Punyashlok Ahilyadevi Holkar Solapur University, Solapur

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

Name of the Faculty: Science &Technology

(As per New Education Policy 2020)

Syllabus: Agrochemicals and Pest Management

Name of the Course: M. Sc. II (Sem. III &IV)

(Syllabus to be implemented from June 2024)

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

M. Sc. Part – II (Semester III and IV)

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, 2024

2. 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 equipment's, 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 its application. 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.

3. 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.

4. DURATION

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

5. PATTERN OF EXAMINATION:-

- Semester system

6. 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.

7. 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 III and IV)

<table>
<tr><th rowspan="2">Year
(2 Yr PG)</th><th rowspan="2">Level</th><th rowspan="2">Sem.(2Yr)</th><th colspan="2">Major</th><th rowspan="2">RM</th><th rowspan="2">OJT/FP</th><th rowspan="2">RP</th><th rowspan="2">Cum. Cr.</th><th rowspan="2">Degree</th></tr>
<tr><th>Mandatory</th><th>Elective</th></tr>
<tr><td rowspan="3">II</td><td rowspan="3">6.5</td><td rowspan="2">Sem III</td><td>DSC-5 (4+2)
Pesticide Residues and Analysis of Agrochemicals</td><td rowspan="2">DSE-3 (4+2)
3.1 Diseases of Crop Plants
OR
3.2 Pests of Crop Plant – I</td><td rowspan="2">-----</td><td rowspan="2">-----</td><td rowspan="2">RP – I
(4)</td><td rowspan="2">22</td><td rowspan="4">88
PG
Degree in
Discipline</td></tr>
<tr><td>DSC-6 (4+2)
Advances in Pest Control</td></tr>
<tr><td rowspan="2">Sem IV</td><td>DSC-7 (4+2)
Manufacture of Agrochemicals</td><td rowspan="2">DSE-4 (4+2)
4.1 Advances in Pest Control & Diseases of Crop Plants
OR
4.2 Pests of Crop Plant – II</td><td rowspan="2">-----</td><td rowspan="2">------</td><td rowspan="2">RP – II
(6)</td><td rowspan="2">22</td></tr>
<tr><td>DSC-8 (4)
Agro-Based Marketing Management</td></tr>
<tr><td colspan="3">Cum. Cr. For PG Diploma</td><td>22</td><td>12</td><td>00</td><td>00</td><td>10</td><td>44</td></tr>
<tr><td colspan="10">Two – year PG Degree in Discipline with 88 Credits</td></tr>
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M.Sc. Agrochemicals and Pest Management (AGPM): Program structure based on NEP 2020
M.Sc. II Semester-III

Course Type	Course	Paper Titles	Credit	Examination scheme		
				UA	CA	Total
Major Mandatory	DSC-5	Pesticide Residues and Analysis of Agrochemicals	04	60	40	100
		Practicals (Based on DSC-5)	02	30	20	50
	DSC-6	Advances in Pest Control	04	60	40	100
		Practicals (Based on DSC-6)	02	30	20	50
Major Elective	DSE-3	**DSE-3 (4+2)** 3.1 Diseases of Crop Plants **OR** 3.2 Plant Protection – I	04	60	40	100
		Practicals (Based on DSE- 3.1 or DSE-3. 2)	02	30	20	50
RP	RP	Research Project-I	04	60	40	100
		Total	**22**	**330**	**220**	**550**

M.Sc. II SEMESTER-IV

Course Type	Course	Paper Titles	Credit	Examination scheme		
				UA	CA	Total
Major Mandatory	DSC-7	Manufacture of Agrochemicals	04	60	40	100
		Practicals (Based on DSC-7)	02	30	20	50
	DSC-4	Agro-Based Marketing Management	04	60	40	100
Major Elective	DSE-4	4.1 Advances in Pest Control & Diseases of Crop Plant – II **OR** 4.2 Plant Protection – II	04	60	40	100
		Practicals (Based on DSE- 4.1 or DSE- 4.2)	02	30	20	50
RP	RP	Research Project-II	06	90	60	150
		Total	**22**	**330**	**220**	**550**
	Total for PG Diploma		**44**	**660**	**440**	**1100**

Two – year PG Degree in Discipline with 88 Credits

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

Semester – III

DSC – 5: PESTICIDE RESIDUES AND ANALYSIS OF AGROCHEMICALS

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

1) The students will get knowledge of pesticide residues in the plants, fruits and human health.
2) Study of pesticide residue in water, soil and atmosphere.
3) Effect of pesticide residue on human health.
4) Study of different techniques of analysis of agrochemicals and their application.

