



SREE VIDYANIKETHAN ENGINEERING COLLEGE

(AUTONOMOUS)

Sree Sainath Nagar, Tirupati-517 102

1.3.1: Institution Integrates cross cutting issues relevant to Professional Ethics, Gender, Human Values, Environment and Sustainability into Curriculum.

The following are the list of courses introduced by SVEC which integrates cross cutting issues.

1.	Professional Ethics
2.	Gender and Environment
3.	Human Values
4.	Indian History
5.	Environmental Science
6.	Environmental Engineering
7.	Environmental Engineering Lab
8.	Disaster Mitigation and Management
9.	Sustainable Engineering
10.	Green Technologies
11.	Energy Audit and Conservation
12.	Environmental Pollution and Control
13.	Planning for Sustainable Development
14.	Air Pollution and Control
15.	Geoenviromental Engineering
16.	Groundwater Development and Management
17.	Solid Waste Management
18.	Industrial Waste water Treatment
19.	Environmental Impact Assessment and Management

Syllabus with Course Outcomes of the above courses

(19BT4HS11) PROFESSIONAL ETHICS

(Open Elective-2)

(Common to CE, ME, CSE, CSSE and IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: --

COURSE DESCRIPTION: Engineering Ethics; Professional Ideals and Virtues; Engineering as Social Experimentation; Responsibilities and Rights; Global Issues.

COURSE OUTCOMES: *After successful completion of the course, students will be able to:*

CO1. Demonstrate knowledge in Engineering Ethics, Responsibilities and Rights.

CO2. Analyze the concepts of Engineering in Social Experimentation and Global Issues.

CO3. Apply the nuances of professional ideals at work place and in social context.

DETAILED SYLLABUS:

UNIT-I: ENGINEERING ETHICS

(09 Periods)

Scope and aim of engineering ethics, Senses of engineering ethics, Variety of moral issues, Types of inquiry, Moral dilemmas, Moral autonomy-Kohlberg's theory, Gilligan's theory, Consensus and controversy.

UNIT-II: PROFESSIONAL IDEALS AND VIRTUES

(08 Periods)

Theories about virtues, Professions, Professionalism, Characteristics, Expectations, Professional responsibility, Integrity, Self-respect, Sense of responsibility, Self-interest, Customs and religion, Self-interest and ethical egoism, Customs and ethical relativism, Religion and divine command ethics, Use of ethical theories, Resolving moral dilemmas and moral leadership.

UNIT-III: ENGINEERING AS SOCIAL EXPERIMENTATION

(10 Periods)

Engineering as experimentation, Similarities to standard experiments, Learning from the past and knowledge gained, Engineers as responsible experimenters, Conscientiousness, Moral autonomy and accountability, The challenger case, Codes of ethics and limitations, Industrial standards, Problems with the law of engineering.

UNIT-IV: RESPONSIBILITIES AND RIGHTS

(09 Periods)

Collegiality and loyalty, Respect for authority, Collective bargaining, Confidentiality, Conflict of interests, Occupational crime, Rights of engineers, Professional rights, Whistle-blowing, The BART case, Employee rights and discrimination.

UNIT-V: GLOBAL ISSUES

(09 Periods)

Multinational corporations, Professional ethics, Environmental ethics, Computer ethics, Engineers as consultants, Witnesses, Advisors and Leaders, Engineers as Managers, Managerial ethics applied to Engineering Profession, moral leadership.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. Mike W. Martin and Roland Schinzinger, *Ethics in Engineering*, Tata McGraw-Hill, 3rd edition, 2007.
2. Govindarajan, M., Nata Govindarajan, M., Natarajan, S. and Senthil kumar, V. S., *Engineering Ethics*, Prentice Hall of India, 2004.

REFERENCE BOOKS:

1. S. Kannan and K. Srilakshmi, *Human Values and Professional Ethics*, Taxmann Allied Services Pvt Ltd., 2009.
2. Edmund G. Seebauer and Robert L. Barry, *Fundamental of Ethics for Scientists and Engineers*, Oxford University Press, 2001.

II B. Tech. - II Semester
(19BT4HS05) GENDER AND ENVIRONMENT
 (Open Elective-2)
 (Common to CE, ME, CSE, CSSE and IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: --

COURSE DESCRIPTION: Gender and the environment relationship, Gendered Roles in the family & community, Gender and sustainable development, Gender in environmental justice, Gender & environmental security.

COURSE OUTCOMES: *After successful completion of the course, students will be able to:*

- CO1. Apply the knowledge of gender & environment connections, key issues and topics within global environmental politics in environmental decision-making.
- CO2. Comprehend the concepts of gender and sustainable development through debates, and policy documents.
- CO3. Analyze the concept of environmental security and justice by identifying the sources of insecurity.

DETAILED SYLLABUS:

UNIT-I: GENDER AND ENVIRONMENT RELATIONSHIP (09 Periods)

Introduction–Gender and Environment–Development of gender roles–Society, gender & environment – Understanding environmental politics – Gender-environment connections–Eco-feminism - Cultural eco-feminism–Social eco-feminism - Feminist political ecology.

UNIT-II: GENDERED ROLES IN THE FAMILY & COMMUNITY (09 Periods)

Organization of the household – Domestic division of labour - Food: growing, harvesting, shopping, preparing, and cooking.

Gender & Power- Planning – Politics – NGO – Gendering of environmental protest – Environmental decision-making.

UNIT-III: GENDER AND SUSTAINABLE DEVELOPMENT (09 Periods)

Concept of sustainability & its achievement – Concept of sustainable development – Ecological Modernization – Gender & sustainability debates – Gender & sustainable development debates - Gender in policy documents – Gender, poverty & equity in sustainable development.

UNIT-IV: GENDER IN ENVIRONMENTAL JUSTICE (09 Periods)

Normative Concerns (Fairness, Inequality & Justice) - Making sense of Environmental justice – Ecological debt, Transnational harm, & human rights – Ecological justice – Gender & Environmental Justice – Gender, Vulnerability & risk – Women in environmental justice movements – Knowledge & participation – Gender, sustainability & justice as guiding concepts.

UNIT-V: GENDER AND ENVIRONMENTAL SECURITY

(09 Periods)

Connections between security & the environment – **Gender, environment & security:** Sustainability as security - poverty & insecurity – Insecurity as injustice – Competing ways of thinking security – Reflecting on sources of insecurity – **Case Study** – Food Security -**Case Study** – The impacts of natural disasters.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. Nicole Detraz, *Gender and the Environment*, Polity Press, Cambridge, UK, 2017.
2. Susan Buckingham- Hatfield, *Gender and Environment*, Routledge, London, 2000.

REFERENCE BOOKS:

1. Promillakapur (ed). (2000). "*Empowering Indian Women*" Publication Division, Government of India, New Delhi.
2. Ronnie Vernooy, (Ed). (2006). "*Social and gender Analysis Natural Resource Management: Learning studies and lessons from Aisa*" Sage, New Delhi.
3. Swarup, Hemlata and Rajput, Pam. (2000). *Gender Dimensions of Environmental and Development Debate: The Indian Experience*" In SturatS.Nagel, (ed). "India"s Development and Public Policy", Ashgate, Burlington.

I B. Tech. - II Semester
(20BT1MC01) UNIVERSAL HUMAN VALUES

(Mandatory Course)

(Common to CE, ME, EEE, ECE and EIE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
-	-	-	2	-	-	-

PRE-REQUISITES:-

COURSE DESCRIPTION: Value education; Human being and self; Family, the society and the nations; Harmony with the nature and Harmony with professional ethics.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1. Understand Values and skills for sustained happiness and prosperity.
- CO2. Analyse realistic implications of a Holistic understanding of ethical human conduct, trustful and mutually fulfilling human behaviour.
- CO3. Apply holistic approach in personal life and profession through a positive understanding of the Human reality and existence.

DETAILED SYLLABUS:

UNIT - I: VALUE EDUCATION

(06 Periods)

Human Values-Introduction; Self-Exploration - Natural Acceptance; Human Aspirations-Right understanding- the current scenario: understanding and living in harmony.

UNIT - II: HUMAN BEING AND SELF

(06 Periods)

Understanding human being - 'I' and the material 'Body'; needs of Self ('I') and 'Body'-happiness and physical facility; Body as an instrument of 'I' - characteristics and activities of 'I' and harmony in 'I'; harmony of I with the Body.

UNIT - III: FAMILY, THE SOCIETY AND THE NATIONS

(06 Periods)

Values in human relationship (nine universal values)- foundational values of relationship; Difference between intention and competence; Difference between respect and differentiation; harmony in the society; Universal harmonious order in society.

