

Shivaji University, Kolhapur



Accredited By NAAC

B

M. Sc. Agrochemicals and Pest Management

Revised Syllabus (Semesters I-IV)

(Credit System)

(Subject to the modifications to be made from time to time)

Syllabus to be implemented

From June ,2012

onwards

**A] Ordinance and Regulations
(as applicable to M.Sc. degree)**

**B] Shivaji University, Kolhapur
Revised Syllabus For
Master of Science of Agrochemicals and Pest Management**

1. TITLE: Subject - Agrochemicals and Pest Management

Under the Faculty of Science

2. YEAR OF IMPLEMENTATION:- Revised Syllabus will be implemented from June, 2012 onwards.

3. PREAMBLE:

Shivaji University since its inception, has successfully tried to meet the regional demands of socio-economic development by introducing need based course. Agrochemicals and Pest Management course is introduced by Shivaji University, Kolhapur. The course is ideally accomplished by having chemical analysis, analytical techniques applied entomology and plant pathology with fairly good knowledge of formulation technology, extension work, marketing of agrochemicals, plant protection equipments, sales and services. Students have one month industrial training especially in pesticide and fertilizer industries, extension and marketing agencies etc. So that they have a good knowledge what goes in industries and application of knowledge. Today there is a great demand for this course, as student have realized that it has better chance of getting jobs in this world of competition, while conventional courses only trend human resources for teaching. Bio-control of insect pest is an important component of this course, students have been taught about various entomopathogens like predators, parasites and various biopesticides.

4. GENERAL OBJECTIVES OF THE COURSE/ PAPER:

(as applicable to the Degree /Subject- Paper concerned)

- 1) Chemistry of pesticide and their formulations.
- 2) Analytical techniques for agrochemicals.
- 3) Agricultural Marketing Management.
- 4) Plant pathology.
- 5) Development of various bio and novel pesticides.
- 6) Setting of Bio-control laboratory.
- 7) To develop field laboratory to study Agronomy, Plantation of Medicinal plants, Composting and Vermi-composting.

5. DURATION:

- The course shall be a full time course.
- The duration of course shall be of Two years four semesters.

6. PATTERN:-

Pattern of Examination will be Semester system.

7. FEE STRUCTURE:- (as applicable to self supporting course)

i) Entrance Examination Fee :- Rs. 300 (Not refundable)

ii) Course Fee-

Particulars	Rupees
Tuition Fee	Rs. 15000/-
Laboratory Fee	Rs. 2500/-
Computer Fee	Rs. 200/-
Other Fee*	Rs. 1275/-
Total annual fee- Per student	Rs. 18975/-*

*Other fee will be applicable as per University rules/norms.

8. IMPLEMENTATION OF FEE STRUCTURE:-

In case of revision of fee structure, this revision will be implemented in phase wise manner as mentioned below:

For Part I- From academic year 2011 onwards.

For Part II- From academic year 2012 onwards.

9. ELIGIBILITY FOR ADMISSION:

Admission to the course open only to the candidates passing B.Sc. degree with Chemistry / Botany / Zoology / Microbiology / Plant protection / Bio-chemistry / Biotechnology / Horticulture / Agriculture as the principal subject. However, one must be chemistry and one must be Botany / Zoology / Microbiology out of three subjects as principal and subsidiary subjects.

Candidates securing at least 50 marks at the degree level are only eligible.

Candidate will be selected from the students appeared for entrance test and fulfilling the conditions as per the university rules for the entrance examination.

