Incineration -3Ts factor affecting incineration ,types of incinerations , Pyrolysis ,design criteria for incineration Energy recovery technique from solid waste management			
<b>L1,L2,L3</b>			
<b>Course outcomes:</b> After studying this course, students will be able to: <ol style="list-style-type: none"> <li>1. Analyse existing solid waste management system and to identify their drawbacks.</li> <li>2. Evaluate different elements of solid waste management system.</li> <li>3. Suggest suitable scientific methods for solid waste management elements.</li> <li>4. Design suitable processing system and evaluate disposal sites.</li> </ol>			
<b>Program Objectives:</b>			
<ul style="list-style-type: none"> <li>• Engineering knowledge</li> <li>• Problem analysis</li> <li>• Interpretation of data</li> </ul>			
<b>Text Books:</b>			
1. George Tchobanoglous, Hilary Theisen , Samuel A Vigil, "Integrated Solid Waste			

Management : Engineering principles and management issues", M/c Graw hill Education . Indian edition

2. Howard S Peavy, Donald R Rowe and George Tchobanoglous, "Environmental Engineering", Tata Mcgraw Hill Publishing Co ltd.,

**Reference Books:**

1. Municipal Solid Wastes (Management and Handling) Rules, 2000.Ministry of Environment and Forests Notification, New Delhi, the 25th September, 2000. Amendment - 1357(E) - 08-04-2016
2. Municipal Solid waste management manual, Part II published under Swachh Bharat Mission, Central Public Health And Environmental Engineering Organization (CPHEEO), 2016, Ministry of Urban Development, Government of India.
3. Handbook of Solidwaste management, second edition, George Tchobanoglous, Frank Kreith, published by M/c Graw hill Education, 2002, ISBN-13 978-0071356237 ISBN -10 0071356231

  
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<b>Course Title: ENVIRONMENTAL PROTECTION AND MANAGEMENT</b> <b>As per Choice Based Credit System (CBCS) scheme]</b> <b>SEMESTER:VI</b>			
<b>Subject Code</b>	<b>17CV662</b>	<b>IA Marks</b>	<b>40</b>
<b>Number of Lecture Hours/Week</b>	<b>03</b>	<b>Exam Marks</b>	<b>60</b>
<b>Total Number of Lecture Hours</b>	<b>40</b>	<b>Exam Hours</b>	<b>03</b>
<b>CREDITS -03</b>		<b>Total Marks- 100</b>	
<b>Course objectives:</b> This course will enable students to gain knowledge in Environmental protection and Management systems			
<b>Module -1 Environmental Management Standards</b>			
Unique Characteristics of Environmental Problems - Systems approach to Corporate environmental management - Classification of Environmental Impact Reduction Efforts -Business Charter for Sustainable Production and Consumption – Tools, Business strategy drivers and Barriers - Evolution of Environmental Stewardship. Environmental Management Principles - National policies on environment, abatement of pollution and conservation of resources - Charter on Corporate responsibility for Environmental protection.			
<b>L1,L2,L3</b>			
<b>Module -2 Environmental Management Objectives</b>			
Environmental quality objectives – Rationale of Environmental standards: Concentration and Mass standards, Effluent and stream standards, Emission and ambient standards, Minimum national standards, environmental performance evaluation: Indicators, benchmarking. Pollution control Vs Pollution Prevention - Opportunities and Barriers – Cleaner production and Clean technology, closing the loops, zero discharge technologies			
<b>L1,L2,L3</b>			
<b>Module -3 Environmental Management System</b>			
EMAS, ISO 14000 - EMS as per ISO 14001- benefits and barriers of EMS – Concept of continual improvement and pollution prevention - environmental policy – initial environmental review – environmental aspect and impact analysis – legal and other requirements- objectives and targets – environmental management programs – structure and responsibility – training awareness and competence- communication – documentation and document control – operational control – monitoring and measurement – management review.			
<b>L1,L2,L3</b>			
<b>Module -4 Environmental Audit</b>			
Environmental management system audits as per ISO 19011- – Roles and qualifications of auditors - Environmental performance indicators and their evaluation – Non conformance – Corrective and preventive actions -compliance audits – waste audits and waste minimization planning – Environmental statement (form V) - Due diligence audit			
<b>L1,L2,L3</b>			
<b>Module -5 Applications</b>			
Applications of EMS , Waste Audits and Pollution Prevention opportunities in Textile , Sugar, Pulp & Paper, Electroplating, , Tanning industry, Dairy, Cement, Chemical industries, etc. Trans boundary movement, disposal, procedures, of hazardous wastes.			
<b>L1,L2,L3</b>			
<b>Course outcomes:</b> After studying this course, students will be able to:			
1. Appreciate the elements of Corporate Environmental Management systems complying to international environmental management system standards			
2. Lead pollution prevention assessment team and implement waste minimization options			
3. Develop, Implement, maintain and Audit Environmental Management systems for Organisations			

