



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Civil and Infrastructure Engineering

Subject Code: 3154009

Semester – V

Subject Name: Green Chemistry and Environmental Technology

Type of course: Professional Elective Course

Prerequisite: Study of Environmental Science and Environmental Sustainability.

Rationale: Civil and Infrastructure engineers have a major role in planning, designing, building, and ensuring a sustainable prospect by providing the connection between science and society. It needs a holistic approach to understand multiple dimensions with ecologist, economists, and sociologists as well as latest sustainable technologies to meet the needs of sustainable future.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	<p>Principles and Concepts of Green Chemistry - Green chemistry –Definition –Principles of Green Chemistry, Importance and limitations, Atom Economy</p> <p>Waste Management and Green Chemistry Waste: sources of waste production, problems and prevention, Management of construction wastes. Waste minimization technique, Waste treatment and recycling,</p> <p>Water and sanitation: Water: Waste water, toxicity, Treatment Processes –Sedimentation -Coagulation and Flocculation -Activated Sludge -Sand Filters -Membrane Separation, advanced oxidation process, adsorption. Sewage treatment process.</p>	12
2	<p>Application of Green Chemistry in Agriculture and Energy</p> <p>Agriculture: Agro production processing, organic farming systems – sustainable organic manure, bio-fertilizer. Post-harvest technologies. Energy: Various green technologies available for energy production, Energy from biomass and solid waste, Biofuels, hydrogen production technology, biofuels from Jatropa</p>	7



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3	Environmental Technologies for Sustainable Cities and Communities- Role of green chemistry in sustainable building- material, Health and safety. Indoor Air quality, The Energy Conservation Building Code (ECBC), Concepts of Green Hotels and Hospitals, Green Technologies for Transport, Green Roads, Industries, 'Green' Infrastructure for Municipal Services and Ecological Sanitation. Utility of Solar energy in buildings- concepts of Solar Passive Cooling and Heating of Buildings. Water Utilization in Buildings.	10
4	Combat Climate Change Air Pollution Control Methods, Steps taken to control Carbon emissions universally, The general approach in planning for the future, Developing mitigative measures for global reduction of Carbon, India's National Action Plan on Climate Change (NAPCC) till date, National Mission for a Green India.	7
5	Circular Economy Concept, Principles, significance and few applications of circular economy, Difference between Cradle to Cradle and Cradle to Grave approach, Concept of sustainable designing in circular economy. Concepts of different R's in designing.	6

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
30	40	30	00	00	00

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. V. Kumar, "An Introduction to Green Chemistry" Vishal publishing Co. Reprint Edition 2010
2. Green Technologies, Soli J. Arceivala, Mc Graw Hill Education
3. .Green Technologies and Environmental Sustainability edited by Ritu Singh, Sanjeev Kumar 2.
4. Sustainable Building Design Manual. Vol 1 and 2, Teri, New Delhi, 2004.



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5. K.S.Jagadish, B. U. Venkataramareddy and K. S. Nanjundarao. Alternative Building Materials and Technologies. New Age International, 2007.
6. Green Chemistry for Sustainable future in “Fundamentals of Environmental Chemistry ” Stanley F. Manahan (Ed). Lewis Publishers.
7. N. Adger , K. Brown , D. Conway. (Vol. 22). 2012. Global Environmental Change: Understanding the Human Dimensions. The National Academic Press.

Course Outcomes:

At the end of the course students will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Understand the environmental status and evolution	20
CO-2	Apply the knowledge of various analytical green methods	30
CO-3	Develop holistic approach towards different segments of infrastructure with the lens of green chemistry and technology	30
CO-4	Understand the Current approaches of designing and economical approach towards better future	20

List of Experiments:

- Introduction to Equipment in Environmental Engineering Laboratory
- Introduction to Standards, Sampling, Collection and Preservation of samples
- Determination of pH and conductivity for water and wastewater
- Determination of Solids (suspended, dissolved and settleable)
- Determination of Acidity and Alkalinity
- Determination of hardness and residual chlorine
- Determination of fluoride and nitrate
- Ambient air quality measurement using High Volume sampler
- Coliform count

Field Study and Report thereof

- Students are required to visit any green community/industry or other site and prepare a study report thereof. The field study will be evaluated on the basis of report and presentation
- Report on Carbon footprint, Carbon Emissions from a Selected Industry in India

Major Equipment:

- pH meter
- TDS meter



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- High volume sampler
- Exhaust gas analyser
- Ion selective meter for Fluoride and Chloride estimation
- Autoclave

List of Open Source Software/learning website:

MoEFCC

www.nptel.ac.in,

www.ocw.mit.edu

<https://www.rsc.org>,

<https://www.weforum.org>,

<http://cpcbenvs.nic.in/greentechnology.html#>