

Punyashlok Ahilyadevi Holkar Solapur University, Solapur



NAAC Accredited-2022
'B++' Grade (CGPA 2.96)

Name of the Faculty: Science & Technology

New Education Policy 2020

Syllabus: Agrochemicals and Pest Management

Name of the Course: M. Sc. I (Sem.– I & II)

(Syllabus to be implemented from June 2023)

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

M. Sc. Part – I (Semester I and II)

Agrochemicals and Pest Management

1. TITLE : Subject - Agrochemicals and Pest Management under the Faculty of Science and Technology

2. YEAR OF IMPLEMENTATION:- Revised Syllabus will be implemented from June, 2023

3. PREAMBLE:-

Punyashlok Ahilyadevi Holkar Solapur University since its inception, has successfully tried to meet the regional demands for socio-economic development by introducing need based course. Agrochemicals and Pest Management course is introduced by Punyashlok Ahilyadevi Holkar Solapur University from 2006. It is an interdisciplinary subject. The course content includes analysis and formulations of agrochemicals, applied entomology, plant pathology, biocontrol of pests, extension work, use and marketing of agrochemicals, plant protection equipments, sales and services. Moreover students have to complete one month industrial training especially in pesticide and fertilizer industries, extension and marketing agencies, and analytical laboratories, various crop research stations, etc. So that they become acquainted with needs of industries and application of knowledge they have. Today there is a great demand for this applied course, as students have realized that they have better chances of getting jobs in this world of competition, as compared to conventional courses which trained human resources for teaching field only.

4. GENERAL OBJECTIVES OF THE COURSE:

- 1) To create skilled human resources useful for agriculture as well as various industries like fertilizer, micronutrient, seed processing, agrochemicals, pesticide, pharmaceutical etc.
- 2) To train the students in the following aspects-
 - i) Preparation of bio and chemical pesticides
 - ii) Setting of analytical and tissue culture laboratories
 - iv) Setting of crop dispensaries
 - v) Specific seed and crop standards
 - vi) Effect of agrochemicals on soil, water, atmosphere and biotic
 - vii) Novel methods of composting, vermicomposting and mass production of biofertilizers
 - viii) To determine the medicinal potential of plants and their plantation

5. DURATION

- It is a full-time course.
- The duration of course shall be of Two years (four semesters).

6. PATTERN OF EXAMINATION:-

- Semester system

7. ELIGIBILITY FOR ADMISSION:-

Admission to the course is open only to the candidates passing B.Sc. degree with Chemistry / Botany / Zoology / Microbiology / Plant protection / Biochemistry/ Biotechnology / Environment / Horticulture / Agriculture as the principal subject and B. Pharm. Candidates will be selected from the students appeared for entrance test and fulfilling the conditions as per the university rules for the entrance examination.

8. SPECIAL INSTRUCTIONS:

- (i) **Study Tours:** The students have to participate in study tours organized to visit tissue culture laboratories, Biocontrol laboratory, Agricultural research institutes, field farms, Fertilizer and pesticide industries etc.
- (ii) **Field Visits:** – The students along with their teacher should frequently visit the various crop fields to study the agronomy, pests and diseases of crop plants, soil and water quality.
- (iii) **Industrial Training:** Every student has to complete one-month industrial training in pesticides and fertilizer industries, National agricultural research institutes, field survey in Agro based industries.
- (iv) **Laboratory Work:** Students have to perform the entire prescribed laboratory practical. This work will be done by the student in collaboration with the other science departments on the campus.
- (v) **Guest Lectures:** The students have to attend the guest lecturers of eminent scientists in the field of agricultural chemistry/ well known farmers/ past students of the department/ Persons in Agricultural and marketing management organized by the department.

**Proposed Structure for Two Year PG Program Agrochemicals and Pest Management (AGPM)
(Semester I and II)**

Year (2 Yr PG)	Level	Sem. (2Yr)	Major		RM	OJT/FP	RP	Cum. Cr.	Degree	
			Mandatory	Elective						
I	6.0	Sem I	DSC-1 (4+2) Chemistry of Pesticides, Soil Science & Fertilizers	DSE-1 (4+2) 1.1 Plant Pathology and Weed Management	RM (4) Research Methodology	--	-	22	PG Diploma (after 3 Yr Degree)	
			DSC-2 (4+2) Introductory and Industrial Entomology	OR 1.2 Microbiology-I						--
		Sem II	DSC-3 (4+2) Chemistry of Pesticides and their Formulations	DSE-2 (4+2) 2.1 Agronomy, Biotechnology and Economic Entomology	-----	OJT/FP (04)	-	-		22
			DSC-4 (4+2) Analytical Techniques for Agrochemicals	OR 2.2 Integrated Pest Management						
Cum. Cr. For PG Diploma			24	12	04	04	- - -	44		
Exit option: PG Diploma (44 Credits) after Three Year UG Degree										

M.Sc. Agrochemicals and Pest Management (AGPM): Program structure based on NEP 2020
M.Sc. I Semester-I

Course Type	Course	Paper Titles	Credit	Examination scheme		
				UA	CA	Total
Major Mandatory	DSC-1	Chemistry of Pesticides, Soil Science & Fertilizers	04	80	20	100
		Practicals (Based on DSC-1)	02	40	10	50
	DSC-2	Introductory and Industrial Entomology	04	80	20	100
		Practicals (Based on DSC-2)	02	40	10	50
Major Elective	DSE-1	1.1 Plant Pathology and Weed Management OR 1.2 Microbiology-I	04	80	20	100
		Practicals (Based on DSE- 1.1 or DSE-1. 2)	02	40	10	50
RM	RM	Research Methodology	04	80	20	100
		Total	22	440	110	550