UNIT - IV: HARMONY WITH THE NATURE

(06 Periods)

Harmony in the Nature; Interconnectedness and mutual fulfilment - the four orders of nature-Recyclability and Self-regulation; Existence as Co-existence; Holistic perception of harmony and existence.

UNIT - V: HARMONY WITH PROFESSIONAL ETHICS

(06 Periods)

Acceptance of human values; Ethical Human Conduct; Basis for Humanistic Education; Competence in professional ethics; Case studies: Holistic technologies, Management Models and Production Systems; Socially and ecologically responsible engineers, technologists and managers - enriching institutions and organizations.

Total Periods: 30

Topics for self-study are provided in the lesson plan.

TEXT BOOKS:

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

REFERENCE BOOKS:

1. Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak,1999.

II B.Tech. II Semester
(19BT3MC01) **ENVIRONMENTAL SCIENCE**
(Mandatory Course)
(Common to CE, ME, CSE, CSSE and IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	-	40	2	-	-	-

PRE-REQUISITES: -

COURSE DESCRIPTION: Natural resources; Ecosystems; Biodiversity; Environment pollution and control; Social issues and environment; Human population and environment.

COURSE OUTCOMES: On successful completion of this course, the students will be able to:

- CO1 Analyze natural resources to solve complex environmental problems and natural resource management considering society, environment and sustainability.
- CO2 Analyze ecosystems and biodiversity to solve complex environmental problems by following environmental ethics considering society, environment and sustainability besides communicating effectively in graphical form.
- CO3 Analyze various types of pollution and their control measures to solve environmental problems through appropriate tools and techniques following latest developments considering society, ethics, environment and sustainability.
- CO4 Analyze social issues and its impact on environment, environmental acts to solve complex environmental problems considering society, environment and sustainability besides communicating effectively in graphical form.
- CO5 Analyze human population and its impact on environment to solve complex environmental problems through team work and using appropriate tools and techniques considering ethics, society, environment and sustainability.

DETAILED SYLLABUS:

UNIT - I: NATURAL RESOURCES (07 Periods)

Multidisciplinary nature of environment; Natural Resources: Renewable and non-renewable resources; Forest, Water, Mineral, Food and Energy resources -Causes, Effects, Remedies, Case studies; Role of an individual in conservation of natural resource and equitable use of resources for sustainable lifestyles.

UNIT - II: ECOSYSTEMS AND BIODIVERSITY (07 Periods)

Ecosystems: Concept of an ecosystem, Structure and function of an ecosystem - Producers, Consumers, Decomposers; Food chains, Food webs, Ecological pyramids - Types; Characteristic features, Structure and functions of forest ecosystem, Desert ecosystem, Aquatic ecosystem.

Biodiversity: Concept and value of biodiversity, Role of biodiversity in addressing new millennium challenges, Hot spots of biodiversity, Threats to biodiversity, Man-wild life conflicts, Endemic, Endangered and extinct species of India, Conservation of biodiversity - In-situ and ex-situ.

UNIT - III: ENVIRONMENTAL POLLUTION AND CONTROL (06 Periods)

Causes, Adverse effects and control measures of pollution - Air pollution, Water pollution, Soil pollution, Noise pollution, Thermal pollution, Nuclear pollution, Solid waste management - Urban waste, industrial waste; Latest developments in pollution control, Hazards and disaster management - Floods, Earthquakes, Tsunamis, Case studies.

UNIT - IV: SOCIAL ISSUES AND THE ENVIRONMENT (06 Periods)

Sustainable development, Urban problems related to energy, Environmental ethics - Issues, Solutions; Global warming, Acid rain, Ozone layer depletion, Nuclear accidents and case studies, Wasteland reclamation, Consumerism and waste products, Concept of green technologies, Environment justice: National Green Tribunal and its importance; Environment protection act, Air act, Water act, Wildlife protection act, Forest conservation act, Issues involved in enforcement of environmental legislation, Public environmental awareness.

UNIT - V: HUMAN POPULATION AND THE ENVIRONMENT (04 Periods)

Population growth, Population characteristics and variation among nations, Population explosion, Family welfare programme, Environment and human health, Human rights, Value education, HIV/AIDS, Women and child welfare, Role of information technology in environment and human health; Case studies - Field Work/Assignment/Seminar on Environmental assets - Water bodies/Forest/Grassland/Hill/Mountain.

Total Periods: 30

Topics for self-study are provided in the lesson plan.

TEXT BOOKS:

1. Anubha Kaushik and C. P. Kaushik, *Perspectives in Environmental Studies*, New Age International (P) Ltd. Publications, 6th Edition, 2018.
2. Erach Barucha, *Environmental Studies*, Orient Blackswan, 2nd Edition, 2013.

REFERENCE BOOKS:

1. Cunningham W.P. and Cunningham M.A., *Principles of Environmental Science*, Tata McGraw-Hill Publishing Company, New Delhi, 8th Edition, 2016.
2. Benny Joseph, *Environmental Studies*, Tata McGraw-Hill, 2nd Edition, 2009.
3. M. Anji Reddy, *Text Book of Environmental Sciences and Technology*, BS Publications, 2014
4. R. Rajagopalan, *Environmental Studies*, Oxford University Press, 2nd Edition, 2011.

ADDITIONAL LEARNING RESOURCES:

1. B. S. Chauhan, *Environmental Studies*, University Science Press, 2nd Edition, 2018.
2. Botkin and Keller, *Environmental Science: Earth as a Living Planet*, John Wiley & Sons, 8th International Student Edition, 2011.

II B.Tech. – II Semester
(19BT40102) ENVIRONMENTAL ENGINEERING

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PREREQUISITES: Environmental Science

COURSE DESCRIPTION: Water Sources, Quality and Quantity, Intakes; Water Treatment and Distribution Systems; Sewage Characteristics, Collection and Quantity; Sewage Treatment; Sewage Effluent, Sludge Treatment and Disposal.

COURSE OUTCOMES: On successful completion of the course, the students will be able to:

- CO1 Analyze water sources, quality and quantity using different tools and techniques for solving water supply problems considering codes of practice, public health and safety, environment and sustainability.
- CO2 Design water treatment and distribution systems using different methods to solve water supply problems by following current developments and considering codes of practice, public health and safety, environment and sustainability besides communicating graphically.
- CO3 Design sewage collection systems for treatment and disposal to solve complex problems considering appropriate methods, code of practices, public health and safety, environment and sustainability.
- CO4 Design sewage treatment and sludge digestion units to solve complex problems by following latest developments and considering code of practices, public health and safety, environment and sustainability besides communicating graphically.
- CO5 Analyze sewage effluent, sludge treatment and disposal, house drainage plumbing systems in buildings using different tools and techniques considering codes of practice, health and safety, environment and sustainability besides communicating graphically.

DETAILED SYLLABUS:

UNIT - I: WATER SOURCES, QUALITY AND QUANTITY, INTAKES (06 Periods)

Water Sources – Types, Quality, Quantity, Drinking water quality analysis and standards; Protected water supply – Need, Objectives; Population forecasting – Methods, Design period; Water demand – Types, Per capita demand, Factors affecting, Fluctuations; Intakes – Types, Factors influencing site selection.

UNIT - II: WATER TREATMENT AND SUPPLY (12 Periods)

Water Treatment: Units, Functions, Processes – Aeration, Coagulation, Flocculation, Optimum Coagulant Dosage; Sedimentation – Types, Factors affecting, Design of sedimentation tank; Filtration – Types; Slow and Rapid Gravity Sand Filters - Design, Operation and Maintenance; Disinfection – Methods, Chlorination, Chlorine demand, Break point chlorination; Latest techniques in water treatment.

Water Supply: Systems and methods; Distribution systems – Layouts, Design by Hardy Cross and equivalent pipe methods; Water supply arrangements in buildings - Flow meters, Pipe appurtenances, Laying and testing of pipe lines, Leakage prevention, Repair and maintenance.

UNIT – III: SEWAGE CHARACTERISTICS, COLLECTION AND QUANTITY

(06 Periods)

Sewage characteristics - Physical, Chemical and Biological; Sewage collection systems – Types, Comparison; Estimation of sanitary sewage and storm water runoff, Hydraulic design of sewers, Sewer appurtenances, BOD Equations and Self purification of streams.

UNIT – IV: SEWAGE TREATMENT

(12 Periods)

Layout of sewage treatment plant; Design of primary treatment units - Screen chamber, Grit chamber, Sedimentation tank; Design of secondary treatment units – Attached growth systems - Trickling filters, Rotating Biological Contactors, Bio-towers; Suspended growth systems - Activated Sludge process, Oxidation ditch, Stabilisation pond; Design of sludge digestion tank – Aerobic and anaerobic, Factors influencing the digestion process; Latest techniques in sewage treatment.