10. MEDIUM OF INSTRUCTION:

The medium of instruction shall be in English

11. STRUCTURE OF COURSE:-**FIRST YEAR JUNE, 2012 (NO.OF PAPERS = 8 (eight))**

Sr. No.	Subjects	Marks
	SEMESTER I	
1.	PAPER-I : CHEMISTRY OF PESTICIDES AND THEIR FORMULATIONS-I	100
2.	PAPER-II : SOIL SCIENCE, FERTILIZERS and MICRONUTRIENTS	100
3.	PAPER -III : INTRODUCTORY AND INDUSTRIAL ENTOMOLOGY	100
4.	PAPER -IV : CROP DISEASES AND WEEDS	100
	Practical I : Chemistry	100
	Practical II : Life Science	100
	SEMESTER II	
5.	PAPER-V : CHEMISTRY OF PESTICIDES AND THEIR FORMULATIONS-II	100
6.	PAPER-VI: ANALYTICAL TECHNIQUES FOR AGROCHEMICALS	100
7.	PAPER-VII : ECONOMIC ENTOMOLOGY	100
8.	PAPER-VIII : BIOTECHNOLOGICAL ASPECTS IN PLANT PROTECTION	100
	Practical III : Chemistry	100
	Practical IV : Life Science	100

SECOND YEAR 2013 (NO.OF PAPERS =8 (EIGHT))

Sr. No.	Subjects	Marks
SEMESTER III		
1.	PAPER-IX : PESTICIDE RESIDUES AND TOXICOLOGY	100
2.	PAPER-X : PESTS OF CROP PLANTS AND THEIR CONTROL-I	100
3.	PAPER -XI : ANALYSIS OF AGROCHEMICALS	100
4.	PAPER -XII : DISEASES OF CROP PLANTS -I	100
	Practical V : Chemistry	100
	Practical VI : Life Science	100
SEMESTER IV		
5.	PAPER-XIII : AGRO-BASED MARKETING MANAGEMENT	100
6.	PAPER-XIV: PESTS OF CROP PLANTS AND THEIR CONTROL -II	100
7.	PAPER-XV : MANUFACTURE OF AGROCHEMICALS	100
8.	PAPER-XVI : DISEASES OF CROP PLANTS -II	100
	Practical VII : Chemistry	100
	Practical VIII : Life Science	100

12. SCHEME OF TEACHING AND EXAMINATION:-

M.Sc-I (SEMESTER – I & II)

Sr. No.	Subject /Paper	Teaching Scheme (Hrs/Week)				Examination Scheme (Marks)		
		L	T	P	Total	Theory	Term Work	Total
SEMESTER I								
1.	PAPER-I : CHEMISTRY OF PESTICIDES AND THEIR FORMULATIONS-I	4	-	-	4	80	20	100
2.	PAPER-II : SOIL SCIENCE, FERTILIZERS and MICRONUTRIENTS	4	-	-	4	80	20	100
3.	PAPER -III : INTRODUCTORY AND INDUSTRIAL ENTOMOLOGY	4	-	-	4	80	20	100
4.	PAPER -IV : CROP DISEASES AND WEEDS	4	-	-	4	80	20	100
	Practical I : Chemistry	-	-	6	6	80	20	100
	Practical II : Life Science	-	-	6	6	80	20	100

SEMESTER II								
1.	PAPER-V : CHEMISTRY OF PESTICIDES AND THEIR FORMULATIONS-II	4	-	-	4	80	20	100
2.	PAPER-VI: ANALYTICAL TECHNIQUES FOR AGROCHEMICALS	4	-	-	4	80	20	100
3.	PAPER-VII : ECONOMIC ENTOMOLOGY	4	-	-	4	80	20	100
4.	PAPER-VIII : BIOTECHNOLOGICAL ASPECTS IN PLANT PROTECTION	4	-	-	4	80	20	100
	Practical III : Chemistry	-	-	6	6	80	20	100
	Practical IV : Life Science	-	-	6	6	80	20	100

M.Sc-II (SEMESTER – III & IV)