Unit No.	Titles and Chapter	Lectures	Credits
I	**Unit-I: Residues of Agrochemicals:** **a) Pesticide residues in water system:** Nature and origin of pollution of aquatic systems, point and non-point pollution. Dynamics of pesticides in aquatic environment. **b) Pesticide residues in the soil:** Absorption, retention, transport and degradation of pesticides in the soil, effect on microorganisms and consequent effect on the soil condition, fertility, interaction in the soil.	**15**	**01**
II	**a) Pesticide Residues in the Atmosphere:** Pesticides into the atmosphere and their fate, transport of vapors, precipitation, Effect of residues on life, Photochemistry of pesticides. b) Penetration and Distribution of pesticide residues and their effects on quality of human life and Environment. Model ecosystem studies of Bioconcentration, Biomagnifications and Biodegradation. Effect of pesticides on life in general and consequent effects on human life**.**	**15**	**01**
III	**a) Separation Techniques**: Principle, instrumentation, applications and advantages of Thin layer chromatography, Paper chromatography and HPLC. **b) Radioactivity**- Applications of radio isotopes in agriculture, Health Hazards, activity ratio, Neutron activation analysis and its applications.	**15**	**01**
IV	**a) Nuclear magnetic resonance spectroscopy**: Magnetic & nonmagnetic nuclei, NMR Instrument schematic diagram, shielding & deshielding effect, chemical shift, measurement by Delta scale, MS as reference compound & its advantages, Spin –spin coupling(n+1) rule. PMR spectra of Ethanol, Ethyl acetate, Acetophenone, 2-Butanone, Benzoic acid & Applications in pesticide residue. **b) Mass spectrometry**: Schematic diagram of mass spectrometer, ionization and fragmentation of molecules. Interpretation and applications in the pesticide residue and metabolites analysis, GC-MS techniques.	**15**	**01**

Sr.no.	Reference Books
1.	Chemical analysis of the environment by Ahuja
2.	Environmental chemistry by A. K. De.
3.	Chemistry of our environment by Home (JW).
4.	Analysis of pesticides residues by H. A. Moye (JW)
5.	Advance in pest control research by R. L. Methcalf (JW)
6.	Chemistry of pesticides by K. H. Buchel (JW).
7.	Evaluation of pesticides in ground water by W. Y. Garnett, R. C. Honeycatt andothers.
8.	Chemistry of pesticides by Edward.
9.	Insecticide biochemistry and physiology by C.F. Wilkinson.
10.	Comprehensive insect physiology, Biochemistry and pharmacology WI, 12, by G.A.Kerkut and L. I. Gilbert.
11.	Spectroscopic methods in Organic Chemistry –D.H. Williams and I. Flemming
12.	Application of spectroscopic techniques inorganic Chemistry-P.S. Kalsi.

DSC – 6 ADVANCES IN PEST CONTROL – I

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

1. The students will have complete knowledge of pests in important crops.
2. The information about pest control method (curative, cultural, mechanical, and biological)
3. Overall information of bioefficacy of pesticides and bioassay method.
4. Information of insect insecticide resistance.
5. Knowledge of recent advance in green chemistry pesticide.
6. They will have information and able to handle plant protection appliances (Dusters and Sprayers)
7. They will get knowledge of Hydroponics recent farming technique.