UNIT – V: SEWAGE EFFLUENT, SLUDGE TREATMENT AND DISPOSAL (09 Periods)

Disposal of sewage effluent – Dilution, Sewage farming, ISI Effluent disposal standards; Design of septic tank, Soak pit, Dispersion trench; Sludge treatment and disposal, House drainage plumbing systems in buildings.

Total Periods: 45

Topics for self-study are provided in the lesson plan.

TEXT BOOKS:

1. G. S. Birdie and J. S. Birdie, *Water Supply and Sanitary Engineering*, Dhanpat Rai and Sons Publishers, 9th Edition, 2011.
2. Peavy, H. S, Rowe, D. R., and Tchobanoglous, G., *Environmental Engineering*, McGraw Hill Inc., 1985.

REFERENCE BOOKS:

1. S. K. Garg, *Environmental Engineering, (Vol. I): Water Supply Engineering*, Khanna Publishers, 20th Edition, 2011.
2. S. K. Garg, *Environmental Engineering (Vol. II): Sewage Disposal and Air Pollution Engineering*, Khanna Publishers, 27th Edition, 2013.
3. Met Calf and Eddy, *Wastewater Engineering*, TMH Education Pvt. Ltd., 4th Edition, 2010.
4. R. Elangovan and M.K Saseetharan, *Unit Operations in Environmental Engineering*, New Age International (P) Limited, 1st Edition, 2008.

ADDITIONAL LEARNING RESOURCES:

1. S. K. Duggal, *Elements of Environmental Engineering*, S. Chand Publishing, 3rd Edition, 2013.
2. P. N. Modi, *Water Supply Engineering (Environmental Engineering-I)*, Standard Book House, 6th Edition, 2018.
3. P.N. Modi, *Sewage Treatment Disposal and Wastewater Engineering (Environmental Engineering-II)*, Standard Publishers Distributors, 17th Edition, 2019.
4. B.C. Punmia, Ashok K. Jain and Arun K. Jain, *Environmental Engineering-II: Wastewater Engineering (Including Air Pollution)*, Laxmi Publications, 2nd Edition, 2019.

(19BT40131) **ENVIRONMENTAL ENGINEERING LAB**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	2	1

PREREQUISITES: Course on Environmental Engineering.

COURSE DESCRIPTION: Experimental analysis of physical, chemical and biological parameters of water and wastewater; Analysis of an ambient air quality.

COURSE OUTCOMES: On successful completion of this course, the students will be able to:

- CO1. Evaluate water using various tools and techniques to solve complex water problems by following the standard procedures/norms and latest developments ensuring safety, environment and sustainability.
- CO2. Evaluate wastewater using various tools and techniques to solve complex wastewater problems by following the standard procedures/norms and latest developments ensuring safety, environment and sustainability.
- CO3. Perform individually or in a team besides communicating effectively in written, oral and graphical forms on water supply and wastewater engineering.

LIST OF EXPERIMENTS:

1. Determination of pH, electrical conductivity and TDS of a given water sample
2. Determination of alkalinity and acidity of a given water sample
3. Determination of total solids, volatile and fixed solids of a given water sample
4. Determination of chlorides of a given water sample
5. Determination of iron and fluoride content of a given water sample
6. Determination of residual chlorine of a given chlorinated water sample
7. Determination of turbidity and optimum coagulant dose of a given water sample
8. Determination of dissolved oxygen and BOD of a given wastewater sample
9. Determination of COD of a given wastewater sample
10. Determination of nitrate nitrogen as NO_3 of a given wastewater sample
11. Determination of sulphates as SO_4 of a given wastewater sample
12. Determination of phosphates as PO_4 of a given wastewater sample
13. Determination of color of a given water or wastewater sample
14. Bacterial examination of a given water or wastewater sample (not for examination)
15. Determination of air pollutants of an ambient air (not for examination)

REFERENCE BOOKS/LABORATORY MANUALS:

1. *Environmental Engineering Lab Manual (SVEC19 Regulations)*, Department of Civil Engineering, Sree Vidyanikethan Engineering College, Tirupati.

II B. Tech. - II Semester
(19BT40106) DISASTER MITIGATION AND MANAGEMENT
(Open Elective-2)
(Common to CE, ME, CSE, CSSE and IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Disasters; Earthquakes; Floods; Cyclones; Droughts; Landslides; Disaster management.

COURSE OUTCOMES: *After successful completion of the course, students will be able to:*

- CO1. Analyze the vulnerability of an area to natural and man-made disasters/hazards as per the guidelines to solve complex problems using appropriate techniques ensuring safety, environment and sustainability.
- CO2. Propose appropriate mitigation strategies for earthquake and tsunami impacts as per code of practice using suitable techniques ensuring safety, environment and sustainability besides communicating effectively in graphical form.
- CO3. Analyze the causes and impacts of floods, cyclones and droughts using appropriate tools and techniques and suggest mitigation measures ensuring safety, environment and sustainability besides communicating effectively in graphical form.
- CO4. Analyze the causes and impacts of landslides using appropriate tools and techniques and suggest mitigation measures ensuring safety, environment and sustainability.
- CO5. Design disaster management strategies to solve pre, during and post disaster problems using appropriate tools and techniques following the relevant guidelines and latest developments ensuring safety, environment and sustainability besides communicating effectively in graphical form.

DETAILED SYLLABUS:

UNIT-I: DISASTERS

(09 Periods)

Types of disasters - Natural disasters; Impact of disasters on environment, infrastructure and development; Concepts of hazards and vulnerability analysis, Hazard Assessment, Guidelines for hazard assessment and vulnerability analysis, Basic principles and elements of disaster mitigation.

UNIT-II: EARTHQUAKES

(09 Periods)

Introduction to earthquake, Intensity scale (MSK-64), Seismic zones and activity in India, Action plan for earthquake disaster preparedness, Elements at risk, Recovery and rehabilitation after earthquake, Concepts of Earthquake resistant design and construction of buildings; Tsunami - Onset, Types and causes, Warning, Elements at risk, Typical effects, Specific preparedness and mitigation strategies, Case studies.

UNIT- III: FLOODS, CYCLONES AND DROUGHTS (11 Periods)

Floods and Cyclones: Onset, Types, Causes, Warnings, Elements at risk, Typical effects, Indian floods and cyclones, Hazard zones, Potential for reducing hazards, Mitigation strategies and community based mitigation, Case studies.

Droughts: Onset, Types and warning; Causes, Impact, Early warning and response mechanisms, Mitigation strategies, Droughts in India, Case studies.

UNIT-IV: LANDSLIDES (08 Periods)

Onset, Types and warning; Causes, Elements at risk, Indian landslides, Hazards zones, Typical effects, Mitigation strategies and community based mitigation, Case studies.

UNIT-V: DISASTER MANAGEMENT (08 Periods)

Disaster management organization and methodology, Disaster management cycle, Disaster management in India – Typical cases and Cost-benefit analysis, Disaster management programs implemented by NGOs and Government of India, Usage of GIS and Remote sensing techniques in disaster management, Leadership and Coordination in Disaster management, Emerging trends in disaster management.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. V. K. Sharma, *Disaster Management*, Medtech Publishing, 2nd Edition, 2013.
2. Anand S. Arya, Anup Karanth, and Ankush Agarwal, *Hazards, Disasters and Your Community: A Primer for Parliamentarians*, GOI-UNDP Disaster Risk Management Programme, Government of India, National Disaster Management Division, Ministry of Home Affairs, New Delhi, Version 1.0, 2005.

REFERENCE BOOKS:

1. Donald Hyndman and David Hyndman, *Natural Hazards and Disasters*, Cengage Learning, 3rd Edition, 2011.
2. *Disaster Management in India*, A Status Report, Ministry of Home Affairs, Govt. of India, May 2011.
3. Rajendra Kumar Bhandari, *Disaster Education and Management: A Joyride for Students, Teachers, and Disaster Managers*, Springer India, 2014.
4. R. B. Singh, *Natural Hazards and Disaster Management*, Rawat Publications, 2009.

ADDITIONAL LEARNING RESOURCES:

1. Tushar Bhattacharya, *Disaster Science and Management*, McGraw Hill, 2014.

II B. Tech. - II Semester
(19BT40107) SUSTAINABLE ENGINEERING
 (Open Elective-2)
 (Common to CE, ME, CSE, CSSE and IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: --

COURSE DESCRIPTION: Principles of sustainability; Sustainability metrics and assessment tools; Sustainable engineering practices; Sustainable engineering applications; Sustainable urbanization and industrialization.

