1.	Affinity Biosensors: Techniques and Protocols by K.R. Rogers and A. Mulchandani. Publisher: Humana Press.
2.	Biosensors and their Applications by V.C. Yang and T.T. Ngo. Publisher: Springer.
3.	Chemical Sensors and Biosensors by B.R. Eggins. Publisher: John Wiley and Sons Inc.
4.	Sensors and Sensing in Biology and Engineering by F.G. Barth, et al. Publisher: Springer Verlag.
5.	Bioinstrumentation and Biosensors by D.L. Wise. Publisher: Marcel Dekker.
6.	Process Biotechnology Fundamentals by S N Mukhopadhyay. Publisher: Viva Books Pvt. Ltd., New Delhi.

GREEN ENERGY TECHNOLOGY

Details of course:-

Course Title	Course Structure			Pre-Requisite
	L	T	P	
Green Energy Technology (BT423)	03	01	00	Nil

Course Objective:

This paper exposes students to the renewable resources of energies and energy conversion processes. It teaches the uses of clean energy technologies and their importance in sustainable development

Course Outcome (CO):

1. Classify energy sources; review conventional energy resources.
2. Discuss solar radiation and its measurements, prediction, and utilization of solar radiation in different aspects.
3. Identify biomass generation, utilization and Properties and learning techniques for biomass assessment, Bio-based chemicals, and materials.
4. Outline principles and conversion of wind, ocean, geothermal & waste energy into each other.
5. Define and distinguish between green chemistry and green nanotechnology.

S.No.	Content	Contact Hours
1.	**Energy Sources, Green Energy and Sustainable Development:** Introduction to nexus between Energy, Environment and Sustainable Development; Classification of energy sources; Review of conventional	8

	energy resources; Fossil fuel reserves; Renewable resources; Global environment concerns: Global warming, Ozone layer depletion, Greenhouse gas emissions; Clean/green energy technologies; International agreements/conventions on energy and sustainability	
2.	**Solar Energy Utilization:** Solar radiation: measurements and prediction; Earth and Sun relation; Solar thermal collectors; Thermal storage; Conversion of heat energy in to mechanical energy; Solar thermal power generation systems; Solar Photovoltaic; Types of solar cells; Solar photocatalysis; Solar energy based industrial processes and systems; Greenhouse technology	8
3.	**Biomass Energy Utilization, Bioenergy and Biomethanation:** Biomass generation and utilization; Properties of biomass; Agriculture crop and forestry residues used as fuels; Techniques for biomass assessment; Bio-based chemicals and materials; Biomass energy conversion processes; Biochemistry and process parameters of bio methanation; Importance of biogas technology; Biogas digester types; Aerobic and anaerobic bioconversion processes; Applications of biogas	8
4.	**Wind, Ocean, Geothermal & Waste to Energy Conversion:** Wind energy potential measurements; Principles of wind energy conversion Wind energy conversion systems; Wind electric generator; Ocean energy resources; Principle of ocean thermal energy conversion systems; Ocean thermal power plants; Principles of ocean wave energy and tidal energy conversion; Types of geothermal energy deposits; Geothermal power plants; Introduction to waste and waste processing; Types and composition of various types of wastes; Waste to energy conversion processes	8
5.	**Green Management:** Introduction to green chemistry, green nanotechnology	10
	Total	42

Books: -

S.No.	Name of Books/ Author/Publisher
1.	Renewable Resources and Renewable Energy- A Global Challenge by M. Graziani and P. Fornasiero. 2nd Ed. CRC-Taylor and Francis
2.	Fundamentals of Renewable Energy Processes by Aldo da Rosa, Academic Press
3.	Municipal Solid Waste to Energy Conversion Processes: Economic, technical and Renewable Comparisons by Gary C. Young. John Wiley & Sons
4.	Biogas from waste and renewable resources by Dieter D. and Angelika S. Wiley-VCH Publication
5.	Energy and the Environment by Ristinen, Robert A. Kraushaar, Jack J. A Kraushaar, Jack P. Ristinen, Robert A., 2nd Ed. John Wiley
6.	Solar Photovoltaics: Fundamental Applications and Technologies by C. S. Solanki. Prentice Hall of India