Unit No.	Titles and Chapter	Lectures	Credits
I	**Introduction to Applied Entomology:** Causes for insect assuming pest status, type of damage to plant by insects and their estimation. IPM:Definition, Methods and principles of pest control, natural and applied Prophylactic & Curative methods, cultural, mechanical. Physical, legal and biological	**15**	**01**
II	**a) Bioefficacy of some pesticides against major pests:** Evaluation of toxicity of insecticides, Bioassay methods, Insecticide resistance and Resistance management. b) Host Plant Resistance: Introduction, Classification of resistance, mechanism of resistance, Evaluation of Antixenosis and anti-biosis, Morphological & Biochemical basis of resistance. Factors affecting plant resistance.	**15**	**01**
III	**Recent advance in pest control:** Green Chemistry in pesticides: Recent insect attractants, Chemosterilants and Repellents, Mode of action and Applications. Neem in plant protection:- Introduction, Chemical constituents, Bioefficacy of Neem preparations, Management of pest in Agricultural crops, Management of the forest pest, Management of insects and diseases in stored agricultural commodities, side effects of applications.	**15**	**01**
IV	**a) Plant protection appliances:** Duster, principles of dusting, spraying, Part of typical Sprayer, types of sprayer. Types of nozzles and other equipment's **b)Hydroponics technique :** i) Introduction ii) Requirements iii) Method iv) Applications	**15**	**01**

Sr.no.	Reference Books
1.	Text Book of applied Entomology Vol. I & II-K.P.Srivastava.
2.	Introduction to Insect Pest Management.-Martin & Luckman
3.	Textbook of Insets Toxicology.-Matsmura
4.	Introduction to Biological Control.-R.Bosch, D.S.Messenger&A.D.Gutierrez.
5.	Principles of Insect Pest Management. –G.S.Dhaliwal andR.Arora.
6.	Entomology and Pest Management –LarryP.Pedigo.
7.	Element of Economic Entomology –B.V.David and T.Kumarswammy.
8.	Insect Pest Management –David Dent.
9.	Critical issues in Insect Pest Management –G.S.Dhaliwal and E.A.Heinrich.
10.	Emerging trends in biology control of phytophagusEd.T.N.Anatkrishnan.

DSE – 3.1 DISEASES OF CROP PLANTS-I

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

1. The students will have complete knowledge of diseases in important crops.
2. The information about pest vectors of plant disease control method
3. Overall information of diseases and causal organism.
4. Information of pesticides used for control of plant disease.
5. Knowledge of recent advance in disease control.

Unit No.	Titles and Chapter	Lectures	Credits
I	**A) Diseases of the cereal plants:** **(Study of symptoms, Disease cycles, Nature of Damage and management) a) Cereals**: **Sorghum:** Rust, Smut, Downy mildew diseases, Grainmold**.** **Wheat:** Rust & Smut diseases & Root rot. **Bajra:** Rust, Ergot, Downey mildew & Blast disease. **B) Diseases of Oil seed crops:** **Groundnut**: Rust, Early and late leaf spot diseases (Tikka), seed rot (Aspergillus sp.) & Seedling blight (Penicillium spp.) Root rots (Sclerotium Rhizoctonia, & Fusarium spp.) **Soybean:** Rust, Leaf spot, Brown stem rot, Anthracnose, Pod & Stem blight, Fusarial wilt, Rots, Leaf spot diseases. **Sunflower**: Rust, Powdery mildew, Downey mildew, Blight, **Mustard**: White rust, Powdery mildews, Seedling blight, wilt &Rots. **Castor**: Rust, Leafspot.	**15**	**01**
II	**C) Diseases of Cash-crops.** Cotton: Rust, Wilt, Anthracnose & Blights, Leaf spot. Sugarcane: Rust, Smut, Downey mildew, Red rot, GSD. Tobacco: Early blight, Black rot & Shank rot, Wilts.	**15**	**01**
III	**D) Diseases of vegetable crops-** **Tomato:**Blight- *Alternaria solani*,Wilt- *Fusarium oxysporium***.** **Okra:** Powdery mildew- *Odium* spp,Cercospora disease- *Cercospora* spp. **Chilies: Powdery mildew-** *Odium* spp, Leaf spot disease- *Cercospora capscia* & Alt. solani **Cruciferous:** Downey mildew- *Peronospora parasitic*,Whit rust-*Alb candida***.** **Onion:** Downey mildew- *Peronospora destructor*, Smut trough scoulee**.**	**15**	**01**
IV	**E) Diseases of Pulses and vegetables:** **Peas**-Chickpea, Pigeon pea, Cow Pea, **Grams**- Green gram, Black gram, Beans –Lima, Broad bean, French bean. **Common diseases:** Rusts, Powdery mildew, Wilts, Blights, Anthracnose	**15**	**01**