COURSE OUTCOMES: *After successful completion of the course, students will be able to:*

- CO1. Analyze the principles of sustainability to solve complex environmental problems following relevant standards/protocols considering society, health, safety and environment.
- CO2. Analyze sustainability metrics and assessment tools to solve complex environmental problems following relevant standards and emerging trends considering society, health, safety, environment and economics besides communicating effectively in graphical form.
- CO3. Analyze sustainable engineering practices to solve complex environmental problems using appropriate tools and techniques following relevant standards considering society, health, safety, environment, economics and management besides communicating effectively in graphical form.
- CO4. Design sustainable engineering applications to solve complex environmental problems using appropriate tools and techniques following relevant standards considering society, health, safety, environment, economics and management besides communicating effectively in graphical form.
- CO5. Analyze sustainable urbanization and industrialization principles to solve complex environmental problems using appropriate tools and techniques following relevant standards considering society, health, safety, environment, economics and management besides communicating effectively in graphical form.

DETAILED SYLLABUS:

UNIT-I: PRINCIPLES OF SUSTAINABILITY (09 Periods)

Emerging challenges, Sustainability and sustainable engineering; Environmental concerns; Social, economic and legal issues; Availability and depletion of natural resources, Disaster resiliency; Multilateral environmental agreements – Basel convention, Clean development mechanism (CDM), Montreal and Kyoto protocols.

UNIT II–SUSTAINABILITY METRICS AND ASSESSMENT TOOLS (09 Periods)

Sustainability indicators, metrics and assessment tools, Material flow analysis and material budget, Carbon footprint analysis, Life cycle assessment, Streamlined life-cycle assessment (SLCA), Economic input output-life cycle analysis, Environmental health risk assessment, Other emerging assessment tools.

UNIT-III: SUSTAINABLE ENGINEERING PRACTICES (09 Periods)

Sustainable energy engineering, Sustainable waste management, Green and sustainable buildings and infrastructure, Sustainable civil infrastructure, Sustainable remediation of contaminated sites, Climate geoengineering.

UNIT-IV: SUSTAINABLE ENGINEERING APPLICATIONS (09 Periods)

Environmental and chemical engineering projects, Materials engineering projects, Infrastructure engineering projects – Background, Methodology, Goal and Scope, Study area, Technical design, Environmental sustainability, Life cycle assessment, Economic sustainability, Social sustainability, Rating systems – ENVISION, LEED, GRIHA, IGBC; Conclusions.

UNIT –V: SUSTAINABLE URBANIZATION AND INDUSTRIALIZATION (09 Periods)

Sustainable urbanization and industrialization, United Nations sustainable development goals – Right to education, Poverty eradication, Social and technological changes; Industrial Processes - Material selection, Energy efficiency, Pollution prevention and control techniques, Industrial Ecology, Industrial symbiosis.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. Reddy, K.R., Cameselle, C., and Adams, J.A., *Sustainable Engineering: Drivers, Metrics, Tools, and Applications*, John Wiley & Sons, Inc., Hoboken, New Jersey, 2019, 544p (ISBN: 978-1-119-49393-8).
2. Allen, D. T. and Shonnard, D. R., *Sustainability Engineering: Concepts, Design and Case Studies*, Pearson Education, 1st Edition, 2012.

REFERENCE BOOKS:

1. Bradley. A.S; Adebayo, A.O., Maria, P., *Engineering Applications in Sustainable Design and Development*, Cengage Learning, 1st Edition, 2016.
2. Purohit, S. S., *Green Technology: An Approach for Sustainable Environment*, Agrobios Publication, 1st Edition, 2016.
3. *Energy Conservation Building Code (ECBC) 2007*, Bureau of Energy Efficiency, Govt. of India, New Delhi.
4. Twidell, J. W. and Weir, A. D., *Renewable Energy Resources*, Routledge, Taylor & Francis Group, 3rd Edition, 2015.

ADDITIONAL LEARNING RESOURCES:

1. Daniel A. Vallero and Chris Brasier, *Sustainable Design: The Science of Sustainability and Green Engineering*, Wiley-Blackwell, 1st Edition, 2008.
2. Jorge A. Vanegas, *Sustainable Engineering Practice: An Introduction*, Committee on Sustainability, American Society of Civil Engineers, <https://doi.org/10.1061/9780784407509>, 2004.
3. Mackenthun, K.M., *Basic Concepts in Environmental Management*, CRC Press, Taylor & Francis Group, 1st Edition, 1999.
4. *Environment Impact Assessment Guidelines*, Notification of Government of India, 2006.

II B. Tech. - II Semester
(19BT50409) GREEN TECHNOLOGIES
(Open Elective-2)
(Common to CE, ME, CSE, CSSE and IT)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Principles of green engineering; Green communications; Green energy; Green computing; Green construction; Green manufacturing.

COURSE OUTCOMES: *After successful completion of the course, students will be able to:*

- CO1. Analyze energy efficient communication systems such as Telecommunication systems, ICT, Wireless networks and cellular networks by understanding the principles of green communications.
- CO2. Understand the impact of conventional energy sources on environment and realize the significance and principles of green energy sources for sustainability.
- CO3. Understand the environmental impacts of IT and approaches for Green IT.
- CO4. Analyze concepts of sustainable green construction using appropriate tools and techniques following latest developments and considering safety and environment besides communicating effectively in graphical form.
- CO5. Demonstrate the environmental impact of traditional manufacturing and explore the need for green manufacturing process promoting sustainability.

DETAILED SYLLABUS:

UNIT-I: PRINCIPLES OF GREEN ENGINEERING AND GREEN COMMUNICATIONS
(09 Periods)

Principles of Green Engineering: Introduction, Definition of green engineering, Principles of green engineering

Green Communications: Introduction, Origin of Green Communications, Energy Efficiency in Telecommunication systems, Telecommunication system model and energy Efficiency, Energy saving concepts, Quantifying energy efficiency in ICT, Energy efficiency metrics of green wireless networks, Embodied energy of communication devices- Introduction, The extended energy model, Embodied/Operating Energy of a BS in Cellular network- A Case study; Energy efficient standards for wireline communications.

UNIT –II: GREEN ENERGY **(09 Periods)**

Introduction, green energy systems - composition, adverse impacts, Green energy and sustainability, the target and solution. Diversification and localization of energy systems, green energy and sustainable development. Energy sources and their availability. Green energy sources - solar energy, wind energy, geothermal energy, ocean energy, biomass and biogas.

UNIT –III: GREEN IT**(09 Periods)**

Introduction, Awareness to Implementation: Green IT Trends, Green Engineering, Greening by IT: Using RFID for Environmental Sustainability, Smart Grids, Smart Buildings and Homes, Green Supply Chain and Logistics, Enterprise-Wide Environmental Sustainability, A Seven-Step Approach to Creating Green IT Strategy: Balancing the Costs and Benefits of Going Green, Research and Development Directions.

UNIT –IV: GREEN CONSTRUCTION**(09 Periods)**

Green Building: Concept, Necessity, Characteristics, Benefits, Requisites for green building construction, Sustainability, Concept of REDUCE, REUSE, RECYCLE, RETHINK, REPLENISH AND REFUSE (6 R's), Sustainable construction focus point – Site selection, Planning, Water, Energy, Material, Indoor air quality, Construction procedures, case studies of residential and commercial green buildings.

Vastu: Concept, History, scientific approach, elements of vastu for selecting a plot.

Indian Green Building Council: Introduction to IGBC green homes, Benefits of IGBC, IGBC green home rating system, Introduction to USGBC, LEED rating system, Procedure to get IGBC certification, GRIHA Rating.

UNIT –V: GREEN MANUFACTURING**(09 Periods)**

Green Manufacturing - Introduction, Background and Definition; Impact of traditional manufacturing in environmental ecology, Need for green manufacturing, Motivation and barriers to green manufacturing, Advantages and Limitations of green manufacturing, Green manufacturing strategies, Green manufacturing and sustainability, Green manufacturing through clean energy supply, Green packaging and Supply chain.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. Konstantinos Samdanis, Peter Rost, Andreas Maeder, Michela Meo, Christos Verikoukis, *Green Communications: Principles, Concepts and Practice*, John Wiley & Sons, 2015.
2. G.D. Rai, *Non-conventional Energy Sources*, Khanna Publishers, Delhi, 5th Edition, 2011.
3. San Murugesan, G.R. Gangadharan, *Harnessing Green IT – Principles and Practices*, John Wiley & Sons Ltd., 2008.
4. Tom Woolley, Sam Kimmins, Paul Harrison and Rob Harrison, *Green Building Handbook*, Volume 1, E & FN Spon, an imprint of Thomson Science & Professional.
5. J Paulo Davim, *Green Manufacturing: Processes and Systems*, Springer, 2012.
6. David A Dornfeld, *Green Manufacturing: Fundamentals and Applications*, Springer, 2013.