Sr. No.	Subject /Paper	Teaching Scheme (Hrs/Week)				Examination Scheme (Marks)		
		L	T	P	Total	Theory	Term Work	Total
SEMESTER III								
1.	PAPER-IX : PESTICIDE RESIDUES AND TOXICOLOGY	4	-	-	4	80	20	100
2.	PAPER-X : PESTS OF CROP PLANTS AND THEIR CONTROL-I	4	-	-	4	80	20	100
3.	PAPER -XI : ANALYSIS OF AGROCHEMICALS	4	-	-	4	80	20	100
4.	PAPER -XII : DISEASES OF CROP PLANTS AND THEIR CONTROL-I	4	-	-	4	80	20	100
	Practical V : Chemistry	-	-	6	6	80	20	100
	Practical VI : Life Science	-	-	6	6	80	20	100
SEMESTER IV								
1.	PAPER-XIII : AGRO-BASED MARKETING MANAGEMENT	4	-	-	4	80	20	100
2.	PAPER-XIV: PESTS OF CROP PLANTS AND THEIR CONTROL -II	4	-	-	4	80	20	100
3.	PAPER-XV : MANUFACTURE OF AGROCHEMICALS	4	-	-	4	80	20	100
4.	PAPER-XVI : DISEASES OF CROP PLANTS AND THEIR CONTROL-II	4	-	-	4	80	20	100
	Practical III : Chemistry	-	-	6	6	80	20	100
	Practical IV : Life Science	-	-	6	6	80	20	100

13. SCHEME OF EXAMINATION :-

- The examination shall be conducted at the end of each semester.
- The theory paper shall carry 80 marks.
- The theory paper (internal) shall carry 20 marks.
- The evaluation of the performance of the students in theory papers shall be on the basis of semester examination of 80+20 marks.(both theory and practicals)
- Question Paper will be set in the view of the /in accordance with the entire Syllabus and preferably covering each unit of syllabi.

The scheme of semester examination is as follows :-

Total marks per theory paper 100
(80 marks external exam + 20marks internal exam.)

M. Sc. I (Semester- I and II) Theory Examination

(For each semester)

External examination 4 Theory papers

80x 4= 320 marks

Internal examination 20x 4= 80 marks

400 marks

M. Sc. I (Semester - I and II) Practical Examination

Chemistry practical: -100marks

60 experiments + 10 seminar + 10 oral and journal = 80marks

Internal practical = 20marks

100marks

Life science practical:-100marks

70 mark experiments + 10marks oral and journal = 80 marks

internal practical examination = 20 marks

100marks

M. Sc. II (Semester – III) Theory Examination

External examination 80 x 40 = 320 marks

Internal examination 20 x 4 = 80 marks

400marks

M. Sc. II Semester - III Practical Examination

Chemistry Practical:-

60 mark experiment +10marks industrial training +10mark

oral and journal = 80marks experimental examination.

= 20 marks internal examination.

100 marks.

Life Science Practical: -

60 marks experiment +10 marks seminar +10 marks oral and Journals.

= 80marks experimental examination.

= 20 marks internal examination.

100 marks.

M. Sc. II (Semester- IV) Theory Examination

External examination $80 \times 4 = 320$ marks
Internal examination $20 \times 4 = \frac{80 \text{ marks}}{400 \text{ marks}}$

M. Sc. II Semester - IV Practical Examination

Chemistry Practical

50marks experiment +25 research project evaluation +5marks oral and journal =
80marks external examination = 80 marks external exam.
 $\frac{= 20 \text{ marks internal Examination}}{100 \text{ Marks}}$

Life Science Practical: -

50 marks experiment +25 Marks Project Presentation +5marks oral and journal =
80 marks external examination = 80 marks external exam.
 $\frac{= 20 \text{ marks internal Examination}}{100 \text{ Marks}}$

600 x 4 semesters = 2400 marks

14. STANDARD OF PASSING:

As prescribed under rules and regulation for each degree.

15. NATURE OF QUESTION PAPER AND SCHEME OF MARKING :-

(Unitwise weightage of marks should also be mentioned)

Theory Examination

Section - I

Q.No.1 is objective and multiple choice type, includes 16 subquestions carries one mark each

Section - II

Q. No.2 to 6 are descriptive carries 16 marks. Candidate is asked to solve Three questions out of five.

Section - III

Q.No.7 is devoted to short notes . Candidate is asked to solve four short notes out of six. Each short note carries five marks.