Sr.no.	Reference Books
1.	Principles and Procedures of Plant Protection –S.B. Chattopadhyay.
2.	Principles of insect pest management by Dhaliewal and Arora.
3.	Chemistry of Insecticides and Fungicides – U.S.Sreeramulu.
4.	Agricultural pest of india & south East Asia by A.Satwal.
5.	Text book of Modern Plant Pathology - K.S. Bilgrami and H.C.Dube.
6.	Crop protection recommendations published by Department of AgricultureM.S.Pune
7.	Plant protection recommendations for Horticulture crops-Directorate of Horticulture M. S.Pune–411005.
8.	Crop production and field experiments- Vaidya ,Sahastrabudhe andKhuspe.
9.	Plant diseases in India- G.Rangaswami.
10.	Diseases of cereals and millets – T.S.Ramkrishna.
11.	Bacterial cell structure by Roger M., ASM publications

DSE – 3.2 PESTS OF CROP PLANTS –I

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

1. The students will have complete knowledge of pests in important crops.
2. The information about pest control method (curative, cultural, mechanical, and biological).
3. Overall information of bioefficacy of pesticides and bioassay method.
4. Information of insect insecticide resistance.

Unit No.	Titles and Chapter	Lectures	Credits
I	**Pest Management:** Tactics and strategies of pest management (IPM) Concept and tools of pest management, Ecosystem concept, Ecological Niche 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.	**15**	**01**
II	**Pests of cereals:** **Rice:** Major- Brown plant hopper, Yellow stem borer, Swarming Caterpillar. Minor – Rice ear head bug, Armyworm, Blue beetle, Gall midge, Rice hispa. **Sorghum :** Major – Midge fly, Aphids , Shoofly, Stem borer Minor- White grub **Wheat:** Major- Jassids, Termites, Stem borers. Minor- Aphids, Nematodes	**15**	**01**
III	**Pests of oil-seed Crops:** **Groundnut:** Major: Groundnut leaf miner aphid. Minor: Stem borer, Jassid & Bihar hairy caterpillar. **Sunflower:** Major: Head borer, Bihar hairy caterpillar. **Safflower:** Major: Aphid & Leaf eating caterpillar. Minor: Safflower bud fly. **Mustard:** Major: Mustard aphid. Minor: Diamond back moth. **Soybean:** Major: Pod borer, Jassids, Grey weevil,spodoptera.	**15**	**01**
IV	**Pests of Forage crops:** **Lucerne or Alfa-alfa**: Major: Aphids, Cutworm, Armyworm. Minor: White spotted flea beetle. Minor: Red pumpkin beetle, Grasshopper. **Pest of Sugarcane:** Major:-Stem borer complex, White grubs, White fly, Sugarcane white woolly aphid Minor:-Army worm, Mites, Pyrilla, Termites.	**15**	**01**

Sr.No.	Reference Books
1.	Text Book of applied Entomology Vol. I & II-K.P.Srivastava.
2.	Introduction to Insect Pest Management.-Martin & Luckman
3.	Textbook of Insets Toxicology.-Matsmura
4.	Introduction to Biological Control.-R.Bosch, D.S.Messenger &A.D.Gutierrez.
5.	Principles of Insect Pest Management. –G.S. Dhaliwal and R.Arora.
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9.	Critical issues in Insect Pest Management –G.S.Dhaliwal and E.A.Heinrich.
10.	Emerging trends in biology control of phytophagus Ed.T.N. Anatkrishnan.

