

DEPARTMENT OF AGRICULTURAL CHEMICALS

Ph.D Programme

<i>Course No.</i>	<i>Title of the course</i>	<i>Credits</i>
1st Semester		
AC- 701	Advanced Organic Chemistry	2+1
AC- 702	Xenobiotic Movement, Transformation and Metabolism	2+1
AC- 703	Approach Towards Synthesis of Pesticides	1+1
AC- 704	Accreditation of Chemical Testing Laboratory	1+1
2nd Semester		
AC- 751	Advances in Agrochemical Formulation	2+1
AC - 752	Chemistry of Biopesticides	2+1
AC- 753	Special Topics in Agro-Chemicals	1+0
AC-691	Seminar-I	1+0
3rd Semester		
AC-849	Seminar-II	1+0
4th Semester		
	Nil	
5th Semester		
	Nil	
6th Semester		
AC-999	Seminar-III	1+0
AC-1000	Doctoral Research	0+45

AC-701**Advanced Organic Chemistry****2+1****Theory**

UNIT I: Stereochemistry: Chiral synthesis, Walden inversion, optical resolution, racemic modification. Stereospecific and stereoselective reactions. Nucleophilic substitution reactions, SN₂ with inversion, SN₁ with partial inversion. Reactions involving carbonions and free radicals. The SN₁ mechanism.

UNIT II: Stereochemistry of eliminations (syn elimination vs. anti-elimination, orientation in elimination reaction, molecular rearrangement, decarboxylation reactions, etc.). Stereo-chemistry of addition reactions of alkenes and alkynes. Electrophilic addition of bromine. Formation and

reactions of epoxides, epoxide opening, orientational preferences, etc.). Addition of carbons to alkenes, hydrogenation, hydroboration Oppenauer oxidation.

UNIT III: Reagents in organic synthesis: Gilman's reagent, lithium dimethyl cuprate, lithium diisopropyl amide (LDA), dicyclohexylcarbodiimide, 1,3-dithiane, trimethyl silyl iodide, triselenium dioxide, tri-butyl tin hydride, osmium tetroxide, Dichloro dicyano quinone etc. Organometallic reagents in organic synthesis.

UNIT IV: Protective group in synthesis of organic compounds. Photochemistry, pericyclic reactions.

UNIT V: Application of UV, IR, NMR and mass spectroscopy in structural elucidation of organic compounds.

Practical

Friedel-Crafts reaction (Alkylation/Acylation), Aldol/Claisen Schmidt reaction, Pechmann condensation/Perkin reaction, Methylation, acetylation, elimination, Oxidation, reduction, hydrolysis, Acid chlorides, amides, esters, Characterisation of Organic compounds (NMR and IR spectroscopy).

AC-702 Xenobiotic Movement, Transformation and Metabolism 2+1

Theory

UNIT I: Movement and fate of pesticides in the environment: Drift, volatilization, adsorption, desorption, leaching, runoff, etc. Soil pesticide interactions. Movement in plant, animal and other living systems: Penetration, translocation, excretion, etc. (Highlight the role of physico-chemical parameters).

UNIT II: Persistence – factors affecting (physical, chemical, biochemical etc.), primary and secondary metabolites in plants and animals with examples. Biotic and abiotic transformations. Bio-chemical transformations in living systems.

UNIT III: Photochemical transformation of pesticides: Introduction to photochemistry, direct and indirect photolysis, photosensitizers, quenchers, light filters. Quantum yield. Phototransformation products and their significance. Other abiotic factors transforming xenobiotics.

UNIT IV: Chemical transformation of xenobiotics – effect of pH, Eh, moisture, environmental gases, etc.

UNIT V: Food chain in environment – significance and implications.

Practical

Preparation of metabolites, Photodegradation of pesticides, Leaching of pesticides, Biological degradation in soil.

AC -703 Approach Towards Synthesis of Pesticides 1 + 1

Theory

Brief introduction on the chemistry and synthesis of agrochemicals; Synthesis and insecticidal activity of pyrethroids from substituted pyrazole methanol precursors; Insecticidal substituted biphenyl methyl oxime ethers; 3-isoxazolidinones and related compounds: a new class of bleaching herbicides; 2-Cyano Aryl ethyl triazoles as Agricultural fungicides; Synthetic route of different class of insecticide/herbicide/fungicide (OC, OP, Carbamate, Dinitroaniline, Phenoxyacetic acid, benzimidazole, etc.