M.Sc. I SEMESTER-II

Course Type	Course	Paper Titles	Credit	Examination scheme		
				UA	CA	Total
Major Mandatory	DSC-3	Chemistry of Pesticides and Their Formulations	04	80	20	100
		Practicals (Based on DSC-3)	02	40	10	50
	DSC-4	Analytical Techniques for Agrochemicals	04	80	20	100
		Practicals (Based on DSC-4)	02	40	10	50
Major Elective	DSE-2	2.1 Agronomy, Biotechnology and Economic Entomology OR 2.2 Integrated Pest Management	04	80	20	100
		Practicals (Based on DSE- 2.1 or DSE- 2.2)	02	40	10	50
OJT/FP	OJT/FP	On Job Training / Field Project	04	80	20	100
		Total	22	440	110	550
		Total for PG Diploma	44	880	220	1100

Exit Option at Level 6: Student can exit, after acquiring 44 credits with post graduate diploma in Agrochemicals and Pest Management after three years UG Degree.

Abbreviations: DSC: Discipline Specific Core, DSE: Discipline Specific Elective, RM: Research Methodology, OJT: On Job Training / Internship/Apprenticeship, FP: Field Project

Semester – I

DSC – 1: CHEMISTRY OF PESTICIDES, SOIL SCIENCE & FERTILIZERS

After studying the above paper students will acquire the knowledge of the following points.

1. The students will get knowledge of the chemistry of pesticides.
2. The information soil and its types for various cropping pattern.
3. The students will have complete knowledge of fertilizer used in farming.
4. The required information of agricultural pesticides and their formulation is given.
5. Development of new Agrochemical residue analysis method for Bio pesticides and Micronutrient.

Unit No.	Titles and Chapter	Lectures	Credits
I	<p>Chemistry of pesticides: Pest and Pesticides, Historical development, chemical and botanical pesticides, classification based on chemical nature and types of targets, Systemic and non-systemic pesticides. Following classes of pesticides are to be studied with respect to their synthesis, chemistry, metabolites, environmental fate, formulations and possible uses: insecticides, herbicides, fumigants, rodenticides, pheromone, non-toxic insect controlling agents.</p>	15	01
II	<p>Soil Science: Soil micronutrients, acidic and alkaline soils, soil reclamation, absorption of toxic metals and chemicals by soil, effect of modern agro-technology and pesticides on soil.</p>	15	01
III	<p>Fertilizers: Classification and types of fertilizers. Nitrogenous Fertilizers: Introduction, ammonium nitrate- Raw materials and manufacturing. Action of urea, calcium cyanamide, calcium ammonium nitrate, sodium nitrate and ammonium chloride as fertilizers. Phosphate fertilizers: Normal super phosphate, triple super phosphate and ammonium phosphate. Potassic fertilizers: Potassium sulphate and the muriate of potash and current status of fertilizer industries in India.</p>	15	01
IV	<p>Micronutrients: Definition, types, properties and uses of micronutrients, manufacture of micronutrients, deficiency and reclamation. Plant Growth Regulators: Introduction, Definition, Classification. Applications of a) Gibberellins b) Auxins c) Cytokinins d) Ethylene and e) Chloro Choline Chloride (CCC) in agriculture. Manures: Introduction, Definition, Humus and decomposing organic matter in soil, Natural organic Manures such as Farmyard Manure, Compost, Vermicompost, Vermiwash and Green Manure. Biofertilizers: Introduction, Definition Rhizobium as Biofertilizers: Isolation of Rhizobium from root nodules, Mass culture of Rhizobium, Inoculation of seeds with Rhizobium. Blue Green Algae as Biofertilizers: Production of BGA by Trough method, Pit Method and Field Method, Application of BGA to crop fields. Merits and demerits of Biofertilizers.</p>	15	01

Sr.no.	Reference Books
1.	N. N. Melnikov: Chemistry of Pesticides (English) Springer.
2.	M. B. Green, G. S. Hartley, T. F. West, Chemical for Crop Improvement and Pest Management (Pergamon).
3.	R. Clemlyn: Pesticides.
4.	K. H. Buchel: Chemistry of Pesticides.
5.	H. B. Scher: Advances in pesticides formulation Technology. ACS, NO.254.
6.	J. Miyamamoto & P.C. Jearney : Pesticide Chemistry Vol. IV (Pergamon).
7.	W. Valukenburg : Pesticide formulations (Dekker).
8.	U.S.Sree Ramulu, Chemistry of Insecticides
9.	Gurdeep Chatwal, Reaction Mechanism and reagents in organic chemistry
10.	A.G.Agarwal,Goel Publishing House Synthetic Organic chemistry, Morison and Boyd, Organic Chemistry.
11.	Finar, Organic chemistry, Vol.I and II, I.L.
12.	Advanced organic chemistry, Jerry March 14, 2011
13.	Ashgate hand book of pesticides and Agricultural Chemicals,G.W.A. Milne
14.	John H. Montgomery Agrochemicals Desk References.
15.	A.K.De. Enviromental Chemistry.
16.	Bear, Chemistry of the soil (ACS Remhold)
17.	Gopal Rao Outline in Chemical Technology.
18.	Shukla and Pandey Introduction to Chemical. Technology.
19.	V.Verma,Plant Physiology
20.	Noggle and Fritz Introductory Plant Physiology
21.	P.C. Das, Manures and Fertilizers

DSC – 2 INTRODUCTORY AND INDUSTRIAL ENTOMOLOGY

After studying the above paper students will acquire the knowledge of the following points.