RESEARCH PROJECT (RP)

Sr.No.	RESEARCH PROJECT
1	**Students should perform research project under the guidance of respective teachers/Mentor/industry expert.**
2	**Students submit the research project for each semester and present his/her research work to external and internal examiner.**
3	**All instructions shall be provided during the research project course work.**

Sr.no.	Reference Books
1.	As per Project subject

PRACTICALS (Based on DSC- 5)

Sr.No.	PRACTICALS
1.	Detection of pesticides residue in food stuffs.
2.	Detection of pesticides in plants.
3.	TLC and Column chromatographic separation of the pesticides or plant products Pesticide Toxicity.
4.	Preparation of Dimethyl Phthalate
5.	Preparation of Phthalimide
6.	Preparation of Benzalacetophenone.
7.	Preparation of 1-Naphthoxyaceticacid
8.	Preparationp of Nitroacetanilide.
9.	Preparation of Phenylhydrazide
10.	Preparation of Phthalanilic acid.
11.	Preparation of Ziram.
12.	Preparationp-Nitroacetanilide.
13.	Preparation of Phenylhydrazide
14.	Preparation of Phthalanilic acid.
15.	Determination of Quinalphos content
16.	Interpretation of IR and PMR spectra of pesticides.
17.	TLC and Column chromatographic separation of the pesticides or plant products.
18.	Preparation of 1-Naphthoxyaceticacid.
19.	Separation and determination of chloride and bromide ion by ion exchange chromatography.
20.	Estimation of phosphate and superphosphate from.

Any Suitable experiment may be added whenever necessary.

PRACTICALS (Based on DSC-6)

Sr.no.	PRACTICALS
1.	Rearing of pest species. (3 to 4 species)
2.	Study of life cycles of important pests of crop plants (as per syllabus at least 2 of each category and laboratory and field diary).
3.	Study of the detection of damage caused by pests.
4.	Identification of different casts of termites.
5.	Study of Plant protection appliances. Hand rotatory duster, Knapsack sprayer, Engine sprayer, Light traps, Sticker traps.
6.	Collection of Pest stages.
7.	Study of Pheromone traps.
8.	Study of hydroponics technique.
9.	Field visits and keeping records of insect pests.

Any Suitable experiment may be added whenever necessary.

PRACTICALS (Based on DSE- 3.1 or DSE- 3.2)

Sr.no.	PRACTICALS
1.	Study of Fungal diseases of Cereals: at least 1 or 2 of each crop (locally available.)
2.	Diseases of oil seed crops: at least 1 or 2 of each crop (locally available.)
3.	Diseases of Cash-crops: at least 1 or 2 of each crop (locally available.)
4.	Diseases of Forage crops, Pulses and Vegetables: at least 1 or 2 of each crop (locally available.)
5.	To calculate VI (Virulence index) at least of two plant diseases.
6.	Estimation of chlorophyll from healthy and infected leaves.
7.	Staining techniques in bacteria.
8.	Measurement of disease intensity.
9.	Rearing of pest species. (3 to 4species)
10.	Study of life cycles of important pests of crop plants (as per syllabus at least 2 of each category and laboratory and field diary).
11.	Study of the detection of damage caused by pests.
12.	Identification of different casts of termites.
13.	Study of Plant Pest of various crops as per syllabus
14.	Collection of Pest stages.
15.	Study of Pheromone traps.

Any Suitable experiment may be added whenever necessary.

Semester – IV

DSC – 7 MANUFACTURE OF AGROCHEMICALS

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

1) Unit operation: principle, equipment, working of different type of operations
2) Study of quality control and R &D, small scale industry, neonicotinoid insecticide.
3) Study of retro synthetic analysis and synthesis of pesticide
4) Get knowledge of manufacture of pesticides and other agrochemicals
5) Study of occupations health hazardous and their control in agrochemical

Unit No.	Titles and Chapter	Lectures	Credits
I	**Types of unit operations & the study of the following**: **Extraction**: Principles, equipment of solid-liquid and liquid-liquid extraction. **Evaporation:** Purpose, operation of multiple effect evaporators. **Distillation:** Fractional distillation, plate and packed columns steam distillation of Azeotropes. **Absorption**: Gas absorption in towers. **Filtration**: Types of filters, working of centrifuge machine. **Crystallization**: Purpose, Batch and contaminates crystallizers. **Drying:** Types of dryers, working of compartment tray and spray dryers.	**15**	**01**
II	**a) Quality control and R&D:** Quality control concept, R&D laboratory specifications, ASTM, BIS and ISI specifications and standards. **b) Small Scale Industry**: Administration, planning of small scale units economics, licenses, marketing of Agrochemicals, marketing research, man-power, HRD.	**15**	**01**
III	**a) Retrosynthetic analysis and synthesis of pesticides**: Retrosynthetic analysis, synthon approaches, synthetic equivalents, types of disconnections, chemo selectivity, Retrosynthesis of: 2,4-D, Endosulphan, IAA and Captan. **b) Study of following fungicides** w.r.t. synthesis, mode of action, environmental effects and applications of: Metalaxyl, Thiophenate methyl and Chlorothalonil	**15**	**01**
IV	**a) Manufacture of Pesticides and otherAgrochemicals:** (Unit processes are to be discussed as they occur in the sequences) typical representative compounds like Captan, dimethoate, Phosphamidon, Maneb and Agro grade sulfur be chosen for detailed study. **b) Occupational Health Hazards and their control in Agrochemicals**	**15**	**01**

