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1.3 - Curriculum Enrichment

1.3.1 - Institution integrates crosscutting issues relevant to Professional Ethics, Gender, Human Values, Environment and Sustainability into the Curriculum:

Response: BOS of Chemistry , University of Gaur Banga,Malda, has prepared curriculum, and various crosscutting issues relevant to Environment,Green Chemistry, and Sustainability are highlighted in the syllabus by the Department of Chemistry:

CBCS-SEMESTER-I	UNIT-TOPIC	Sub-Topic
Teacher	Unit 1: Introduction to Environmental Studies	Sub-Topic
Dr.Niranjan Kumar Mridha, Associate Professor	Unit 2: Natural Resources: Renewable and Non-renewable Resources	Energy resources: Renewable and non-renewable resources, use of alternative energy sources, growing energy needs -- case studies. Water resources: Distribution of water on earth, use and over exploitation of water on earth, floods, drought, conflicts over water (international and national), Dams -- benefits and problems. Forest Resources: Types and importance of forest resources, use and over exploitation, Deforestation and its effects. Conservation and protection of Forest, Wild life management. Mineral resources: Types and importance of minerals and exploitation, effect of extraction on environment.
Dharitri Mandal,SACT-1	Unit 5: Environmental Pollution	Definition, types , causes, effects and controls Air , water , soil and noise pollution causes and

		consequences □ Thermal, nuclear and marine pollution causes, present status and consequences. □ Solid waste management causes, effects and control of urban and industrial wastes. □ Role of an individual in prevention of pollution. □ Pollution: case studies. □ Disaster management: flood, earthquake, cyclone and landslides.
Gulbuddin Hekmotiar,SACT-2	Unit 6: Environmental Policies and Practices	□ Climate change, Global warming, Ozone layer depletion, Acid rain and its impacts on human communities and Agriculture. □ Environmental laws: Environment Protection Act , 1986 ; Air (prevention and control of pollution) Act, 1981; Water(prevention and control of pollution) Act, 1972; Wild life protection Act 1972; Forest conservation Act 1920, 1988 ; International agreements Montreal protocols, 1987 and Kyoto protocols, 1997 and Convention on Biological Diversity(CBD).
Dr.Niranjan Kumar Mridha, Associate Professor	CEMHP-4- Organic Chemistry – II-	B. Purification of the crude product is to be made by crystallization from water/alcohol, crystallization after charcoal treatment, or sublimation, whichever is applicable.
Dr.Niranjan Kumar Mridha, Associate Professor	CEMHSE-1B- Basic Analytical Chemistry	3. Analysis of food products (4L) Nutritional value of foods, idea about food processing and food preservations and adulteration. Identification of adulterants in some common food items like coffee powder, asafoetida, chilli

		powder, turmeric powder, coriander powder and pulses, etc.
Dr.Niranjan Kumar Mridha, Associate Professor	CEMHTDSE- 4- Green Chemistry	1. Introduction to Green Chemistry: (4L) What is Green Chemistry? Need for Green Chemistry. Goals of Green Chemistry. Limitations/ Obstacles in the pursuit of the goals of Green Chemistry 2. Principles of Green Chemistry and Designing a Chemical synthesis: (27 L) Twelve principles of Green Chemistry with their explanations and examples and special emphasis on the following: Designing a Green Synthesis using these principles; Prevention of Waste/ byproducts; maximum incorporation of the materials used in the process into the final products, Atom Economy, calculation of atom economy of the rearrangement, addition, substitution and elimination reactions. Prevention/ minimization of hazardous/ toxic products reducing toxicity. risk = (function) hazard × exposure; waste or pollution prevention hierarchy. Green solvents– supercritical fluids, water as a solvent for organic reactions, ionic liquids, fluorous biphasic solvent, PEG, solventless processes, immobilized solvents and how to compare greenness of 55 solvents. Energy requirements for reactions – alternative sources of Energy requirements for reactions – alternative sources of energy: use of microwaves and ultrasonic energy. Selection of starting materials; avoidance of unnecessary derivatization – careful use of

		blocking/protecting groups. Use of catalytic reagents (wherever possible) in preference to stoichiometric reagents; catalysis and green chemistry, comparison of heterogeneous and homogeneous catalysis, biocatalysis, asymmetric catalysis and photocatalysis. Prevention of chemical accidents designing greener processes, inherent safer design, principle of ISD "What you don't have cannot harm you", greener alternative to Bhopal Gas Tragedy (safer route to carcarbaryl) and Flixiborough accident (safer route to cyclohexanol) subdivision of ISD, minimization, simplification, substitution, moderation and limitation. Strengthening/ development of analytical techniques to prevent and minimize the generation of hazardous substances in chemical processes.
Gulbuddin Hekmotiar,SACT-2		3. Examples of Green Synthesis/ Reactions and some real world cases (25 L) Green Synthesis of the following compounds: adipic acid, catechol, disodium iminodiacetate (alternative to Strecker synthesis) Microwave assisted reactions in water: Hofmann Elimination, methyl benzoate to benzoic acid, oxidation of toluene and alcohols; microwave assisted reactions in organic solvents Diels-Alder reaction and Decarboxylation reaction Ultrasound assisted reactions: sonochemical Simmons-Smith Reaction (Ultrasonic alternative to Iodine) Surfactants for carbon dioxide – replacing smog producing and ozone depleting

		solvents with CO2 for precision cleaning and dry cleaning of garments. Designing of Environmentally safe marine antifoulant. Right fit pigment: synthetic azopigments to replace toxic organic and inorganic pigments. An efficient, green synthesis of a compostable and widelyapplicable plastic (poly lactic acid) made from corn. Healthier Fats and oil by Green Chemistry: Enzymatic Inter esterification for production of no Trans-Fats and Oils Development of Fully Recyclable Carpet: Cradle to Cradle Carpeting 4. Future Trends in Green Chemistry: (4L) Oxidation reagents and catalysts; Biomimetic multifunctional reagents; Combinatorial green chemistry; Proliferation of solventless reactions; co crystal controlled solid state synthesis (C2S3); Green chemistry in sustainable development.
Gulbuddin Hekmotiar,SACT-2	CEMHPDSE- 4- Green Chemistry	1. Safer starting materials: Preparation and characterization of nanoparticles of gold using tea leaves. 2. Using renewable resources: Preparation of biodiesel from vegetable/ waste cooking oil.
Dr.Niranjan Kumar Mridha, Associate Professor	CEMHPDSE- 4- Green Chemistry	6. Alternative sources of energy: Solvent free, microwave assisted one pot synthesis of phthalocyanine complex of copper (II). Photoreduction of benzophenone to benzopinacol in the presence of sunlight.

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