Practical Examination

Which is given in paragraph (13) Scheme of examination experimental wise distribution of marks etc.

16. EQUIVALENCE IN ACCORDANCE WITH TITLES AND CONTENTS OF PAPERS- (FOR REVISED SYLLABUS)

SEMESTER – I & II

Sr. No.	Title of Old Paper	Title of New Paper
1.	PAPER-I : CHEMISTRY OF PESTICIDES AND THEIR FORMULATIONS-I	PAPER-I : CHEMISTRY OF PESTICIDES AND THEIR FORMULATIONS-I
2.	PAPER-II : SOIL SCIENCE, FERTILIZERS and MICRONUTRIENTS	PAPER-II : SOIL SCIENCE, FERTILIZERS and MICRONUTRIENTS
3.	PAPER-III: INTRODUCTORY AND INDUSTRIAL ENTOMOLOGY	PAPER-III: INTRODUCTORY AND INDUSTRIAL ENTOMOLOGY
4.	PAPER-IV : CROP DISEASES AND WEEDS	PAPER-IV : CROP DISEASES AND WEEDS
5.	PAPER-V : CHEMISTRY OF PESTICIDES AND THEIR FORMULATIONS-II	PAPER-V : CHEMISTRY OF PESTICIDES AND THEIR FORMULATIONS-II
6.	PAPER-VI: ANALYTICAL TECHNIQUES FOR AGROCHEMICALS	PAPER-VI: ANALYTICAL TECHNIQUES FOR AGROCHEMICALS
7.	PAPER-VII : ECONOMICS ENTOMOLOGY	PAPER-VII : ECONOMIC ENTOMOLOGY
8.	PAPER-VIII : BIOTECHNOLOGICAL ASPECTS IN PLANT PROTECTION	PAPER-VIII : BIOTECHNOLOGICAL ASPECTS IN PLANT PROTECTION

SEMESTER – III & IV

Sr. No.	Title of Old Paper	Title of New Paper
9.	PAPER-IX : PESTICIDE RESIDUES AND TOXICOLOGY	PAPER-IX : PESTICIDE RESIDUES AND TOXICOLOGY
10.	PAPER-X : ADVANCES IN PEST CONTROL-I	PAPER-X : PESTS OF CROP PLANTS AND THEIR CONTROL- I
11.	PAPER-XI: ANALYSIS OF AGROCHEMICALS	PAPER-XI: ANALYSIS OF AGROCHEMICALS
12.	PAPER-XII : PEST AND DISEASES OF CROP PLANTS-I	PAPER-XII : DISEASES OF CROP PLANTS AND THEIR CONTROL-I
13.	PAPER-XIII : AGRO-BASED MARKETING MANAGEMENT	PAPER-XIII : AGRO-BASED MARKETING MANAGEMENT
14.	PAPER-XIV: ADVANCES IN PEST CONTROL-II	PAPER-XIV: PESTS OF CROP PLANTS AND THEIR CONTROL-II
15.	PAPER-XV : MANUFACTURES OF AGROCHEMICALS	PAPER-XV : MANUFACTURES OF AGROCHEMICALS
16.	PAPER-XVI : PESTS & DISEASES OF CROP PLANT-II	PAPER-XVI : DISEASES OF CROP PLANTS AND THEIR CONTROL-II

17. SPECIAL INSTRUCTIONS , IF ANY.

- (i) Study tour for M.Sc. Part II students to visit tissue culture laboratories, Biocontrol laboratory, Agricultural research institutes , field farms ,Fertiliser and pesticide industries etc.
- (ii) Field visits for M.Sc. part I and II students – To study the agronomy, pest and diseases of crop plants, soil, water quality nearby Kolhapur, Sangli, Satara and Western Ghats of Sahyadri region.
- (iii) One month industrial training in pesticides and fertilizer industries (R and D as well as Quality control section), National agricultural research institute, field survey in Agrobased industries.
- (iv) To work in field laboratory at Shivaji University campus day per week. To study the Agronomy, plantation of medicinal plants. This work will be done by the student with collaboration with the other science departments in the campus.
- (v) To arrange guest lectures of eminent scientists in the field of agricultural chemistry, well knowm farmers, past students of the department, Persons in Agricultural marketing management.