	Industries: Handling of chemicals and Pesticides, Occupational Hazards like Asthma and pulmonary diseases, Dermatitis & Cancer. Health education for workers. Occupational Health Management and Industrial safety.		

Sr.no.	Reference Books
1.	Unit Operations:W.L.Badger
2.	Encyclopedia of chemical technology: Kirk and Othmar
3.	A text book of chemical technology: S.D.Shukla & G.N.Pandey
4.	Industrial chemistry by James Kent & Reigel
5.	Survey of industrial chemistry 2 Ed. by P.J.Chenier
6.	Industrial chemicals: F.A.Lowheim and M.A.Moran
7.	Encyclopedia of pesticides Manufacture
8.	Advances in chemical Engeenering-JamesWei
9.	A Text Book of Chemical Technology-G.N.Pandey
10.	Introduction to chemical Engeenering-Walter L Badgar, Juliust T.,Banchero.

DSC – 8 AGRO-BASED MARKETING MANAGEMENT

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

1) Principle of marketing and working of different type of operations in market.
2) Use of social media in agro-based marketing.
3) Study of quality and scope of agriculture marketing.
4) Study of role of marketing in agro-based business, problems of agro-based marketing.
5) Get knowledge of consumer behavior in agro-based business.

Unit No.	Titles and Chapter	Lectures	Credits
I	**Introduction of Marketing** Meaning, Scope, Importance and functions of Marketing. Marketing Planing, Nature, Process of Marketing Plan. Rural Marketing- Introduction, Classification of Rural Markets, Problems of Rural Marketing.	**15**	**01**
II	**Marketing Environment and Marketing Segmentation** Elements of Marketing Environment. Impact of changing marketing environment on Agro-based business Types of Market, Base of Market Segmentation.	**15**	**01**
III	**Role of Marketing in Agro-Based Business** Role of Marketing in Agro-Based Business, Problems of Agro-based Marketing, Green Marketing – Meaning and Nature **Role of Social Media in Marketing** Introduction, various platform of social media in agro based marketing.	**15**	**01**
IV	**CONSUMER BEHAVIOUR IN AGRO-BASED BUSINESS** Factors determining the Consumer Behavior, Importance of Consumer Behavior. Buying Process, Marketing Research and Marketing Skills.	**15**	**01**

Sr.no.	Reference Books
1.	Marketing Management- Philip Kotler
2.	Agriculture Marketing – Premjit Sharma
3.	Marketing Management- Josph
4.	Service Marketing- Vasanti Venugopal, Raghu
5.	Agriculture Marketing- S.S.Acharya
6.	Marketing Management For Agriculture- R.K. Lal

DSE – 4.1 ADVANCES IN PEST CONTROL & DISEASES OF CROP PLANT – II

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

1. The students will have complete knowledge of pests in important crops.
2. The information about role of predators & parasitoids in pest control method and their mode of action.
3. Overall information of microbial insect control method and their mode of action.
4. Information of Bacillus thuringensis and its mode of action.
5. Knowledge of light activated pesticide, chemosterilants and pro-pesticide.
6. Pests and diseases of Fruits, Vegetables & Plantation Crops
7. Disease identification and control measures.