1. Rearing Bio control agents for Insect Pest Management.
2. General description and morphology of insects.
3. Anatomy and Physiology of the insect.
4. General life cycle patterns in insect pests.
5. Insects of Industrial Importance i.e., Sericulture, Apiculture and some bio control insects.

Unit No.	Titles and Chapter	Lectures	Credits
I	<p>Introduction to insects:-</p> <p>i. General description and morphology of insects:-Head, Thorax and Abdomen – Generalized structure in brief of their appendages.</p> <p>ii. Definition of insect pests, General characters, Habitats, Damage, Economic threshold level, Natural enemies, Parasites and Predators.</p>	15	01
II	<p>Anatomy and Physiology of the insect: -</p> <p>i. Classification of pests Based on damage, feeding habits, taxonomy etc.</p> <p>ii. Digestive system, respiratory system, Circulatory system, Excretory system, Reproductive systems and Nervous systems.</p>	15	01
III	<p>General life cycle patterns in insect pests, Grasshopper, Aphids, Jowar stem borer, Mango stem borer, White grubs, Red hairy caterpillar, Termites, Snails, Slug, Nematodes and Rat.</p>	15	01
IV	<p>Insects of Industrial Importance:-</p> <p>Sericulture: -Mulberry cultivation and rearing of silkworms; pest and disease management of mulberry plant and silkworm.</p> <p>Apiculture: - Types of honeybees, life cycle, bee keeping equipment, honey quality, pest and disease management, Agricultural and nonagricultural flora and bee keeping.</p> <p>Biocontrol: - The production of egg parasitoids of Lepidopteran pest. Production of Bioagents: Production of Trichogramma, Production of Nuclear Polyhydrosis Virus (NPV) and Muscardine fungal pathogens. Production of predator: <i>Chrysoperla carnae</i>.</p>	15	01

Sr.no.	Reference Books
1.	A.S.Atwal, Agriculture pests of India and South East Asia
2.	K.P.Srivastava, A textbook of applied entomology.
3.	Larry P.Pdigo, Entomology and pest management
4.	Sathe and Jadhav Sericulture and pest management –DPH-Delhi.
5.	S.Pradhan Agricultural Entomology
6.	Govt.Maharashtra.Crop pest and how to fight them B.D.Ratnaik,Text Book Of Entomology.
7.	R.Mathur Text Book Of Entomology.
8.	V.B.Avasthi, Introduction to General and Applied Entomology.
9.	K.P.Srivastava, The Text Book Of Applied Entomology.
10.	Koul O.and Dhaliwal G.S. Biopesticides and Pest Management
11.	Krishnaswami S.Silkworm rearing sericulture manual Luyuplian, Silkworm disease.
12.	Mathur and Upadhya,A Text Book Of Entomology.
13.	Abrol D.P.Honey bee diseases and their management.

DSE – 1.1 PLANT PATHOLOGY AND WEED MANAGEMENT

After studying the above paper students will acquire the knowledge of the following points.

1. The students will have complete knowledge of concept plant diseases.
2. Information about disease causal organisms.
3. Overall information of symptoms produced by causal organisms.
4. Identification and control measures of plant diseases.
5. Knowledge of weed association in the cultivated crop.
6. Weeds control measure (Chemical, Mechanical, Physical).

Unit No.	Titles and Chapter	Lectures	Credits
I	<p>The concept of plant diseases: Disease causing organisms, their characters and classification. (Viruses, MLBs, Bacteria and Fungi), significance of plant diseases. Basic procedures in plant disease diagnosis (microscopic, histochemical and molecular basis), Koch's postulates. Stages in plant disease development. Chemical weapons of plant pathogens.</p> <p>Epidemiology: Assessment and forecasting of plant diseases- Elements of an epidemic, slow and rapid epiphytotic, factors affecting the development of epidemic. Assessment of yield loss, measurement of disease intensity, forecasting of plant disease epidemics.</p>	15	01
II	<p>Viral diseases: Causal organism, Symptomology, Etiology, transmission of plant viruses, purification, detection and control of plant viruses. Study of viral diseases-Papaya ring spots, leaf curl of chillies, Yellow vein mosaic of bean, Tobacco mosaic virus with respect to symptomology, cause, disease cycle and control measures.</p> <p>MLO diseases- Properties of mycoplasma, Causal organism, Symptomology, Etiology transmission, diseases caused by MLOs-GSD, little leaf of brinjal with respect to symptoms, cause, disease cycle and control measures.</p>	15	01
III	<p>Bacterial diseases: Causal organism, Symptomology, of bacterial diseases, Etiology, Dispersal of bacterial pathogens and control of bacterial diseases. Study of bacterial diseases- Bacterial blight of bean, Wilt of banana, Citrus greening with respect to symptoms, causal organisms, disease cycle and control measures.</p> <p>Fungal diseases: Causal organism, Symptomology of fungal diseases, Etiology, Dispersal and control of fungal diseases. Study of fungal diseases- Club root of cabbage, <i>Rhizopus</i> soft rot of fruits, Banana leaf spots, Ergot of bajara, red rot of sugarcane, with respect to symptoms, causal organism, disease cycle and control measures.</p>	15	01
IV	<p>Weeds: definition, classification, life cycle, dispersal of weed, growth and development of weeds, assessment of losses, factors affecting competitive ability, associations of weeds with certain crops. Methods of weed controls- physical, chemical and biological.</p>	15	01