**REVISED SYLLABUS FOR
DEPARTMENT OF AGROCHEMICALS AND PEST MANAGEMENT**

M. Sc. Part I (Semester –I)

PAPER-I

CHEMISTRY OF PESTICIDES AND THEIR FORMULATIONS - I

Unit-I

Study of Organic reactions: (15)

Substitution, Addition, Elimination and Aromatic Substitutions: Nitration, Sulfonation, Halogenation and Friedel –Crafts reaction and Deamination etc.

Unit-II

Chemistry of Pesticides: (3)

Pests and Pesticides, Historical development, Chemical and Botanical pesticides, Classification based on chemicals, 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 etc.

a) Pyrethroids and Other Natural Pesticides (6)

Alicyclic Carboxylic acids and derivatives, Pyrethrins and their synthetic analogues, Fenvalerate, Fluvalinate, Permethrin, Deltamethrin.

b) Recent advances in pest control: Green Chemistry in pesticides (6)

Recent insect attractants, Chemosterilants and Repellents, Mode of action and Applications of Neem in plant protection: Introduction, Chemical constituents, Bioefficacy of neem preparation.

Unit-III:

Organophosphorus pesticides: (15)

Malathion, Monocrotophos, Dimethoate, Phosphamidon or Phosalone, Chloropyrifos, Finitrothion, Phenthoate, Phorate (Thimate), Quinolphos, Acephate, Ethephon, Temephos, Methomyl, Triazophos (Synthesis, properties, formulation, uses and Environmental fate expected).

Unit-IV:

Formulation (15)

Purpose of formulation, Adjuvants, Synergism, Wettable and Flowable powders, Emulsions, Emulsifiable oils, Solubility limitations, Solution concentrates, Aqueous suspensions, Chemicals formulations, Dusts for spraying, Aerosols, Smokes, Granules preparation, Baits, Micro-encapsulation, Soluble emulsions, etc.

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) Chemistry of Insecticides by U.S.SreeRamulu

PAPER-II**SOIL SCIENCE, FERTILIZERS and MICRONUTRIENTS****Unit- I****Soil Science****(15)**

Importance of Soil formation, Properties and Composition of Soils, Soil profile, Organic matter in soil, Soil micronutrients, Acid and Alkaline soil, Absorption of toxic metal and chemicals by soil, Effects of modern agro –technology and pesticides on soil, Nitrogen fixation, and Soil Reclamation, Study on N, P, K , and S transformations, Leaching, Run off, Absorption of water and ground water.

Unit-II**Fertilizers****(15)**

Classification and types of fertilizers, Essential fertility requirement of the Nitrogenous fertilizers: Ammonium nitrate, Urea, Calcium Cyanamide, Calcium Ammonium Nitrate, Sodium Nitrate, Ammonium Chloride: Introduction, Raw materials, Manufacture, Action of as a fertilizers. Phosphate fertilizers: Normal super phosphate, Triple Super Phosphate, Ammonium Phosphate. Potassic fertilizers, Bricakating technology of fertilizers, Mixed fertilizers and positions of Fertilizer Industries in India.

Unit-III**(15)****A) Micro nutrients**

Definition, Types, Properties and Uses of Micro- nutrients, Manufacture of Micro-nutrients, Deficiency and Reclamation.

B) Plant Growth promoters and hormones

- a) Gibberellins
- b) Auxins
- c) Cytokinins
- d) Ethylene

Unit-IV**(15)****A) Manures**

Humus and decomposing organic matter in soils, Compost and composting of agriculture and city wastes, Manures, Oil cakes, Role of Micro-organisms in the process. Types and Chemical properties of Manures. Application of Organic Manures and Soil fertility and Vermi-culture, Vermi-composting, Enriched Vermi-culture.