Unit No.	Titles and Chapter	Lectures	Credits
I	**i) Biocontrol in Agro ecosystem 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. **ii) Microbial control of insect:** Introduction, Definition, History, principle groups of pathogen, Bacillus thuringensis, fungi, viruses, their mode of action and methods of applications.	**15**	**01**
II	**Biorational and other innovative approaches**: Introduction, chemicals based on insect cuticle chitin, Protein chemicals: based on Endocrine system- Brain, Juvenile and moulting hormones.	**15**	**01**
III	**Unit-II-Fruit trees & Fruit diseases:** **Mango:** Anthracnose of mango Colletotrichum gleosporioides. Fruit root of mango- Gloeosporium ampelophagum **Guava-**Fruit Rot Gloeosporium pseudo Delacrox Black spot disease- Colletotrichum psidii Curzi, *Nigrospora oryzye.* **Grapes:** Anthracnose- *Gloesporium ampleophagum* rot- Doweny and powdery mildew, Black root of fruits, Cotton root Rot, Wilts v) **Citrus, Lemon & Oranges: Brown rot** –Brown watery rot Orange rot- Fusarium .moniliformis, Orange fruit rot **Chickoo:** Leaf spot- **Papaya:** Anthacnose- Wilt, oily spot Fruit rot- **Banana**:Fruit rot – (Diamond spot fruit rot),Cigatokka Leaf spot **Pomegranate:** Brown rot (Storage) –wilt, oily spot. **Ber:** Foliage disease & fruit storage diseases.	**15**	**01**
IV	**A) Diseases of Forest trees** **Teak-** Rust & Powdery mildew **Bamboo:** Rust & Star spot diseases **Santalum:** Powdery mildew & Asterina diseases. **B)Diseases of Ornamental plants:** **Roses:** Black spot, Powdery mildew, Cankers, Anthracnose. **Gladiolus:** Rot of corm, root, Flower blights. **Chrysanthemum:** Powdery mildew, Rust, Leaf spot, Wilt, Petal blights	**15**	**01**

Sr.no.	Reference Books
1.	Plant pathology by G.N. Agrios.
2.	Pathological problems of economics crop plants & their management by PaulKhurana, S.M.,1998.
3.	Fungi & plant diseases, by Mundkur B.B.1995.4.Tropical plant diseases by Turston H. D.
4.	Integrated Diseases management and plant health by Gupta V.K.& Sharma R.C. 6.Diseases of millets by Ramkrishnan T.S. I.C.A.R.publ. New Delhi.
5.	Fungal diseases of rice in India by Padmanabhan S.Y. I.C.A.R. publ., Delhi.
6.	Pathological problems of economics crop plants & their management by PaulKhurana, S.M.,1998.
7.	Atwal. Agricultural pests of India and southeast Asia
8.	K. M. Smith., Agriculture entomology.
9.	K. Shrivastava, A textbook of applied entomology.
10.	Graham & Night., Principles of forest entomology.
11.	S. Pradhan., Agricultural entomology.
12.	Govt. of Maharashtra Crop pests and how to fight them.
13.	Khare B.P.,Stored grain pests and their management
14.	Atwal. Agricultural pests of India and south East Asia

DSE – 4.2 PESTS OF CROP PLANT – II

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

1. Pests and diseases of Fruits, Vegetables & Plantation Crops
2. Pests Biology, Classification, Nature of Damage and Integrated Control Measures.
3. Disease identification and control measures.
4. The students will have complete knowledge of pests in important crops.
5. The information about role of predators & parasitoids in pest control method and their mode of action.
6. Overall information of microbial insect control method and their mode of action.

Unit No.	Titles and Chapter	Lectures	Credits
I	**Pests of Plantation Crops:** **Coconut:** Major: Rhinoceros beetle, Red palm weevil, black headed caterpillar, and mites. Minor: Coconut weevil, White grubs, Rodents. **Cashewnut:** Major: Leaf miner, Tea mosquito,Thrips. Minor: Stem borer, Scale insects. **Rubber trees**: Minor: Stem borer, Bark , Scale insects, Termites	**15**	**01**
II	**Pests of vegetables:** **Cabbage & Cauliflower** Major: Diamond back month, Cabbage Semi looper mustard aphid. Minor: Leaf Webber & Cabbageborer. **Bringal** Major: Shoot & Fruit borer, Jassidsaphids. Minor: Stem borer, Melon fruitfly. **Tomato:** Major: Fruit borer, Aphids, Cotton whitefly. Minor: Thrips, Leaf hopper, Mealybug.	**15**	**01**
III	**Pests of Spices and Condiments:** **Tobacco:** Major: Leaf eating Caterpillar, Stem borer, Aphids. Minor: Cut worm, Flea beetle, Bud borer &Nematodes **Turmeric & Ginger:** Minor: Rhizome fly, Caster capsuleborer. **Coriander:** Major –Cotton white fly, Pentatomidbug Minor: Indigo Caterpillar.	**15**	**01**
	Pests of fruits & fruit Trees **Mango:**		

