

PG Courses: Ph.D. (Ag)		
1 <sup>st</sup> Semester	Theory	Practical
AC 701: Advanced organic chemistry (2 + 1)	<p><u>UNIT I:</u> Stereochemistry: Chiral synthesis, Walden inversion, optical resolution, racemic modification. Stereospecific and stereoselective reactions. Nucleophilic substitution reactions, SN<sub>2</sub> with inversion, SN<sub>1</sub> with partial inversion. Reactions involving carbonions and free radicals. The SN<sub>1</sub> mechanism.</p> <p><u>UNIT II:</u> 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.</p> <p><u>UNIT III:</u> Reagents in organic synthesis: Gilman's reagent, lithium dimethyl curparate, lithiumdiso-propyl amide (LDA), dicyclohexylcarbodiimide, 1,3-di-thiane, trimethyl selyl iodide, triselenium dioxide, tri-butyl tin hydride, osmium tetraoxide, Dichloro dicyano quinone etc. Organometallic reagents in organic synthesis.</p> <p><u>UNIT IV:</u> Protective group in synthesis of organic compounds. Photochemistry, pericyclic reactions.</p> <p><u>UNIT V:</u> Application of UV, IR, NMR and mass spectroscopy in structural elucidation of organic compounds.</p>	<p>Friedal craft 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).</p>
AC 702: Xenobiotic movement, transformation and metabolism (2 + 1)	<p><u>UNIT I:</u> 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).</p> <p><u>UNIT II:</u> Persistence – factors affecting (physical, chemical, biochemical etc.), primary and secondary metabolites in plants and animals with examples. Biotic</p>	<p>Preparation of metabolites, Photodegradation of pesticides, Leaching of pesticides, Biological degradation in soil.</p>

	<p>and abiotic transformations. Bio-chemical transformations in living systems.</p> <p><u>UNIT III:</u> 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.</p> <p><u>UNIT IV:</u> Chemical transformation of xenobiotics– effect of pH, Eh, moisture, environmental gases, etc.</p> <p><u>UNIT V:</u> Food chain in environment – significance and implications.</p>	
AC 703: Approach towards synthesis of pesticides (1 + 1)	<p>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.</p>	<p>Hydrolysis of benzamide; Preparation of aromatic nitro compounds; Preparation of Phthalimide compounds; Side chain oxidation of an aromatic compound; Preparation of dibenzalacetone.</p>
AC 704: Accreditation of chemical testing laboratory (1 + 1)	<p><u>UNIT I</u> 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.</p> <p><u>UNIT II</u> Overview on ISO 17025, Management Requirement, Technical requirement, Quality Manual, Assessment Criteria, Scope of Accreditation.</p> <p><u>UNIT III</u> Method validation, calibration and Measurement of Uncertainty, Quality Assurance system.</p>	<p>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.</p>

	<p><u>UNIT IV</u> Process of Accreditation, Application format, Check list of application, Use of NABL logo.</p> <p><u>UNIT V</u> System Planning and Acceptance, Good Laboratory Policies, Compliance Issues of Laboratory Accreditation Standard.</p>	
2 <sup>nd</sup> Semester	Theory	Practical
AC 751: Advances in agrochemical formulation (2 + 1)	<p><u>UNIT I:</u> Basic concept of surface chemistry: Surfactants, Surface tension, Viscosity, Contact angle, Micellisation.</p> <p><u>UNIT II:</u> New generation surfactants, synergists, safeners, encapsulants, antioxidants, stabilizers, etc. highlighting chemistry, classification, properties, uses, etc., formulant-toxicant interactions, pesticide mixtures; Mechanism of adjuvancy</p> <p><u>UNIT III:</u> Latest development in formulations: Advantages; Properties and methods of preparation of Oil in Water emulsion (EW); Suspo emulsion (SE); Micro emulsion (ME); Water Dispersable Granules (WDG / WG); Controlled release (CR) formulations, mechanism of release</p> <p><u>UNIT IV:</u> 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.</p> <p><u>UNIT V:</u> 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</p>	<p>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.</p>
AC 752: Chemistry of biopesticides (2 + 1)	<p><u>UNIT I:</u> 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.</p> <p><u>UNIT II:</u> Insect behaviour modifying chemicals (Semiocchemicals) –</p>	<p>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</p>

	<p>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, hemistry, mode of action, chemical ecology. Application of biotechnology in pest management (ex. <i>Bt</i>).</p> <p><u>UNIT III:</u> 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 <math>\alpha</math>-terthieyl.</p> <p><u>UNIT IV:</u> Pesticides of microbial origin: Sources, chemistry and mode of action of avermectins, milbimycins and spinosad. Herbicides like biolaphos and phosphonothricin. Phytotoxins like <i>Alternaria alternata</i> toxin, tentoxin, cornexistin, hydantoxidin. Other microbials such as NPV based insecticides.</p>	analysis.
AC 753: Special topics in agro chemicals (1 + 0)	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.	