# NIRMA UNIVERSITY
## School of Engineering, Institute of Technology
## B.Tech. in Chemical Engineering
## Semester VII

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| Course Code | XXXXX (Open Elective) |
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| Course Title | Green Chemistry and Technology |

## Course Outcomes (CO):

At the end of the course, students will be able to-

1. comprehend the principles and concepts of green chemistry
2. identify the societal issues that may impede the adoption of green energy
3. recognize the importance of green chemistry and technology for safer environment
4. explain and apply the principles of green chemistry and technology

## Syllabus

| | | Teaching Hours |
|---|---|---|
| **Unit I** | **Principles and Concepts of Green Chemistry**<br>The Environment and the five environmental spheres, Green Chemistry and Synthetic Chemistry. Waste: production, problems and prevention, sources of waste, Basic principles of Green Chemistry. Chemical Reactions for making materials safely. | **10** |
| **Unit II** | **Green Energy**<br>Energy and its sources, efficiency and sustainability, energy from biomass and solid waste, biofuels, hydrogen production technologies, green engineering and energy conversion efficiency. | **12** |
| **Unit III** | **Role of Green Chemistry for Safer World**<br>**Solar Energy:** Nature and availability of solar energy, Solar energy & environment. Various methods of using solar energy –Photo thermal, Photovoltaic, Photosynthesis, Present & future scope of solar.<br>**Bio Energy:** Importance of biogas technology, Different types of biogas plants. Aerobic and anaerobic bioconversion processes, various substrates used to produce Biogas (cow dung, human and other agricultural waste, municipal waste etc.) Application of biogas.<br>**Water as Ultimate Green Solvent:** Uses and environmental chemistry, Heavy metal water pollutants, Inorganic water pollutants, Organic water pollutants, Water treatment<br>**Air and Atmosphere:** Atmospheric pollutant particles, Acid rain, Photochemical smog<br>**The Biosphere:** Revolution in biology related to green chemistry, Biological interaction with environmental chemicals, biodegradation.<br>**The Geosphere, Soil and Food Production:** Second green revolution, Environmental hazards of the geosphere<br>**Towards Greener Anthrosphere through Industrial Ecology:** Green chemistry in the service of industrial ecosystems | **18** |

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| | **Terrorism, Toxicity and Vulnerability:** Chemistry in defense of human welfare, Green chemistry for sustainable prosperity and a safer world | |
| **Unit IV** | **Green Environmental Issues** | **05** |
| | Introduction to ecological and carbon foot print, carbon credits, clean development mechanism. | |

## Self Study:

The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

## Suggested Readings


1. S.E. Manahan, *Green Chemistry and the Ten Commandments of Sustainability*, ChemChar Research, Inc, USA.
2. P. T. Anastas and J.C. Warner, *Green Chemistry, Theory and Practice* Oxford.
3. H.S. Peavy, D.R. Rowe and G. Tchbanoglous, *Environmental Engineering*, McGraw Hill International Edition.
4. V. K. Ahluwalia, *Green Chemistry: Environmentally Benign Reactions*, Ane Books India, New Delhi.
5. M. M. Srivastava, R. Sanghi, *Chemistry for Green Environment*, Narosa, New Delhi.