REFERENCE BOOKS:

1. Soli J. Arceivala, *Green Technologies for a better future*, McGraw Hill Education (India) Pvt. Ltd, 2014.
2. Marty Poniatowski, *Foundation of Green Information Technology*, Prentice Hall, 2009.
3. Athanasios V Alavanidis, Thomais Vlachogianni, *Green Chemistry and Green Engineering*, Synchrone Themata, 2012.

III B.Tech. – II Semester
(16BT60241) ENERGY AUDIT AND CONSERVATION

(Interdisciplinary Elective – 2)

Int. Marks	Ext. Marks	Total Marks	L	T
P	C			
30	70	100	3	1
-	3			

PRE-REQUISITES: -

COURSE DESCRIPTION: Principles of energy audit and conservation; Energy efficiency in buildings; Energy efficient motors, lighting, instruments and significance of energy economics.

COURSE OUTCOMES: On successful completion of this course, the students will be able to

- CO1. Demonstrate knowledge on auditing practices, conservation measures and economics of energy.
- CO2. Analyze auditing practices, conservation measures and economics of energy.
- CO3. Design an appropriate energy conservation measures in commercial and industrial applications.
- CO4. Provide feasible solutions for problems associated with energy auditing and conversion through proper investigation and interpretation of data.
- CO5. Use appropriate techniques for energy auditing and conservation.
- CO6. Solve energy auditing and conservation problems with societal relevance.
- CO7. Consider environment and sustainability in energy auditing and conservation.
- CO8. Follow relevant rules and regulations in practicing energy audit and conservation.
- CO9. Communicate effectively on energy audit in written and graphical forms.
- CO10. Consider financial issues in energy audit and conservation.

DETAILED SYLLABUS:

UNIT - I: ENERGY AUDIT PRINCIPLES

(09 Periods)

Energy audit - Definitions, Concept, Types of audit, Energy index, Cost index, Pie charts, Sankey diagrams; Load profiles, Energy audit of industries, Energy saving potential, Energy audit of process industry, Building energy audit, IE rules and regulations for energy audit.

UNIT - II: ENERGY CONSERVATION PRINCIPLES

(09 Periods)

Rules for efficient energy conservation, Technologies for energy conservation, Energy scenario, Principles of energy conservation, Resource availability, Energy savings, Current energy consumption in India, Roles and responsibilities of energy managers in industries.

UNIT - III: ENERGY EFFICIENCY IN BUILDINGS

(11 Periods)

Introduction, Definition and concepts, Energy and water as a resource - Heating, Ventilating and Air conditioning systems; Energy economic analysis, Domestic energy consumption, Savings, Energy use in buildings, Residential and commercial buildings, Green buildings, Smart buildings, Rating of buildings, Efficient use of buildings, Solar passive architecture, Eco-housing concepts.

UNIT - IV: ENERGY AUDIT INSTRUMENTS AND ENERGY EFFICIENT MOTORS

(08 Periods)

Energy Audit Instruments: Watt meter, Data loggers, Thermocouples, Pyrometers, Lux meters, Tongue testers, PLCs and applications.

Energy Efficient Motors: Factors affecting efficiency, Loss distribution, Constructional details, Characteristics, Variable speed, Variable duty cycle systems, Applications of life cycle costing analysis, Return on investment.

UNIT - V: ECONOMIC ASPECTS AND ANALYSIS

(08 Periods)

Economic concepts, Computation of economic aspects calculation of simple payback method, Net present worth method, Depreciation Methods, Time value of money, Rate of return, Present worth method, Replacement analysis, Life cycle costing analysis.

Total Periods: 45

REFERENCE BOOKS:

1. Ashok V. Desai, Wiley Eastern, *Energy Demand – Analysis, Management and Conservation Hand Book on Energy Auditing* - TERI (Tata Energy Research Institute), 2005.
2. Albert Thumann, William J. Younger, *Handbook of Energy Audits*, Taylor & Francis Ltd, 7th Edition, 2008.
3. Ashok V. Desai, Wiley Eastern, *Energy Demand – Analysis, Management and Conservation Hand Book on Energy Auditing* - TERI (Tata Energy Research Institute), 2005.
4. Dale R. Patrick, Stephen W. Fardo, Ray E. Richardson, Steven R. Patrick, *Energy Conservation Guide Book*, Taylor & Francis Ltd, 2nd Edition, 2007.
5. Ashok V. Desai, *Energy Economics*, Wiley Eastern, 1st Edition, 1990.
6. *Industrial Energy Conservation Manuals*, Cambridge, MIT Press, 1982.
7. Frank Kreith, Ronald E. West, *Handbook of Energy Efficiency*, CRC Press, 1st Edition, 1996.
8. *Energy Efficiency In Buildings*, CIBSE Guide F, 3rd Edition, May, 2012.
9. Nilesh Y. Jadhav, *Green and Smart Buildings: Advanced Technology Options*, Springer Science Business Media, Singapore, 2016.

III B.Tech - II Semester
(16BT60115) ENVIRONMENTAL POLLUTION AND CONTROL

(Open Elective)

(Common to CSE, CSSE, IT, CE & ME)

Int. Marks	Ext. Marks	Total Marks	L	T
P	C			
30	70	100	3	1
-	3			

PRE-REQUISITES: -

COURSE DESCRIPTION: Fundamentals of air pollution; Dispersion of pollutants; Effects and control of air pollution; Water pollution; Soil pollution and control; Municipal solid waste management.

COURSE OUTCOMES: On successful completion of this course, the students will be able to:

- CO1. Demonstrate knowledge on air, water, soil pollution and their control and solid waste management.
- CO2. Analyze causes and effects of air, water and soil pollution and their remedial measures.
- CO3. Recommend suitable solutions to complex environmental pollution problems.
- CO4. Use appropriate remedial technique to solve environmental pollution problems.
- CO5. Understand the effects of environmental pollution on human health and vegetation.
- CO6. Encourage sustainable development through implementation of pollution control measures.
- CO7. Maintain IS Codes for environmental quality control.

DETAILED SYLLABUS:

UNIT – I: AIR AND NOISE POLLUTION

(08 Periods)

Air Pollution: Scope, Significance, Classification, Sources – Line, Area, Stationary, Mobile; Effects of air pollutants on man, material and vegetation; Global effects of air pollution; Air pollution meteorology - Lapse rate, Inversion, Plume pattern; Dispersion of air pollutants - Dispersion models and applications; Ambient air quality standards. **Noise Pollution:** Sound pressure, Power and intensity, Impacts of noise, permissible limits of noise pollution, measurement of noise.

UNIT – II: AIR AND NOISE POLLUTION CONTROL

(10 Periods)

Self cleansing properties of the environment, Dilution method, Control at source, Process changes and equipment modifications, Control of particulates – Types of equipment, Design and operation - Settling chambers, Centrifugal separators, Bag house filters, Wet scrubbers, Electrostatic precipitators; Control of gaseous pollutants – Adsorption, Absorption, Condensation, Combustion; Control of air pollution from automobiles, Control of noise pollution.

UNIT – III: WATER POLLUTION AND CONTROL

(10 Periods)

Water pollution – Sources, Causes, Effects; Surface and groundwater quality – Physical, Chemical, Biological; Drinking water quality standards, Water purification – Processes, Engineered systems – Aeration, Solids separation, Settling operations, Coagulation, Softening, Filtration, Disinfection; Wastewater – Sources, Causes, Effects, Treatment and disposal – Primary, Secondary, Tertiary; Case studies.

UNIT – IV: SOIL POLLUTION AND CONTROL

(08 Periods)

Soil pollutants, Sources of soil pollution, Causes, Effects and control of soil pollution, Diseases caused by soil pollution, Methods to minimize soil pollution, Effective measures to control soil pollution, Case studies.

**UNIT – V: MUNICIPAL SOLID WASTE MANAGEMENT
(09 Periods)**

Types of solid waste, Composition of solid waste, Collection and transportation of solid waste, Methods of disposal – Open dumping, Sanitary landfill, Composting, Incineration, Utilization - Recovery and recycling, Energy Recovery.

Total Periods: 45

TEXT BOOKS:

1. Peavy, H. S, Rowe, D. R., and Tchobanoglous, G., *Environmental Engineering*, McGraw-Hill Inc., 1985.
2. C. S. Rao, *Environmental Pollution Control Engineering*, New Age International Pvt. Ltd., 2nd Edition, 2007.
3. Ibrahim A. Mirsa, *Soil Pollution: Origin, Monitoring & Remediation*, Springer, UK, 2nd Edition, 2008.