B) Biofertilizers:

Nitrogen fixation by Azetobacter, Acetobacter, Phosphate Solubilizing Bacteria, Algal culture, Production and Quality assessment.

Reference Books:

- 1) Bear : Chemistry of the soil (ACS Remhold)
- 2) M. B. Green, G. S. Hartley and T. F. West: Chemicals for crop improvement and pest management (Pergamon).
- 3) D. N. Shreve: The Chemical process Industries.
- 4) W. L. Badger and J. T. Bandhiro: Introduction to chemical Engineering (McGraw Hill).
- 5) A. M. Deshmukh: Biofertilizers
- 6) Gopal Rao: Outlines in Chemical Technology.
- 7) Shukla and Pandey: Introduction to Chemical Technology.
- 8) B. K. Sharma: Industrial Chemistry by B.K.Sharma.
- 9) Outline in Chemical Technology by Gopal Rao
- 10) Introduction to Chemical Technology by Shukla and Pandey.
- 11) Industrial Chemistry by B. K. Sharma.

PAPER –III**INTRODUCTORY AND INDUSTRIAL ENTOMOLOGY****Unit-I (15)****Introduction of insects:**

Pests, General characters, Habitats, Damage, Economic Threshold Level, Natural enemies, Parasitoids and Predators. General description and morphology of the Insect: Head, Thorax and Abdomen.

Unit-II (15)

Anatomy and Physiology of the Insect: Digestive system, Nervous system, Excretory system, Reproductive system and Circulatory system. Classification of pests: Based on damage, Feeding habitat and Taxonomy etc.

Unit-III (15)

General life cycle patterns of insect pests: Grasshopper, Aphid, Lepidopteran Borer, White grub, Red hairy caterpillar, Snails, Slug, Nematodes, Rat.

Unit-VI (15)**Insects of Industrial Importance:**

Sericulture: Mulberry cultivation and Rearing of Silkworms; Pest and Disease management of Mulberry and Silkworm.

Apiculture: Types of honey bees, Life cycle, Bee keeping equipments, Honey quality, Pest and disease management Agriculture and Non-Agricultural Flora and Bee keeping.

Biocontrol: The product of an egg parasite of Lepidopteran pest.

Production of Biocontrol agents: Production of *Trichogramma*, Production of Nuclear Polyhydrosis Virus (NPV). Production of predator: *Chrysoperla carnea*

Reference Books:

1. Agriculture pest of India and South East Asia by A. S. Atwal.
2. A textbook of applied entomology by K. P. Srivastava.
3. Entomology and pest management-Larry P. Pedigo.
4. Sericulture and pest management-DPH-Delhi by Sathe & Jadhav.
5. Agricultural Entomology by S. Pradhan.
6. Crop pests and How to fight them- Govt. Maharashtra.

PAPER-IV**CROP DISEASES AND WEEDS****Unit-I Plant Disease Concept****(15)**

Plant pathogens concepts of Plant diseases, Classification of plant disease based on casual organisms such as Fungi, Bacteria, Viruses, MLO's impact of plant diseases on crop production assessment, Diagnosis, Identification of casual organism by Koch postulates, Microscopic principles of plant disease control, Histochemical and Serological methods of studying plant pathogens.

Molecular basis of diagnosis, Chemicals, Enzymes of pathogens in infective, Microbial toxins. Modern techniques in analysis of plant diseases. Plant disease Epidemiology, dissemination factors affecting the development of epidemics, Disease forecasting. Plant disease epidemic assessment, Monitoring studies in illustrative and typical cases.

Unit-II**(15)**

Fungi and fungal disease, and Storage fungi, Infectious fungi, Mechanism of infection, and Dissemination of fungal diseases, Symptomology and Identification of fungal diseases.

Bacteria and bacterial disease, Classification, Mechanism of infection, Dissemination, Symptomology and Identification.