Sr.no.	Reference Books
1.	G.N. Agrios, Plant Pathology.
2.	M.B.Green, Chemicals for crop improvement and pest management.
3.	T.J.Masik (Tata McGraw Hill) Weed biology and control.
4.	Mundkar B.B. (1972, Edition), Fungi and plant diseases.
5.	Sharma P.D., Plant pathology Rastogi Publication Merrut.
6.	Guptoa V.K. and R.C.Sharma, (1988). Integrated disease management and plant health.
7.	Marmorosch K., (1982)-Mycoplasma diseases.
8.	Taxonomy of plant pathogenic bacteria in India, Journal of Indian phytopathology.
9.	A. K. Shriwastav, Principles of plant pathology and diseases.
10.	V.S.Rao Principles of weed science.
11.	L.R.Saha, Hand book of plant protection-Kalyani publishers New Delhi.

DSE – 1.2 MICROBIOLOGY – I

After studying the above paper students will acquire the knowledge of the following points.

1. Soil microbiology & Soil as an ecosystem.
2. Pathogenesis of viruses: Host and virus factors involved in pathogenesis, patterns of infection.
3. Microbial World: General characteristics and outline classification of Bacteria, Yeasts, Molds, Viruses, Protozoa, Lichens.
4. General study of microbes and their characters.

Unit No.	Titles and Chapter	Lectures	Credits
I	<p>Soil Microbiology: Introduction: Definition, approaches to soil microbiology, current topics in soil microbiology, Soil as an ecosystem Soil formation, structure and properties, Soil microorganisms: Types and their role in Carbon cycle, Nitrogen cycle, Sulphur cycle, Phosphorous cycle Applications of Biotechnology in Agriculture Surface properties of bacteria and its significance</p>	15	01
II	<p>Pathogenesis of Viruses Host and virus factors involved in pathogenesis, patterns of infection, pathogenesis of plant [TMV], Satellite viruses and their role in plant virus replication. Insect viruses [NPV], Viruses pathogenic to algae and fungi. Host cell transformation by viruses, oncogenesis by DNA and RNA viruses. Outline classification of algae, micro algae, algal cell structure and reproduction & use.</p>	15	01
III	<p>Bacterial nomenclature and classification: Classification of prokaryotic organisms – an overview, Introduction to Bergey’s manual of Determinative Bacteriology and Bergey’ Manual of Systemic Bacteriology Principles of bacterial nomenclature Outline classification of fungi, structure of fungal cell- hyphae and nonmotile unicells, motile cells and spores. General characteristics of Lichens and Mycorrhizae.</p>	15	01
IV	<p>Microbial Diversity Microbial World: General characteristics and outline classification of Bacteria, Yeasts, Molds, Viruses, Protozoa, Lichens, Mycorrhiza Viroids and Prions and their role in the biosphere Differentiation: In Bacillus ,Azotobacter, Candida, Mycoplasma and Aureobasidium spp. General characteristics and molecular architecture of Mycoplasmas.</p>	15	01

Sr.no.	Reference Books
1.	Bacterial cell structure by Rogers, ASM publications
2.	General Microbiology by Stanier et al, 5th Edn.
3.	Microbial Ultra structure by Fuller R.
4.	Chemical Microbiology by Rose.
5.	Microbial and Plant Protoplasts by Peberdy Etal.
6.	Biology of Mycoplasma by Smith P. I.
7.	Introduction to Fungi by Alexopolus.
8.	Bergey's manual of systemic bacteriology Vol. 1, 2, 4 Williams, Wilkins & Baltimore Academic Press.
9.	A Manual of Soil Fungi – Gilman J. C. (1967) Oxford & JBH Publications.
10.	A Biologist's guide to principles techniques of Practical biochemistry by K. Wilson and K.
11.	Bacterial cell structure by Roger M., ASM publications

RESEARCH METHODOLOGY (RM):

After studying the above paper students will acquire the knowledge of following points.

1. Recall and identify key concepts and terminology related to research methodology.
2. Analyze the strengths and weaknesses of different research methodologies in relation to specific research contexts or objectives.
3. Apply the principles of a specific research methodology to design a research study or experiment.
4. Instrumental Techniques: pH Meter, Potentiometry & Electrical conductivity.
5. Computer in pesticide development.

Unit No.	Titles and Chapter	Lectures	Credits
I	<p>Introduction of Research: Meaning and objectives of research, criteria of good research, types of research, selection of research problem, literature review, types of hypotheses.</p> <p>Research Design: types of research design exploratory, descriptive, diagnostic and experimental. Maintaining a laboratory record; On-line literature searching, Database, Sci-finder, Scopus, Citation Index, Impact Factor.</p>	15	01
II	<p>Writing scientific report: Planning, preparation, draft, revision and refining; writing project proposal to funding agency, Paper writing for International Journals, Conference presentation, preparation of effective slides and presentation. Numbers, units, abbreviations and nomenclature used in scientific writing. Writing references. Scientific writing and ethics, Introduction to copyright-academic misconduct/plagiarism.</p> <p>Computer in pesticide development: Computer assisted correction analysis in the development of pesticide. Computer optimization in emulsion formulations, computer-based application of pesticide development and formulation development. Use of computer-based equipment for pesticide analysis.</p>	15	01
III	<p>Instrumental Techniques</p> <p>pH Metry: Introduction, instrumentation of pH meter; glass electrode, reference electrode, measurement of pH and its application in the pH soil and water sample.</p> <p>Potentiometry: Introduction types of electrodes, instrumentation, working measurement of EMF, Application for measurement of pH.</p>	15	01
IV	<p>Electrochemical Method:</p> <p>Electrical conductivity: Electrical conductivity of electrolyte, conductivity meter, specific and equivalent conductivities, application of measurement in the analysis of salinity, halide and soil moisture.</p>	15	01