REFERENCE BOOKS:

1. M. N. Rao and H. V. N. Rao, *Air Pollution*, Tata McGraw-Hill Education Pvt. Ltd., 19th Edition, 2010.
2. Daniel Vallero, *Fundamentals of Air Pollution*, Academic Press (Elsevier), 5th Edition, 2014.
3. S. M. Khopkar, *Environmental Pollution Monitoring and Control*, New Age International Pvt. Ltd., 2nd Edition, 2007.
4. V. M. Domkundwar, *Environmental Engineering*, Dhanpat Rai & Co. Pvt. Ltd., New Delhi, 2014.

III B.Tech - II Semester
(16BT60116) PLANNING FOR SUSTAINABLE DEVELOPMENT

(Open Elective)

(Common to CSE, CSSE, IT, CE & ME)

Int. Marks	Ext. Marks	Total Marks	L	T
P	C			
30	70	100	3	1
-	3			

PRE-REQUISITES:-

COURSE DESCRIPTION: Sustainable development; Environmental impact; Sustainable Policies; Governance; Theories and strategies; Media and education for sustainability.

COURSE OUTCOMES: On successful completion of this course, the students will be able to:

- CO1. Demonstrate the knowledge on sustainable development, environmental impact, sustainable policies, governance, systems and strategies, media and education for sustainability.
- CO2. Analyze theories, environmental impact, policies, systems and strategies for sustainable development.
- CO3. Develop suitable methods and systems for sustainable development.
- CO4. Use appropriate techniques in solving issues related to sustainable development.
- CO5. Provide solutions to problems associated with sustainable development considering society.
- CO6. Consider environment while planning sustainable development.
- CO7. Communicate effectively on sustainable development issues through media and education.
- CO8. Consider economical issues while planning for sustainable development.

DETAILED SYLLABUS:

UNIT – I: SUSTAINABLE DEVELOPMENT
(09 Periods)

Definition and concepts of sustainable development, Capitalization of sustainability - National and global context; Millennium development goals, Emergence and evolution of sustainability and sustainable development, Theories of sustainability, Case studies.

UNIT – II: ENVIRONMENTAL IMPACT
(09 Periods)

Climate change – Science, Knowledge and sustainability; Unforeseen environmental impacts on development, Challenges of sustainable development, Centrality of resources in sustainable development, Case studies.

UNIT – III: SUSTAINABLE POLICIES AND GOVERNANCE
(09 Periods)

Governance - Democracy and Eco-welfare; Global civil society and world civil politics, Civic environmentalism, Policy responses to sustainable development, Economics of sustainability, Social responsibility in sustainability, National action, ISO 14001: Environmental management system.

UNIT – IV: SUSTAINABLE SYSTEMS AND STRATEGIES
(09 Periods)

Need for system innovation, Transition and co-evolution, Theories and methods for sustainable development, Strategies for eco-innovation, Ecological foot print analysis, Socio ecological indicators – Eco labels; Policy programmes for system innovation, Case studies.

UNIT – V: MEDIA AND EDUCATION FOR SUSTAINABILITY
(09 Periods)

Role of emerging media, Remarkable design and communication art, Activism and the public interest, Education for sustainability, Participation in decision making, Critical thinking and reflection, Case studies.

Total Periods: 45

TEXT BOOKS:

1. John Blewitt, *Understanding Sustainable Development*, Earth Scan Publications Ltd., 2nd Edition, 2008.
2. Jennifer A. Elliot, *An Introduction to Sustainable Development*, Earth Scan Publications Ltd., 4th Edition, 2006.

REFERENCE BOOKS::

1. Peter Rogers, Kazi F Jalal and John A Boyd, *An Introduction to Sustainable Development*, Earth Scan Publications Ltd., 2006.
2. Simon Dresner, *The Principles of Sustainability*, Earth Scan Publications Ltd., 2nd Edition, 2008.
3. Peter Bartelmus, *Environment Growth and Development: The Concepts and Strategies of Sustainability*, Routledge, 3rd Edition, 2003.
4. Gabriel Moser, Enric Pol, Yvonne Bernard, Mirilia Bonnes, Jose Antonio Corraliza and Maria Vittoria Giuliani, *People Places and Sustainability*, Hogrefe & Huber Publishers, 2nd Edition, 2003.

IV B.Tech. - I Semester
(16BT70118) AIR POLLUTION AND CONTROL
 (Program Elective - 4)

Int. Marks	Ext. Marks	Total Marks	L	T
P	C			
30	70	100	3	1
-	3			

PRE-REQUISITES: Course on Environmental Studies

COURSE DESCRIPTION: Fundamentals of air pollution; Effects of air pollution; Sampling and analysis; Control methods and equipment; Air and noise pollution from industrial operations.

COURSE OUTCOMES: On successful completion of this course, the students will be able to:

- CO1. Demonstrate the knowledge on air pollution, effects, sampling, control methods and equipment.
- CO2. Identify and analyse air pollution and control measures.
- CO3. Design various air pollution controlling systems.
- CO4. Provide solutions to complex air pollution problems through proper investigations and interpretation.
- CO5. Use appropriate techniques in the analysis, control and management of air pollution.
- CO6. Consider the ill effects of air pollution on human health, materials and vegetation in designing controlling systems.
- CO7. Understand and demonstrate the need for sustainable development.
- CO8. Follow IS codes in analysis and control of air pollution.

DETAILED SYLLABUS:

UNIT – I: AIR POLLUTION
(08 Periods)

Scope and significance of air pollution, Episodes in India and other nations – Overview; Sources and classification of air pollutants, Meteorology and air pollution – Plume behaviour, Wind rose; Dispersion theories and model, Stack height.

UNIT – II: EFFECTS OF AIR POLLUTION
(09 Periods)

Effects of air pollution on human health, animals and plants; Global effects of air pollution – Green house effect, Heat islands, Acid rains, Ozone holes; Economic effects of air pollution – Material damage; Art treasures in India and other countries.

UNIT – III: SAMPLING AND ANALYSIS
(09 Periods)

Classification, Stages and methods of sampling, Difficulties encountered, Instruments of sampling, Duration and location of sampling sites, Sampling - High volume filtration, Stack sampling techniques; Recent trends in sampling of stack effluents.

UNIT – IV: CONTROL METHODS AND EQUIPMENT
(10 Periods)

Analytical methods – Chemical, Instrumental and biological methods; Types of collection equipment – Settling chambers, Inertial separators, Cyclones, Filters and electrostatic precipitators, Scrubbers or wet collectors; Choice of equipment and economical aspects, Control of smoke, Gaseous contaminants, Odours and by process changes.

UNIT – V: AIR AND NOISE POLLUTION FROM INDUSTRIAL OPERATIONS
(09 Periods)

Air Pollution from Industrial Operations: Air pollution from major industrial operations – Mineral product industries, Cement industry, Petroleum refineries, Ferrous and non-ferrous metallurgical operations, Thermal power plants; Kinds of air quality standards, Emission standards and air pollution indices.

Noise Pollution from Industrial Operations: Noise pollution from industrial operations, Noise standards.

Total Periods: 45

TEXT BOOKS:

1. M. N. Rao and H. V. N. Rao, *Air Pollution*, Tata McGraw-Hill Education Pvt. Ltd., New Delhi, 19th Edition, 2010.
2. Thod Godish, *Air Quality*, Levis Publishers, Taylor and Francis Group, New Delhi, 4th Edition, 2003.
3. K. Wark and C. F. Warner, Harper and Row, *Air Pollution: Its Origin and Control*, Addison-Wesley, New York, 3rd Edition, 1998.

REFERENCE BOOKS:

1. R. K. Trivedy and P. K. Goel, *An introduction to Air Pollution*, B. S. P. Books Pvt. Ltd., Hyderabad, 2nd Edition, 2005.
2. K. V. S. G. Murali Krishna, *Air Pollution and Control*, Kousal and Co. Publications, New Delhi, 3rd Edition, 2008.
3. B. Padmanabha Murthy, *Environmental Meteorology*, I. K. Internationals Pvt. Ltd., New Delhi, 2009.
4. Crawford, M., *Air pollution Control Theory*, Tata McGraw-Hill, New Delhi, 1980.
5. H. C. Perkins, *Air Pollution*, McGraw-Hill Higher Education, Lincoln, United Kingdom, 1974.

III B.Tech. – II Semester
(16BT60108) GEOENVIRONMENTAL ENGINEERING
 (Program Elective – 1)

Int. Marks	Ext. Marks	Total Marks	L	T
P	C			
30	70	100	3	1
-	3			

PREREQUISITES: Courses on Soil Mechanics, Environmental Engineering.

COURSE DESCRIPTION: Fundamentals of geoenvironmental engineering; Soil–water–contaminant interaction; Waste containment system; Contaminant site remediation; Advanced soil characterization.

