Bachelor of Science (Hons.) in Applied Life Sciences with Agrochemicals and Pest Management

SEMESTER-IV

Chemistry Component - DSC

DISCIPLINE SPECIFIC CORE COURSE (DSC 04)

Credit distribution, Eligibility and Pre-requisites of the Course

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course
		Lecture	Tutorial	Practical/ Practice		
Fundamentals of Agrochemistry ALS CHEM DSC 04	**4**	**2**	**0**	**2**	**Class 12th Pass with Science**	**NIL**

Learning Objectives:

The Learning objectives of this course are as follows:

- to develop a scientific understanding of the diverse approaches to classify the agrochemicals.
- to make them familiar of chemical structure, mode of action and uses of pesticides.
- to impart the knowledge of pesticide formulation, their types, advantages and disadvantages.
- to make them aware of the hazards of agrochemicals and their impact on human health.

Learning Outcomes:

By studying this course, students will be able to:

- learn classification of pesticides.
- analyze the impact of stereochemical aspects on pesticidal activity.

- carry out preparation of formulations and analysis.
- handle pesticides safely in view of human health and environment.

Unit 1: Pesticides (5 Hours)

Different classes of pesticides based on use or target pests (Only definitions and examples- no structural requirement): Herbicides, Fungicides, Insecticides, Rodenticides, Acaricides, Bactericides**,** Chemosterillant, Molluscicide, Nematicides, Plant growth regulators, Repellents, Antifeedants, Sex attractants, Classification of pesticides based on chemical nature, mode of entry, mode of action and toxicity.

Unit 2: Herbicides (6 Hours)

Structure, uptake, mode of action and uses along with key points on human toxicity, with special reference to the individual compounds mentioned (synthesis excluded):

a) Aryl alkanoic acids: 2, 4 D, 2,4DB, MCPA and other acid derivatives: dicamba, dichlorobenil, dalapon {along with structure-activity relationship (SAR)}
b) Aromatic carbamates: Barban and asulam.
c) Triazines: Simazine, Atrazine
d) Bipyridinium: Paraquat
e) Organophosphorous: Glyphosate
f) Sulfonylurea: Chlorosulfuron
g) Uracils: Bromacil
h) Ureas: Monuron and Isoproturon

Unit 3: Fungicides (6 Hours)

Structure, mode of action and uses along with key points on human toxicity, with special reference to the individual compounds mentioned (synthesis excluded):

a) Copper and mercury derivatives
b) Dithiocarbamates: Thiram, Ziram, Nabam
c) Dinitro phenols: 2, 4-Dinitro o-Cresol (DNOC)

d) Quinines: Dichlone
e) Benzimidazoles: Benomyl
f) Organophosphorus fungicides: Kitazine
g) Phenyl amides: Metalaxyl
h) Triazoles: Propiconazole
i) Thiophanates: Thiophanates

Unit 4: Conventional Pesticides (4 Hours)

With special reference to the individual compounds mentioned (*synthesis excluded*): Structure, pesticidal properties and stereochemical aspects (*if any*), mode of action, uses and comments on human toxicity

a) Carbamate insecticides: Carbaryl, Methomyl
b) Organophosphorus insecticides: Malathion, Parathion
c) Organochlorine Insecticides: Chlordane, Heptachlor, DDT

Unit 5: Introduction to other Pesticides (4 Hours)

Structure, stereochemical aspects (if any), use and toxicity of the following (*synthesis excluded*):

a) Alkaloid family: Nicotine
b) Pyrethrins: Pyrethrin-I and II
c) Fumigants: Example of Halogenated Hydrocarbons
d) Rodenticides: Inorganic and organic (Two examples each)
e) Repellents: DEET, Diethylphthalate

Unit 6: Pesticide Formulations (5 Hours)

1. Definition and purpose of formulations.
2. Brief discussion on the following type of formulations:
    a) Solid formulations: dusts (D), granules (G), pellets (P), wettable powders (WP or W), dry flowable (DF), soluble powders (SP); poison baits (B)

b) Liquid formulations: emulsified concentrates (EC or E), solutions, flowing suspensions (F or L), Suspension Concentrate (SC), aerosols (A)

c) Other type of formulations: fumigants (F); microencapsulated product (M) for controlled-release.

PRACTICAL **(60 Hours)**

1. Preparation of Bordeaux mixture and Bordeaux paste.

2. Preparation of Dithiocarbamate fungicide analogous from aromatic/aliphatic amine and separated as sodium /zinc/ manganese salt.

3. Preparation of homemade rodent bait.

4. Preparation of Emulsifiable concentrate (EC) formulation of given organic compound as oil in water emulsion(O/W).

5. Preparation of EC formulation: Emulsifiable concentrate of neem oil.

6. Preparation of standard hard water.

7. To determine the emulsion stability of given EC formulation.

8. Determination of bulk density of WP formulation.

9. **Project Writing**: For project work pesticides to be selected from the theory portion

(a) Use of Globally Harmonized System (GHS) of classification and labelling of chemicals
(b) The impact of pesticides on the environment.
(c) Pesticide exposure and its impact on human health.

Essential /Recommended readings:

1. Buchel, K. H**.,** (1983) *Chemistry of Pesticides*, John Wiley & Sons Inc ISBN 13 978-0471056829
2. Melnikov,N.N. (1971) *Chemistry of Pesticides,* Edited By: Frances A. Gunther, Jane Davies Gunther, Springer, ISBN: 978-1-4684-6253-1
3. Cremlyn, R. (1978) *Pesticides: Preparation and mode of action*, 1st edition (October 19, 1978) John Wiley & Sons., 0471996319

4. Kenneth, A., Hessall (2013) *The chemistry of Pesticides, their Metabolism, Mode action and uses in crop*, Bio-Green Books, ISBN13: 978-9386237118
5. Sree Ramulu, U. S. (1979) *Chemistry of insecticides and fungicides,* 3rd Edition, Scientific Publishers; Edition: 2020, ISBN: 9789389832020
6. Roberts, T.R., Hutson, D.H., Jewess P.J., (1998) *Metabolic pathways of agrochemicals: insecticides and fungicides.* Royal Society of Chemistry
7. Handa, S.K., (2008) *Principles of Pesticide Chemistry*, Ed. By Agrobios (India) ISBN-13: 9788177542165
8. Singh Anupama et. al (2022) *Basics of Agrochemical Formulations*, Brillion Publishing ; ISBN: 9789392725128
9. Parmar, B.S., Tomar, S.S., (2010) *Pesticide formulation-Theory and practice* , CBS Publisher; ISBN 13: 9788123911243

Suggestive readings

1. Matolcsy,G., Nádasy,M., Andriska,V.,(1989) *Pesticide Chemistry,* 1st Edition - January 1, 1989; eBook ISBN: 9780080874913
2. Vyas, S. C. (1993) *Handbook of Systemic Fungicides: Compounds*. Tata McGraw-Hill.
3. Ashworth, R. D. B., (1970) *Analysis of technical and formulated pesticides,* Volume 1 ,*CIPAC handbook.*
4. Jim A. Turner, (2018*) The Pesticide Manual: A World Compendium*, British Crop Production Council.
5. World Health Organization. (2011). *International code of conduct on the distribution and use of pesticides: guidelines for quality control of pesticides* (No. WHO/HTM/NTD/WHOPES/2011.4). World Health Organization.
6. Zweig, G. (Ed.). (2013). *Principles, Methods, and General Applications: Analytical Methods for Pesticides, Plant Growth Regulators, and Food Additives, Vol. 1* (Vol. 1). Elsevier.