Sr.no.	Reference Books
1.	G.R.Chatwal, Instrumental method of chemical analysis.
2.	A text of inorganic quantitative analysis by Shree Ramulu.
3.	Instrumental methods of chemicals analysis by Willard, Meritt
4.	Rastogi S.C. Mendecutta, N.Bioinformatics Methods and application
5.	Sharma B.K. Instrumental Methods of chemical analysis
6.	Chopra & Kanvar, Analytical agriculture chemistry
7.	Robert Brown, Introduction to instrumental Analysis
8.	Peter Atkins, Physical chemistry
9.	Sivasankari, Bioseparation Principles and Techniques.
10.	Practical Research Methods, Catherine Dawson, UBS Publishers Distribution, New Delhi 2002.
11.	Research Methodology – Methods and Techniques, C. R. Kothari, Wiley Easter Ltd, New Delhi 1985.
12.	Research Methodology – A Step by step Guide for Beginners 2 nd edn. Kumar Ranjit, Pearson Education, Singapore, 2005.
13.	Introduction to Research and Research Methodology M. S. Sridhar.
14.	The Information Specialist's Guide to Searching & Researching on the Internate & the World Wide Web by Ernest Ackermann, Karen Hartman, Fitzroy Dearborn Publishers, London.
15.	Learning to Use the World Wide Web, Ernest Ackermann, BPB Publications

PRACTICALS (Based on DSC- 1)

Sr.no.	PRACTICALS
1.	Estimation of copper from copper fungicide.
2.	Estimation of sulfur from wettable sulphur powder.
3.	Estimation of nitrogen from ammonium sulphate.
4.	Estimation of Ca from super phosphate.
5.	Estimation of Nitro group from organic pesticides.
6.	Determination of electrical conductance of various soil samples
7.	To study the deficiency symptoms of N, K, Mg and Fe in plants
8.	Determination of pH of various water samples by pH meter.
9.	Determination of Water Holding Capacity of soil samples
10.	Determination of soil pH by pH paper and pH meter method.
11.	Determination of salinity of soil by conductometric method.
12.	Estimation of phosphorus from soil by colorimetric method.
13.	Preparation for FAS.
14.	Determination of organic carbon in vermicompost
15.	To study the effect of plant growth regulators on germination and vegetative growth of crop
16.	Effect of IAA & GA on seed germination
17.	Preparation of copper fungicide.
18.	Preparation of aluminum fungicide.

Any Suitable experiment may be added whenever necessary.

PRACTICALS (Based on DSC-2)

Sr.no.	PRACTICALS
1.	Rearing of an egg parasite, <i>Trichogramma</i> sp.
2.	Study of system of given specimen
3.	Rearing of predator, <i>Chrysoperla carnae</i>
4.	Rearing of <i>Helicoverpa armigera</i> / Jowar stem borer.
5.	Rearing of Silkworm
6.	Rearing of White grub
7.	Rearing of Hairy caterpillar.
8.	Release techniques in parasites, predators and NPV in field
9.	Visit to Apiculture/ Sericulture centre.
10.	Collection of various crop pests and their submission

Any Suitable experiment may be added whenever necessary.

PRACTICALS (Based on DSE- 1.1 or DSE- 1.2)

Sr.no.	PRACTICALS
1.	Study of viral, MLO, bacterial and fungal diseases of vegetables.
2.	Study of viral, MLO, bacterial and fungal diseases of cash crops.
3.	Study of viral, MLO, bacterial and fungal diseases of pulses.
4.	Estimation of chlorophyll from healthy and infected leaves.
5.	Determination of percentage of organic carbon from the compost.
6.	Preparation of culture media, dilution technique, inoculation of soil fungi and Identification of soil borne pathogen.
7.	Staining techniques in bacteria.
8.	Measurement of disease intensity.
9.	Study of morphological and biochemical defense mechanisms in plants.
10.	Classification and identification of weeds.
11.	Demonstration of: Bacterial and yeast DNA
12.	Induction of ascospore in yeasts of <i>Saccharomyces cerevesiae</i> .
13.	Preparation of yeast protoplasts.
14.	Single cell and single spore isolation techniques.
15.	Isolation and purification of lysozyme from egg white and preparation of bacterial protoplasts.
16.	Isolation of bacterial cell wall and study of cell wall polysaccharide by chromatographic technique.
17.	Single cell and single spore isolation techniques.

Any Suitable experiment may be added whenever necessary.

Semester – II

DSC – 3 CHEMISTRY OF PESTICIDES AND THEIR FORMULATIONS

After studying of the above paper students will acquire the knowledge of following points.

1. Carbamates Insecticides Synthesis, properties & uses of Carbamates.
2. Organophosphorus pesticides Synthesis, properties & uses.
3. Synthesis & properties of organochlorine Insecticides.
4. Inorganic pesticides Synthesis, properties & uses.
5. Synthesis of new lead molecules as pesticides.
6. Knowledge of fungicides, herbicides, insecticides and rodenticides.