COURSE OUTCOMES: On successful completion of this course, the students will be able to:

- CO1. Acquire knowledge on fundamentals of geoenvironmental engineering, site characterization, waste containment systems and remediation.
- CO2. Characterize contaminated site and analyze waste containment systems and remediation techniques.
- CO3. Design waste containment systems and remediation techniques.
- CO4. Solve complex geoenvironmental problems through proper investigations.
- CO5. Use appropriate techniques for site characterization and remediation.
- CO6. Propose geoenvironmental solutions considering health and safety issues.
- CO7. Protect environment through sustainable remediation techniques.
- CO8. Follow ethics in geoenvironmental engineering practice.

DETAILED SYLLABUS:

UNIT – I: FUNDAMENTALS OF GEOENVIRONMENTAL ENGINEERING
(09 Periods)

Scope of geoenvironmental engineering, Multiphase behavior of soil, Role of soil in geoenvironmental applications, Importance of Soil physics, Soil chemistry, Hydrogeology, Biological process; Sources and type of ground contamination, Impact of ground contamination on geoenvironment, Case histories on geoenvironmental problems.

UNIT – II: SOIL–WATER–CONTAMINANT INTERACTION
(09 Periods)

Soil mineralogy characterization and its significance in determining soil behavior, Soil–water interaction and concepts of double layer, Forces of interaction between soil particles, Concepts of unsaturated soil, Importance of unsaturated soil in geoenvironmental problems, Measurement of soil suction, Water retention curves, Water flow in saturated and unsaturated zone, Soil–water–contaminant interactions and its implications, Factors affecting retention and transport of contaminants.

UNIT – III: WASTE CONTAINMENT SYSTEM
(09 Periods)

Evolution of waste containment facilities and disposal practices, Site selection based on environmental impact assessment, Different roles of soil in waste containment, Different components of waste containment system and its stability issues, Property evaluation for checking soil suitability for waste containment, Design of waste containment facilities.

UNIT – IV: CONTAMINANT SITE REMEDIATION
(09 Periods)

Site characterization, Risk assessment of contaminated site, Soil remediation technologies– Soil vapor extraction, Soil washing, Stabilization/solidification, Electrokinetic remediation, Thermal desorption, Vitrification, Bioremediation, Phytoremediation; Groundwater remediation technologies – Pump and treat, In–situ flushing, Permeable reactive barriers, In–situ air sparging, Monitored natural attenuation, Bioremediation; Selection and planning of remediation technologies, Some examples of in–situ remediation.

UNIT – V: ADVANCED SOIL CHARACTERIZATION
(09 Periods)

Contaminant analysis, Water content and permeability measurements, Electrical and thermal property evaluation, Use of GPR for site evaluation, Introduction to geotechnical centrifuge modeling.

Total Periods: 45

TEXT BOOKS:

1. Reddi, L. N. and Inyang, H. I., *Geoenvironmental Engineering Principles and Applications*, Marcel. Dekker, Inc., 2000.
2. Sharma, H. D. and Reddy, K. R., *Geoenvironmental Engineering: Site Remediation, Waste Containment, and Emerging Waste Management Technologies*, John Wiley & Sons, Inc., USA, 2004.

REFERENCE BOOKS

1. Rowe, R. K., *Geotechnical and Geoenvironmental Engineering Handbook*, Kluwer Academic, 2001.
2. Yong, R. N., *Geoenvironmental Engineering, Contaminated Soils, Pollutant Fate, and Mitigation*, CRC Press, New York, 2001.
3. Phillip B. Bedient, Refai, H. S. and Newell, C. J., *Ground Water Contamination*, Prentice Hall Publications, 4th Edition, 2008
4. LaGrega, M. D., Buckingham, P. L. and Evans, J. C., *Hazardous Waste Management*, McGraw-Hill, 2001.

III B.Tech. – II Semester
(16BT60109) GROUNDWATER DEVELOPMENT AND MANAGEMENT

(Program Elective – 1)

Int. Marks	Ext. Marks	Total Marks	L	T
P	C			
30	70	100	3	1
-	3			

PRE-REQUISITES: Courses on Engineering Hydrology, Engineering Geology, Irrigation Engineering.

COURSE DESCRIPTION: Groundwater occurrence and movement; Analysis of pumping test data; Saline water intrusion in an aquifer; Artificial recharge of groundwater; Groundwater exploration.

COURSE OUTCOMES: On successful completion of this course, the students will be able to:

- CO1. Demonstrate the knowledge on ground water occurrence, exploration, movement, pollution, and recharge methods.
- CO2. Analyze problems associated with occurrence, pumping test data, artificial recharge and exploration of groundwater and saline water intrusion.
- CO3. Design and develop artificial groundwater recharge sites using various techniques.
- CO4. Conduct investigations on occurrence of groundwater and saline water intrusion in a basin.
- CO5. Use appropriate tools and techniques in exploration, development and management of groundwater.
- CO6. Solve groundwater issues related to saline water intrusion considering societal issues.
- CO7. Consider environmental sustainability in solving groundwater problems.

DETAILED SYLLABUS:

UNIT - I: GROUNDWATER OCCURRENCE AND MOVEMENT
(09 Periods)

Groundwater hydrologic cycle – Origin of groundwater; Vertical distribution of groundwater, Geological formations as aquifers, Types of aquifers, Aquifer parameters; Darcy's law, Groundwater flow equation; Groundwater flow contours and their applications.

UNIT - II: ANALYSIS OF PUMPING TEST DATA
(10 Periods)

Steady groundwater flow towards a well in confined and unconfined aquifers, Unsteady radial flow towards a well, Non equilibrium equations – Thies solution, Jacob and Chow's solutions; Yield of an open well.

UNIT - III: SALINE WATER INTRUSION IN AN AQUIFER
(08 Periods)

Saline water intrusion, Ghyben–Herzberg relation, Shape of interface, Effects and control of sea water intrusion, Recognition of sea water in groundwater.

UNIT - IV: ARTIFICIAL RECHARGE OF GROUNDWATER
(08 Periods)

Artificial recharge - Recharge methods, Merits, Application of GIS and Remote Sensing in artificial recharge of groundwater along with case studies; Conjunctive use.

UNIT - V: GROUNDWATER EXPLORATION
(10 Periods)

Groundwater exploration, Surface methods - Electrical resistivity and seismic refraction methods; Subsurface methods – Geophysical logging and resistivity logging; Field survey using electrical resistivity method.

TEXT BOOKS:

1. H. M. Raghunath, *Groundwater*, Wiley Eastern Ltd., 3rd Edition, 2009.
2. David Keith Todd, *Groundwater Hydrology*, Wiley India Pvt. Ltd., 2nd Edition, 2010.

REFERENCE BOOKS:

1. K. R. Karanth, *Groundwater Assessment, Development and Management*, TMH, 2003.
2. R. Willis and W. W. G. Yeh, *Groundwater System Planning and Management*, PHI, 1987.
3. V. C. Agarwal, *Groundwater Hydrology*, PHI, 2012.
4. Bhagu R. Chahar, *Groundwater Hydrology*, Mc. Graw Education Pvt. Ltd., 2014.

III B.Tech. – II Semester
(16BT60110) SOLID WASTE MANAGEMENT
 (Program Elective - 1)

Int. Marks	Ext. Marks	Total Marks	L	T
P	C			
30	70	100	3	1
-	3			

PREREQUISITES: Course on Environmental Studies

COURSE DESCRIPTION: Sources and types of municipal solid wastes; Onsite handling; Storage and processing; Collection and transfer; Off sites processing; Disposal.

COURSE OUTCOMES: On successful completion of this course, the students will be able to:

- CO1. Demonstrate the knowledge on sources, characterization, collection, segregation, transportation, storage, off-site processing and disposal of solid waste.
- CO2. Analyze characteristics; collection, transportation, storage, processing and disposal methods of solid waste.
- CO3. Design of solid waste disposal systems.
- CO4. Investigate and interpret data to recommend suitable solutions to solid waste management.
- CO5. Use appropriate techniques for solid waste management.
- CO6. Consider health and safety in solid waste management.
- CO7. Ensure environmental sustainability in solid waste management.
- CO8. Follow environmental acts in solid waste management.
- CO9. Provide economically viable solid waste management solutions.

DETAILED SYLLABUS:

UNIT – I: MUNICIPAL SOLID WASTE
(09 Periods)

Sources and types of solid wastes – Quantity, Factors affecting generation of solid wastes, Characteristics, Methods of sampling and characterization, Effects of improper disposal of solid wastes, Public health effects, Social and economic aspects, Public awareness, Role of NGOs, Legislation.

UNIT – II: ON-SITE STORAGE AND PROCESSING
(09 Periods)

Principles of solid waste management, On-site segregation and storage methods, Materials used for containers, Public health and economic aspects of storage, Options under Indian conditions, Critical evaluation of options.