IV	Major: Mango hoppers, Stem borer, Giant mealy bug, Stone Weevil, Fruitfly Minor: Leaf and Shoot gall insects, Red ants, Termites. **Grape vine:** Major: Thirps, Flea beetle, Mealybugs. Minor: Leaf hopper, Two spotted spidermite **Pomogranate:** Major: Anar butterfly, Fruit suckingmoth. Minor: Shoot borer, Mites, Thrips, Scaleinsects	**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 (springererlag)
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.

RESEACRH PROJECT (RP)-II

<table>
<tr><td>Sr. No.</td><td>RESEARCH PROJECT-II</td></tr>
<tr><td>1</td><td>Students should perform research project under the guidance of respective teachers/mentors.</td></tr>
<tr><td>2</td><td>After completion of project, students are to prepare a comprehensive report highlighting their learnings and takeaways during the project period. The report shall be signed by the Supervisor and Faculty Mentor.</td></tr>
<tr><td>3</td><td>Reflection
1. What do you think are the three most important learning outcomes covered and why?
2. Which of these learning outcomes do you think will prove most useful to you in the future, and why?
3. Which learning outcomes did you not fully understand? How will you overcome this?
4. What other skills/knowledge have you gained in this session?</td></tr>
<tr><td>4</td><td>Skills Audit – End of Course Review
1. What are the principle skills that you have gained as a result of participating in this course? How do you think these skills will help you in the future?
2. How would you rate your current skills
<table>
<tr><td>Skill</td><td>Score 1 to 5
1 = Poorly skilled 5 = Highly skilled</td></tr>
<tr><td>Working in a Team
Leading a Team
Networking & Meeting New People
Knowledge of Business
Project Planning
Giving a Presentation</td><td></td></tr>
</table></td></tr>
<tr><td>5</td><td>The assessment of project will be based on the following criteria:
• Quality and effectiveness of presentation
• Depth of knowledge and demonstrated skills
• Variety and relevance of learning experience
• Practical applications and relationships with concepts taught in the course
• Project Report</td></tr>
</table>

Sr.no.	**Reference Books**
1.	As per Project subject

PRACTICALS (Based on DSC-7)

Sr.No.	PRACTICALS
1.	Estimation of copper from copper fungicide.
2.	Estimation of Ca from super phosphate.
3.	Determination of organic carbon in compost and vermicompost.
4.	Determination of total sulphur in soil sample.
5.	Preparation of ziram and ferban
6.	Preparation of 2,4-D
7.	Preparation of salicylanilide.
8.	Determination of soil pH by pH paper and pH meter method.
9.	Estimation of phosphorus from soil by colorimetric method.
10.	Determination of salinity of soil by conductometric method
11.	Preparation of P-Nitroacetanilide.
12.	Preparation of Phenylhydrazide

Any Suitable experiment may be added whenever necessary.

PRACTICALS (Based on DSE- 4.1 or DSE-4.2)

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.	Collection and submission of pests.
4.	Study of crop plants as per syllabus.
5.	Pests of solanaceous vegetables.
6.	Pest of malvaceous vegetables.
7.	Pest of cruciferous vegetable
8.	Pest of cucurbitaceous vegetable.
9.	Pest of mango.
10.	Pest of citrus.
11.	Study of Fungal diseases of Fruit crops: at least 1 or 2 of each crop.
12.	Study of Fungal diseases of Forest crops: at least 1 or 2 of each crop.

Any Suitable experiment may be added whenever necessary.