Unit No.	Titles and Chapter	Lectures	Credits
I	<p>Carbamate Insecticides: Synthesis, properties & uses of: Carbamates, thiocarbamic acids, oxime carbamates, phenol carbamates, ziram, zineb, maneb, carbaryl, carbofuran, bendiocarb, propoxure (Baygon) Aldicarb, Methomyl. Isomerism and kinetic studies of hydrolysis of pesticides. Structure activity relationship of carbamate with reference to acetylcholine.</p>	15	01
II	<p>Organophosphorus pesticides: Synthesis, Properties, Uses and environmental fate of following: Malathion, Dimethoate, Monocrotophos, Phosphamidon, Chloropyriphos, Finitrothion, Phorate (Thimate), Quinolphos.</p>	15	01
III	<p>Synthesis & properties of Organochlorine Insecticides: BHC (Lindane), 2,4-D, Dicofol, Endosulphan, PCNB, Butachlor, persistence of the pesticides in environment and biota, resistance by pests.</p>	15	01
IV	<p>Inorganic pesticides: Preparations and applications of Fungicides: Sulphur, copper salts, organomercurials and tin compounds. Fumigants: Hydrogen cyanide, carbon disulphide. Rodenticide: Arsenic, Zinc oxides, Zinc phosphide and Thallium salts. Herbicides: Copper compounds and sodium chlorate.</p>	15	01

Sr.no.	Reference Books
1.	N. N. Melnikov: Chemistry of pesticides (English) Springer.
2.	R. Clemlyn: Pesticides.
3.	M. B. Green, G. S. Hartley and T. F. West, Chemicals for crop Improvement and pest management (Pergamon).
4.	N. B. Scher: Controlled releases Pesticides ACS Symp. No. 53.
5.	N. E. Cardarelli: Controlled Released Pesticides Formulation CRC.
6.	Kydonius: controlled release formulation. Technologies, CRC.
7.	P. C. Keemey and D. D. Kaufman: Herbicide chemistry, degradation and mode of action. Vol. I, II (Dekker).
8.	Miob and Satake, Chemicals in the environment by Miob and Satake.
9.	A. K. De., Environmental chemistry
10.	Sree Ramulu, Chemistry of insecticides and fungicides 11. Text book of Applied Entomology K.P. Shrivastava
11.	Hand book of Medicinal Plants Prajapati, Purohit, Sharma, Kumar.

DSC – 4 ANALYTICAL TECHNIQUES FOR AGROCHEMICALS

After studying the above paper students will acquire the knowledge of following points.

1. Separation techniques: Instrumentation and application of TLC, paper chromatography, column Chromatography, Ion exchange and Ion chromatography.
2. Non-Instrumental Techniques: Acid base titrations acid- base indicators & Redox titrations.
3. Knowledge of Ultraviolet Spectroscopy & Infrared Spectroscopy.
4. Optical Methods like Flame emission and atomic absorption spectrometry & Polarimetry.

Unit No.	Titles and Chapter	Lectures	Credits
I	Separation techniques: Sampling of solids, liquids and gases; solvent Extraction, Principle, Instrumentation and applications of TLC, Paper chromatography, Column chromatography, Ion exchange and Ion chromatography.	15	01
II	Non Instrumental Techniques: Acid base titrations, acid base indicators; Redox titrations, determination of halide ions by complexometric titration, precipitation titrations, methods of determination of Mg, Zn, Ca, Al, Cu, Metallochromic indicators, Gravimetric estimation of SO_4^{2-} and Fe^{++} .	15	01
III	Ultraviolet Spectroscopy: Principle, Theory, instrumentation and applications. Infrared Spectroscopy (IR): Principles, Fundamental modes of vibrations, fundamental group regions of IR spectrum, functional group region, finger print region, Types of vibrations, Instrumentation of IR, IR Spectrum, Applications of IR spectroscopy in structure determination.	15	01
IV	Optical Methods: Flame emission and atomic absorption spectrometry: Atomization, flame Photometry and its applications in the estimation of Na, K, Ca; Atomic absorption, instrumentation and applications in the analysis of Soil, water, food and environmental samples. Polarimetry: Principle and application in the analysis of optically active pesticides.	15	01

Sr.no.	Reference Books
1.	A. I. Vogel. A text of inorganic quantitative analysis
2.	Shree Ramulu., Methods of pesticide analysis
3.	A. I. Vogel, A textbook practical organic chemistry including qualitative and quantitative analysis
4.	Willard, Meritt & Dean, Instrumental methods of chemicals analysis
5.	Chopra & Kanwar, Analytical agricultural chemistry.
6.	H. A. Moye Analysis of pesticide residues
7.	Robert Brown, Introduction to Instrumental Analysis
8.	Ausotosh Kar, Pharmaceutical Drug Analysis
9.	Colin Banwell and M. Mccash, Fundamentals Of Molecular Spectroscopy.
10.	Gupta P.K., Methods in Environmental Analysis- Water, Soil and Air
11.	Rastogi S.C. Mendecutta, N., Bioinformatics methods and applications Peter Atkins, Physical Chemistry
12.	Sivasankar, B., Bioseparations Principles and Techniques
13.	William Merritt, Instrumental methods of analysis
14.	G.R. Chatwal, Instrumental methods of Chemical analysis
15.	Sharma B.K., Instrumental methods of Chemical analysis

DSE – 2.1 AGRONOMY, BIOTECHNOLOGY AND ECONOMIC ENTOMOLOGY

After studying the above paper students will acquire the knowledge of the following points.