UNIT – III: COLLECTION AND TRANSFER
(09 Periods)

Methods of collection, Types of vehicles, Manpower requirement, Analysis of Collection routes, Transfer stations, Selection of location, Operation and maintenance, Collection options under Indian conditions.

UNIT – IV: OFF-SITE PROCESSING
(08 Periods)

Processing techniques and equipment, Resource and energy recovery from solid wastes – Composting, Incineration and pyrolysis.

UNIT – V: DISPOSAL
(10 Periods)

Dumping of solid waste, Sanitary landfills – Site selection, Design and operation of sanitary landfills, Leachate collection and treatment; Biomedical waste management – Incineration and pyrolysis.

Total Periods: 45

TEXT BOOKS:

1. T. V. Rama Chandra, *Management of Municipal Solid Waste*, 2011.
2. B. Bilitewski, G. HardHe, K. Marek, A. Weissbach, and H. Boeddicker, *Waste Management*, Springer, 1994.

REFERENCE BOOKS:

1. George Tchobanoglous, Hilary Theisen and Samuel A. Vigil., *Integrated Solid Waste Management: Engineering Principles and Management Issues*, McGraw-Hill Publishers, 2002.
2. *Manual on Municipal Solid Waste Management*, CPHEEO, Ministry of Urban Development, Government of India, 2000.
3. Bhide, A. D. and Sundaresan, B. B., *Solid Waste Management in Developing Countries*, INSDOC, 2010.
4. G. Burke, B. R. Singh and L. Theodore, *Handbook of Environmental Management and Technology*, John Wiley & Sons, 2nd Edition, 2000.

IV B.Tech - I Semester
(16BT70114) INDUSTRIAL WASTEWATER TREATMENT
 (Professional Elective – 3)

Int. Marks	Ext. Marks	Total Marks	L	T
P	C			
30	70	100	3	1
-	3			

PREREQUISITES: Course on Wastewater Technology.

COURSE DESCRIPTION: Industrial wastewater sources and characteristics; Principles of Primary and biological treatment; Advanced wastewater treatment systems; Typical wastewater treatment systems for different industries; Waste minimization.

COURSE OUTCOMES: On successful completion of this course, the students will be able to:

- CEO1. Demonstrate the knowledge on characteristics of industrial wastewater, treatment systems and waste minimization.
- CEO2. Analyze characteristics, treatment systems and waste minimization techniques of industrial wastewater.
- CEO3. Design wastewater treatment

DETAILED SYLLABUS:

UNIT – I: CHARACTERISTICS OF INDUSTRIAL WASTEWATER

(08 Periods)

Industrial sources of wastewater and characterization, Significance in determination of characteristics for different industrial effluents, Pattern of pollution and self-purification of a stream, ISI tolerance limits for disposal of effluent into inland surface water and public sewers.

UNIT – II: PRIMARY AND BIOLOGICAL TREATMENT

(10 Periods)

Scope, Working principle and functions - Equalization, Neutralization, Screen chamber, Grit chamber, Primary sedimentation tank; Microbiological metabolism - Basic kinetic equations, Biological treatment kinetics, Growth kinetics; Complete mix and plug flow systems, Oxygen requirement in aerobic process, Design of conventional biological treatment facilities.

UNIT – III: ADVANCED TREATMENT SYSTEMS

(08 Periods)

Pollution characteristics, Toxic chemicals, Treatments – Oxidation and reduction systems, Thermal reduction, Air stripping, Membrane systems; Nitrogen removal by biological nitrification and denitrification, Phosphate removal by activated sludge process and anaerobic filters.

UNIT – IV: TYPICAL INDUSTRIAL WASTEWATER TREATMENT

(10 Periods)

Origin, Characteristics and treatment of wastewater - Pulp and paper mills, Breweries, Wineries, Distilleries, Tanneries, Textile mills, Sugar mills, Refineries and dairy units.

UNIT – V: WASTE MINIMIZATION

(09 Periods)

In-plant survey, Flow measurement, Composition of wastewater generated, Analytical methods recommended for characterization, Waste volume and strength reduction, Water conservation, Factors encouraging the waste minimization, Clean-up and cleaner technologies, Remediation, Hierarchy of waste management options.

TEXT BOOKS:

1. M. N. Rao and A. K. Dutta, *Waste Water Treatment*, Oxford and IBH Publishers, 3rd Edition, 2009.
2. Met Calf and Eddy, *Wastewater Engineering, Treatment and ReUse*, Mc.Graw Hill Education Private Limited, 4th Edition, 2010.

REFERENCE BOOKS:

1. Newmerow, *Liquid Waste of Industry*, Pearson Education Publishing Co., 1971.
2. Mark J. Hammer and Mark J. Hammer Jr., *Water and Wastewater Technology*, 6th Edition, 2008.
3. A. D. Patwardhan, *Industrial Wastewater Treatment*, PHI Publisher, 2008.
4. Rakesh Kumar and R. N. Singh, *Municipal Water and Wastewater Treatment*, TERI, 2009.

IV B.Tech. I Semester
(16BT70106) ENVIRONMENTAL IMPACT ASSESSMENT AND
MANAGEMENT
 (Program Elective – 2)

Int. Marks	Ext. Marks	Total Marks	L	T
P	C			
30	70	100	3	1
-	3			

PREREQUISITES: Courses on Environmental Studies, Water Supply Engineering, Wastewater Technology.

COURSE DESCRIPTION: Environmental impact assessment (EIA); EIA methodologies; Environmental impact on soils, ground water and surface water; Environmental impact assessment on air, vegetation and wild life; Environmental audit and acts.

COURSE OUTCOMES: On successful completion of this course, the students will be able to:

- CO1. Gain basic knowledge on EIA, EIA methodologies, environmental audits and acts and preparation of EIA reports for various projects.
- CO2. Analyze factors, elements, methodologies and reports of EIA; environmental audits and acts.
- CO3. Interpret EIA and audit reports to provide solutions for environmental problems.
- CO4. Use appropriate methods to prepare EIA and audit reports.
- CO5. Consider health and safety in EIA.
- CO6. Give suitable recommendations based on EIA study for sustainable development.
- CO7. Follow environmental acts in EIA.
- CO8. Prepare EIA and audit reports.

DETAILED SYLLABUS:

UNIT – I: ENVIRONMENTAL IMPACT ASSESSMENT
(09 Periods)

Basic concept of EIA, Introduction to life cycle analysis, Initial environmental examination, Elements of EIA, Factors affecting EIA, Impact evaluation and analysis, Preparation of environmental base map and classification of environmental parameters.

UNIT – II: EIA METHODOLOGIES
(08 Periods)

Criteria for the selection of EIA Methodology, EIA Methods – Adhoc method, Matrix method, Network method, Environmental medium quality index method, Overlay method and Cost/benefit analysis.

UNIT – III: EIA ON SOIL, GROUND WATER AND SURFACE WATER
(10 Periods)

Prediction and assessment, Soil quality, Methodology for the assessment of soil and groundwater – Delineation of study area, Identification of activities, Impact prediction, Assessment of impact significance, Identification and incorporation of mitigation measures; EIA on surface water - Methodology for the assessment of impacts on surface water environment, Watershed management schemes.

UNIT–IV: EIA ON AIR, VEGETATION AND WILDLIFE
(08 Periods)

Air pollution sources, Generalized approach for assessment of air pollution impact on various anthropogenic activities, Assessment of impact of developmental activities on vegetation and wildlife, Environmental impact of deforestation – Causes and effects of deforestation.

UNIT – V: ENVIRONMENTAL AUDIT, ACTS AND MANAGEMENT
(10 Periods)

Environmental audit and environmental legislation, Objectives of environmental audit, Types of environmental audit, Audit protocol, Stages of environmental audit, Onsite activities, Evaluation of audit data and preparation of audit report, Post audit activities,

Environmental Acts - Environmental protection act, The water act, The air act, Wild life act; Case studies - Preparation of EMP report and EIA statement for various projects; Environmental management systems.

Total Periods: 45

TEXT BOOKS:

1. Y. Anjaneyulu, *Environmental Impact Assessment Methodologies*, B.S. Publications, 2nd Edition, 2007.
2. J. Glynn and Gary W. Heinke, *Environmental Science and Engineering*, Prentice Hall, 2nd Edition, 1996.

REFERENCE BOOKS:

1. Suresh K. Dhameja, *Environmental Engineering and Management*, S.K. Kataria and Sons, 2010.
2. H. S. Bhatia, *A Text Book of Environmental Pollution and Control*, Galgotia Publications (P) Ltd., 2003.
3. Charless H. Eccleston, *Environmental Impact Assessment*, CRC Press, Taylor and Francis Group, 2011.
4. Balakrishna Moorthy, *Environmental Management*, PHI Publications, 2nd Edition, 2008.