**Program Objectives:**

- Engineering knowledge
- Problem analysis
- Interpretation of data

**Reference Books:**

1. Christopher Sheldon and Mark Yoxon, "Installing Environmental management Systems – a step by step guide" Earthscan Publications Ltd, London, 1999.
2. ISO 14001/14004: Environmental management systems – Requirements and Guidelines – International Organisation for Standardisation, 2004
3. ISO 19011: 2002, "Guidelines for quality and/or Environmental Management System auditing, Bureau of Indian Standards, New Delhi, 2002
4. Paul L Bishop „Pollution Prevention: Fundamentals and Practice“, McGraw- Hill International, Boston,2000.
5. Environmental Management Systems: An Implementation Guide for Small and Medium-Sized Organizations, Second Edition, NSF International, Ann Arbor, Michigan, January 2001.

  
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**B.E IN CIVIL ENGINEERING(CV-2018-19)  
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)  
SEMESTER – V**

**ENVIRONMENTAL STUDIES**

Course Code	<b>18CIV59</b>	CIE Marks	40
Teaching Hours / Week (L:T:P)	(1:0:0)	SEE Marks	60
Credits	01	Exam Hours	02

**Module - 1**

**Ecosystems** (Structure and Function): Forest, Desert, Wetlands, Riverine, Oceanic and Lake.  
**Biodiversity:** Types, Value; Hot-spots; Threats and Conservation of biodiversity, Forest Wealth, and Deforestation.

**Module - 2**

**Advances in Energy Systems** (Merits, Demerits, Global Status and Applications): Hydrogen, Solar, OTEC, Tidal and Wind.  
**Natural Resource Management** (Concept and case-studies): Disaster Management, Sustainable Mining, Cloud Seeding, and Carbon Trading.

**Module - 3**

**Environmental Pollution** (Sources, Impacts, Corrective and Preventive measures, Relevant Environmental Acts, Case-studies): Surface and Ground Water Pollution; Noise pollution; Soil Pollution and Air Pollution.  
**Waste Management & Public Health Aspects:** Bio-medical Wastes; Solid waste; Hazardous wastes; E-wastes; Industrial and Municipal Sludge.

**Module - 4**

**Global Environmental Concerns** (Concept, policies and case-studies): Ground water depletion/recharging, Climate Change; Acid Rain; Ozone Depletion; Radon and Fluoride problem in drinking water; Resettlement and rehabilitation of people, Environmental Toxicology.

**Module - 5**

**Latest Developments in Environmental Pollution Mitigation Tools (Concept and Applications):** G.I.S. & Remote Sensing, Environment Impact Assessment, Environmental Management Systems, ISO14001; Environmental Stewardship- NGOs.

**Field work:** Visit to an Environmental Engineering Laboratory or Green Building or Water Treatment Plant or Waste water treatment Plant; ought to be Followed by understanding of process and its brief documentation.

**Course outcomes:** At the end of the course, students will be able to:

- CO1: Understand the principles of ecology and environmental issues that apply to air, land, and water issues on a global scale,
- CO2: Develop critical thinking and/or observation skills, and apply them to the analysis of a problem or question related to the environment.
- CO3: Demonstrate ecology knowledge of a complex relationship between biotic and a biotic components.
- CO4: Apply their ecological knowledge to illustrate and graph a problem and describe the realities that managers face when dealing with complex issues.

**Question paper pattern:**

- The Question paper will have 100 objective questions.
- Each question will be for 01 marks
- Student will have to answer all the questions in an OMR Sheet,
- The Duration of Exam will be 2 hours.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
<b>Textbook/s</b>				
1	Environmental Studies	Benny Joseph	Tata Mc Graw – Hill.	2 <sup>nd</sup> Edition, 2012

2.	Environmental Studies	S M Prakash	Pristine Publishing House, Mangalore	3 <sup>rd</sup> Edition 2018
3	Environmental Studies – From Crisis to Cure	R. Rajagopalan	Oxford Publisher	2005
<b>Reference Books</b>				
1	Principals of Environmental Science and Engineering	Raman Sivakumar	Cengage learning, Singapur.	2 <sup>nd</sup> Edition, 2005
2	Environmental Science – working with the Earth	G. Tyler Miller Jr.	Thomson Brooks / Cole,	11 <sup>th</sup> Edition, 2006
3	Text Book of Environmental and Ecology	Pratiba Sing, AnoopSingh & PiyushMalaviya	Acme Learning Pvt. Ltd. New Delhi.	1 <sup>st</sup> Edition

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