1. The students will have complete knowledge of cultivation of important crops.
2. Information about soil, climate seed rate and sowing method. Overall information of fertilizer requirement and plant protection.
3. Knowledge of Seed technology and Production of standard seed. Information of plant breeding method.
6. Knowledge of the tissue culture tech. and recombinant DNA tech.
7. Knowledge of Pests i.e., household, crop plant pest & polyhouse pest.
8. Economic damage of crop plants done by various pests.

Unit No.	Titles and Chapter	Lectures	Credits
I	<p>Cultivation of important crops Sugarcane, Bajra, Sorghum, Maize, Wheat, Gauva, Pomegranate, Soybean, Ground nut, Gram, Tomato, Brinjal, Cabbage and cauliflower, in respect to : Soil & climate, seed rate & sowing, varieties/ cvs. Fertilizer, requirement and protection.</p>	15	01
II	<p>Tissue culture : Introduction, Definition, Terminologies in tissue culture, Sterilization methods & Techniques of tissue culture. Genetic resistance: Types of disease resistance (horizontal and vertical resistance), Back cross method and Escape method. Genetic engineering: Introduction, Methodology – Physical, Chemical and Biological methods (<i>Agrobacterium</i> mediated gene transfer) Seed Technology: Introduction, Definition, Classes of seeds and techniques of producing hybrid seeds for disease resistance and other relevant characters.</p>	15	01
III	<p>Household pests: Major: Cockroach, Mosquitoes, Houseflies, Bed bug, Lizard and Rat. Minor: Lesser grain borer, Indian meal moth, Saw toothed beetle, Silverfish. Stored grain pests: Major: Khapara beetle, Riceweevil, Ricemoth, Pulse beetle and rodents. Minor: Lesser grain borer, Indian meal month, saw-toothed beetle. Pest of medicinal plants: Major: Opium capsule borer, Hadda beetle, Mealy bug. Minor: Pentatomid bug. Pest of Livestock: Major: Sucking cattle louse, Stablefly and Sand flies. Minor: Black flies, Horse flies. Forest Pests: Major: Termite, white grubs, teak-defoliator. Minor: Cut worms, Stem and Root borers.</p>	15	01
IV	<p>Pest of polyhouse or Greenhouse plants: Major: <i>Helicoverpa borer</i>, Mites, Mealy bugs, Aphids, White flies Minor: Leaf minor and Armyworm. Nematode pests of crops (polyphagous) : Migratory Endo-parasitic nematodes, Root knot nematodes (<i>Meloidogyne</i> spp.), Seed gall nematodes (<i>Anguina</i> spp.) Vertebrate Pests of Agriculture Crops: Major: Indian field mouse, Monkey, House sparrow. Minor: Common green bee-eater. Molluscan pests of Agricultural Crops: Snails - <i>Helix</i> spp. <i>Achatina fulica</i> & <i>Amarginata</i>. Slugs - <i>Limax</i> species. Polyphagous pests: Major: Termites/ White ants, Hairy caterpillars, Locustsand white grubs-, <i>Holotrichia serrata</i>, <i>Spodoptera</i> sp. Minor: Grasshoppers, fruit flies.</p>	15	01

Sr.no.	Reference Books
1.	Dadheeck P.K., 1997. Seed Proqrament Management System & concept
2.	Dadheeck P.K., 1995. Handbook of pure seed definition with illustration
3.	SchmittGrob, R., 1997Handbook for seedlings Evaluation (2nd Edition)
4.	Reddy S.M., 1997. Microbial Biotechnology.
5.	M.K.Razdan,Introduction to Plant Tissue Culture
6.	K.K.De, Plant Tissue Culture book
7.	T.B.Jha and B.Ghosh, Plant Tissue Culture Basic and Applied
8.	P.S.Verma and V.K. Agarwal, Genetics
9.	Atwal. Agricultural pests of India and southeast Asia
10.	K. M. Smith., Agriculture entomology.
11.	K. Shrivastava, A textbook of applied entomology.
12.	Graham & Night., Principles of forest entomology.
13.	S. Pradhan., Agricultural entomology.
14.	Govt. of Maharashtra Crop pests and how to fight them.
15.	Khare B.P.,Stored grain pests and their management
16.	Atwal. Agricultural pests of India and south East Asia

DSE – 2.2 INTEGRATED PEST MANAGEMENT

1. Anatomy and Physiology of the insect.
2. General life cycle patterns in insect pests.
3. Causes for insect assuming pest status: type of damage to plant by insects and their estimation.
4. Tactics and strategies of pest management (IPM). Concept and tools of pest management.
5. Role and impact of predators, parasitoids biological characteristics.
6. Microbial insect control and their mode of action.