Practical

Hydrolysis of benzamide; Preparation of aromatic nitro compounds; Preparation of Phthalimide compounds; Side chain oxidation of an aromatic compound; Preparation of dibenzalacetone.

AC-704**Accreditation of Chemical Testing laboratory****1+1****Theory**

UNIT I: Introductory concept on accreditation system, Terms and definition, Objective, Benefits of accreditation, Importance of accreditation for the laboratory, Pre-Requisites for Accreditation, Types of Assessment, Function of accreditation body.

UNIT II: Overview on ISO 17025, Management Requirement, Technical requirement, Quality Manual, Assessment Criteria, Scope of Accreditation.

UNIT III: Method validation, calibration and Measurement of Uncertainty, Quality Assurance system.

UNIT IV: Process of Accreditation, Application format, Check list of application, Use of NABL logo.

UNIT V: System Planning and Acceptance, Good Laboratory Policies, Compliance Issues of Laboratory Accreditation Standard.

Practical

Preparation of analytical pesticide standard; Storage stability test of pesticides; Calibration of glass goods; Preparation of SOP for testing chemicals; Preparation of questionnaire for Internal audit; Internal audit of laboratory; Compliance to the audit query. Master degree syllabus of Department of Agricultural Chemicals

AC-751**Advances in Agrochemical Formulation****2+1****Theory**

UNIT I:

Basic concept of surface chemistry: Surfactants, Surface tension, Viscosity, Contact angle, Micellisation.

UNIT II: New generation surfactants, synergists, safeners, encapsulants, antioxidants, stabilizers, etc. highlighting chemistry, classification, properties, uses, etc., formulants-toxicant interactions, pesticide mixtures; Mechanism of adjuvancy

UNIT III: Latest development in formulations: Advantages; Properties and methods of preparation of Oil in Water emulsion (EW); Suspo emulsion (SE); Micro emulsion (ME); Water Dispersible Granules (WDG / WG); Controlled release (CR) formulations, mechanism of release

UNIT IV: Pesticide Disposal and Waste management: Techniques, Parameters of effluent monitoring, decontamination, etc.; Occupational exposure of chemical and safety in manufacturing units; Physico-chemical basis of pesticide antidotes.

UNIT V: Principles of pesticide application: Dose, distribution, coverage. Brief coverage of machinery and equipment. Precautions in use of pesticides; Atomization and retention; Factors affecting uptake and translocation of pesticide after application

Practical

Test for active ingredients for different classes of Pesticides formulations using Spectrophotometry (UV - VIS); Chromatography (GLC / HPLC); Determination of flash point of solvents and agro-formulations; Preparation of controlled release formulation; Release of active ingredient from CR formulation in soil and water; Preparation of micro-emulsion formulation.

AC-752**Chemistry of Biopesticides****2+1****Theory**

UNIT I: Conventional natural insect control agents such as pyrethrins, rotenones,

nicotine, ryanodine, isobutylamides, sesquiterpenoids, withanolides, clerodanes, quassinoids and limonoids - sources, isolation, characterization, synthesis, application and mode of action.

UNIT II: Insect behaviour modifying chemicals (Semi-chemicals) – pheromones (sex alarm, trail, territorial, aggregation, etc.). Allelochemicals – allomones, kairomones, synomones, apneumones. Insect hormones – JH, Anti – JH, JH-mimics, feeding deterrents and repellents – both natural and synthetic: Sources, chemistry, mode of action, chemical ecology. Application of biotechnology in pest management (ex. *Bt*).

UNIT III: Phytoalexins, stress metabolites: Sources such as Leguminosae, Solanaceae etc. Acetylene and polyacetylene phytoalexins. Chemistry, use and mode of action of natural fungicides, nematicides including photo-activated pesticides like α -terthienyl.

UNIT IV: Pesticides of microbial origin: Sources, chemistry and mode of action of avermectins, milbemycins and spinosad. Herbicides like bio-laphos and phosphonothricin. Phytotoxins like *Alternaria alternata* toxin, tentoxin, cornexistin, hydantoxidin. Other microbials such as NPV based insecticides.

Practical

Extraction by steam distillation, isolation of pure compounds, their characterization, Extraction of tobacco leaves, isolation of nicotine and its identification, Extraction of neem seed kernels, enrichment of azadirachtin, analysis of azadirachtin and its analysis.

AC-753

Special Topics in Agro Chemicals

1+0

Theory

The teacher will give a topic relevant to the area of specialization of the student as a term paper to develop proficiency in his field of research.

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