RAM KRISHNA DHARMARTH FOUNDATION UNIVERSITY, BHOPAL

Airport Bypass Road, Gandhi Nagar, Bhopal - 462033

6th Semester

Branch	Subject Title	Subject Code
B.Sc. (CHEMISTRY) DSE - 1	**Green and Agricultural Chemistry**	**CHDSE1-161**

Course Objectives:- One of the objectives of this course is to provide the student knowledge about the principles for Green Chemistry. Central topics will include the reduction of waste, use of renewables, catalysis, substitution of hazardous and dangerous chemicals with more benign alternatives etc. Agricultural chemistry is the chemistry, especially organic chemistry and biochemistry, as they relate to agriculture. Agricultural chemistry embraces the structures and chemical reactions relevant in the production, protection, and use of crops and livestock.

Course Learning outcomes (CLO)

By the end of this course students will acquire the knowledge of following aspects of green and agricultural chemistry

- Basic principles of green and sustainable chemistry.
- Understand stoichiometric calculations and relate them to green process metrics.
- Learn alternative solvent media, green catalysis and energy sources for chemical processes
- Understand the requirements of manures and fertilizers for various crops and their proper time of application.
- Understand to maintain soil fertility for better crop production

Content

Unit - 1

Concepts and Principles of Green Chemistry

History and evolution of Twelve principles of green chemistry and their explanations with examples.
Tools of green chemistry-green solvents, green catalysts, energy efficient processes, environmentally benign products, dry media synthesis (use of sun light, UV. microwaves and ultrasonic energy).
Metrics of green chemistry-different metrics relating to the principles of green chemistry, atom economy, percentage yield, reaction mass efficiency, effective mass efficiency, environmental factor. eco scale and biologic tool plots, difference between mass based and impact- based matrices, life cycle assessment (LCA) and environment foot print.
Challenges and scope of green chemistry in India.

Unit - 2

Green Catalysis and Processes

Heterogeneous catalysis, use of zeolites, silica and alumina supported catalysis, biocatalysis: Enzymes. microbes, Phase transfer catalysis (micellar/surfactant). Prevention of chemical accidents, designing greener processes. Strengthening/development of analytical techniques to prevent and minimize the generation of hazardous substances in chemical processes.
Cutting Edge Research in pharma, paint, detergent and other synthetic industries.
Green Synthesis of the following compounds: adipic acid & catechol, Microwave assisted reaction in water - Hoffmann elimination, oxidation of toluene and alcohols.

Unit – 3

Soil Fertility

Soil fertility evaluation and soil testing.
Critical levels of different nutrients in soil.
Forms of nutrients in soil, plant analysis, rapid plant tissue tests. Indicator plants.
Methods of fertilizer recommendations to crops. Factors influencing nutrient use efficiency (NUE). methods of application under rainfed and irrigated conditions.

Unit - 4

Organic Manuring

Classification and importance of organic manures, properties and methods of preparation of bulky manures. Green/leaf manuring. Transformation reactions of organic manures in soil and importance of CN ratio in rate of decomposition.

Unit - 5

Fertilizers

Chemical fertilizers: classification, composition and properties of major nitrogenous, phosphatic, potassic fertilizers. secondary and micronutrient fertilizers. complex fertilize nano fertilizers.
Soil amendments, fertilizer storage and fertilizer control order.
History of soil fertility and plant nutrition. Criteria of essentiality.
Role, deficiency and toxicity symptoms of essential plant nutrients.
Mechanisms of nutrient transport to plants. factors affecting nutrient availability to plants.
Chemistry of soil nitrogen, phosphorus, potassium, calcium, magnesium, sulphur and micronutrients.
Use of Bio-fertilizers in Agriculture and their Advantages.

Practical's

1. Green preparations:

Part-A

(i) Manganese(III) acetylacetonate complex by using potassium permanganate and acetylacetone in water.

(ii) Green preparation of Iron (III) acetylacetonate complex by using ferric trichloride and potassium hydroxide in water.

(iii) Preparation of ionic liquid, 1-Pentyl-3- methylimidazolium bromide (pmIm]Br.

2. Green bromination of trans-stilbene by sodium bromide-sodium bromate.

3. Diels-Alder reaction between furan and maleic acid.

4. Benzoin condensation Coenzyme (Thiamine hydrochloride) catalyzed synthesis of benzoin.

Part B

5. Study of soil profile in the field.

6. Study of soil sampling tools, collection of representative soil sample, its processing and storage.

7. Study of soil forming rocks and minerals.

8. Estimation of organic matter content of soil.

Part C

9. Determination of soil pH and electrical conductivity

10. Determination of clion exchange capacity of soil.

11. Determination of soil density, moisture content and porosity.

12. Determination of soil texture by feel and Bouvoucos methods.