Unit No.	Titles and Chapter	Lectures	Credits
I	<p>Causes for insect assuming pest status: type of damage to plant by insects and their estimation. Methods and principles of pest control, natural and applied .Prophylactic & Curative methods, cultural, mechanical. Physical, legal and biological</p>	15	01
II	<p>Pest Management: Tactics and strategies of pest management (IPM) Concept and tools of pest management, Ecosystem concept, EcologicalNiche concept, Colonization of island, Crop Island in ecosystem, Quantitative basis of pest management, sampling and measuring system, Analysis and Modelling in pest management, Monitoring, Forecasting and Field loss assessment, Design making systems, Constrains and Strategies in implementation of IPM, validation of IPM. Host plant resistance.</p>	15	01
III	<p>Biocontrol in Agroecosystem through management & Entamophagous insects: Introduction, Definition, Role and impact of predators, parasitoids Biological characteristics, Role and impact strategies of biological control, conservation and habitat management.</p> <p>Microbial control of insect: Introduction, Definition, History principle groups of pathogen, <i>Bacillus thuringensis</i>, fungi, viruses, protozoa, their mode of action and methods of applications.</p>	15	01
IV	<p>Pests of crops: (Classification, Biology, nature of damage and control measures).</p> <p>Pests of cereals :</p> <p>Rice: Major- Brown plant hopper, yellow stem borer, Swarming Caterpillar. I Minor – Rice ear head bug, Armyworm, Blue beetle, Gall midge, Rice hispa.</p> <p>Sorghum : Major – Midge fly, Aphids , Shoofly, Stem borer Minor- White grub</p> <p>Maize: Major- Bug (Deliphacids), Ear head bug, stem borer, pink borer. Minor- Pyrilla, Aphids.</p> <p>Pearl millet: Major- Blister beetle. Minor- Surface grasshopper, Armywarm.</p> <p>Wheat: Major- Jassids, Termites, Stem borers. Minor- Aphids, Nematodes.</p>	15	01

Sr.no.	Reference Books
1.	Biological insect control chapter 10-14, by M.S. Quraishi.
2.	Biological insect pest suppression by H.C.Cooper (springerlag)
3.	Agriculture use of anti-biotics by W.A. Moats.
4.	Pesticide chemistry by j.Miyamoto and P.C.Kearney (Pergamon)
5.	Hand book of pest management in agriculture Wi.II by D. pimentel.
6.	Biological pest control by N.W. Hussey and N. Scopes (Glandford press)
7.	Safer pesticides by E. Hodgson and R.J.Kuber (Dekker)
8.	Insect sex pheromones by M.Jacobson (AP).
9.	Chemicals with Noval mode of action-Isshac.
10.	Control mechanisms in plant development by A.W. Gloston and P.J.Davies. Insect pathogenic fungi as pest control agent in “Biological plant & Health Protection” by Zimmermann,G.

ON JOB TRAINING (OJT) / FIELD PROJECT (FP)

1. Industrial Visit students can understand the working of industry.
2. Field visit one can get information of pests, disease and fertilizer management in various crop plants.
3. Industrial Training students can get complete information about industry, its production, marketing, and production cost.
4. Knowledge of training will encourage entrepreneurship in students.

Sr.no.	ON JOB TRAINING (OJT) / FIELD PROJECT (FP)
1.	Industrial Visit
2.	Field Visit
3.	Industrial Training
4.	Any suitable topic may be added whenever necessary.

PRACTICALS (Based on DSC-3)

Sr.no.	PRACTICALS
1.	Determination of Alkalinity of water.
2.	Determination of nitrate from water.
3.	Analysis of lime material.
4.	Determination of Malathion content.
5.	Determination of Metasystox content.
6.	Determination of hardness of bore well water sample by using EDTA method.
7.	Determination of acidity or alkalinity of given pesticide sample.
8.	Ion exchange chromatographic separation and determination of Zn(II) and Mg(II).
9.	Determination of Fe ⁺⁺⁺ ion from given solution by using colorimetric method.
10.	Estimation of Dicofol content.

Any Suitable experiment may be added whenever necessary.

PRACTICALS (Based on DSC-4)

Sr.no.	PRACTICALS
1.	Determination of hardness of water.
2.	Determination of sulphate (SO_4^{2-}) and phosphate (PO_4^{3-}) from given water sample Nephelometrically
3.	Separation and detection of pesticide by thin layer chromatography.
4.	Separation and determination of chloride and bromide ion by anion exchange chromatography.
5.	Determination of ammonium sulphate in a given fertilizer sample spectrophotometrically using Nessler's reagent.
6.	Determination of normality of acid by titration against alkali by conductometric method.
7.	Determination of chloride ion in the water sample by precipitation titration (Mohr's method)
8.	Preparation of Tetramine Cu (II) sulphate.
9.	Determination of calcium carbonate in soil sample.
10.	Determination carbonate and bicarbonate in given water sample titrimetrically.

Any Suitable experiment may be added whenever necessary.

PRACTICALS (Based on DSE- 2.1 or DSE-2.2)

Sr.no.	PRACTICALS
1.	Rearing of two to three pests in laboratory. (As per syllabus)
2.	Field collection of pests stages and its submission
3.	Field visits (Minimum four) & field diary.
4.	Large scale production of <i>Bacillus thuriengnisis</i> , <i>Beauveria bassiana</i> , <i>Apanteles sp.</i> , <i>Bracon sp.</i> , Nematodes.
5.	Study of life cycles of important pests of crop plants as per syllabus. At least two of each category and laboratory and field diary.
6.	Determination of LC ₅₀ and LC ₉₀ in given insects.
7.	Study of the detection of damage caused by pests
8.	Identification of different casts of termites Locally available.
9.	Collection and submission of pests.
10.	Study of crop plants as per syllabus
11.	Study of seed standards: Seed germination: Local & Hybrid seeds and their Characteristics.
12.	Study of stored seed Pest. Comparative study of the resistant & susceptible cultivars to pathogens.
13.	Collection of seed or plant varieties availability and its germination and few growth observations.
14.	Sterilization methods and inoculation technique.
15.	Visit the seed processing unit and make a report on it.
16.	Preparation of MS media.
17.	Tissue Culture Technique
18.	Study of stored grain fungi (Moist petriplate Method).

Any Suitable experiment may be added whenever necessary.