Unit-III**(15)**

Viruses and viral disease: Mechanism of Infection and Dissemination symptoms and methods of Identification, MLO's as diseases causing Prokaryotes, Classification of MLO'S

Diseases caused, Symptoms, Method of infection and Identification. Parasitic Green algae and parasitic higher plants-Symptoms and Identification

Unit-IV**(15)**

A) Plant quarantine: Domestic and International

B) Weeds: Classification, Life cycle, Dissemination, Growth and Development, assessment of losses, Factor affecting Competitive ability, Association of weeds with certain crops. Physical, Chemical and Biological Method of control, Herbicides and their Classification.

Reference Book

1. Plant Pathology 5th Edition by G. N. Agrios
2. Chemical for crop improvement and pest management by M. B. Green.
3. Weed Biology and control by T. J. Musik (Mc Graw Hill)
4. Pathological problems of economic crop plant and their management by Paul and Khurana S. M., 1998.
5. Tropical plant diseases by Thurston H. D., 1993.
6. Fungi and plant diseases by Mundkar B. B., 1972.
7. Integrated diseases Management ant plant health by Gupta V. K. & R.C.Sharam, 1988.
8. Principles of plant pathology by Tarr, S. A. J., 1972.
9. Plant diseases caused by fastidious Prokaryotes by Raychandhuri S. P. and Anupam varma, 1989.
10. Mycoplasma molecular biology and pathogenesis by Maniloffj, 1992.
11. Mycoplasma diseases by Marmorosch k., 1982/85.
12. Taxonomy of plant pathogenic bacteria in India, Indian Phythology 50(1): 153- 155
13. International standards on naming of pathogens of Phytopathogenic bacteria and their lists by Dye D. W. et. Al. 1980 Rev. Plant Pathology.59 153-163.

SEMESTER-I
CHEMISTRY: PRACTICAL-I: BASED ON PAPER I and II

- i) Chemistry of pesticides and formulation.
- ii) Soil, fertilizers, micronutrients and manures.
 - 1. Estimation of copper form copper fungicide.
 - 2. Estimation of sulfur form wettable sulphur powder.
 - 3. Estimation of nitrogen form ammonium sulphate.
 - 4. Estimation of Ca form super phosphate.
 - 5. Estimation of Nitro group from organic pesticides.
 - 6. Determination of salinity of soil by conductometrically.
 - 7. Estimation of phosphorus from soil by colorimetrically.
 - 8. Estimation of potassium from soil by flame photometrically.
 - 9. Estimation of nitrogen from soil by Kjeldahals method.
 - 10. Determination of organic carbon in compost, vermicompost.
 - 11. Determination of carbendazim content.
 - 12. Determination of turbidity of given water sample by nephelometrically.
 - 13. Nephelometric determination, turbidity of water sample, sulphate and phosphate.
 - 14. Estimation of iron, sulphur, and boron from soil sample.
 - 15. Submission of quality analysis of three inorganic and three major nutrients N, P, K.
 - 16. Analysis of mixed fertilizers and micronutrients.
 - 17. Determination of potassium in commercial sample of muriate of potash.
 - i) Cobaltinitrite method.
 - ii) Perchlorate method.
 - 18. Analysis of organic manures.
 - i) Moisture content
 - ii) Organic matter and ash content.
 - 19. Determination of total sulphur in soil sample.
 - 20. Determination of apparent specific gravity or bulk density, particle density or true density of the soil, water holding capacity of the soil.

Any Suitable experiment may be added whenever necessary.

Reference Books

- 1. A Text Book of Qualitative Inorganic Analysis by A. I. Vogel.
- 2. Methods of Pesticide Analysis by Shree Ramulu.
- 3. Soil and Plant Analysis by C. S. Piper (Hans Publisher).
- 4. Analytical Agricultural Chemistry by Chopra and Kanwar.

SEMISTER-I
LIFE SCIENCE: PRACTICAL BASED ON PAPER- III and IV

(Collection and preservation of major pests and Botanical and Microbial practicals)

Entomology (Zoology):

1. Rearing of an egg parasite, *Trichogramma sp.*
2. Rearing of predator, *Chrysoperla carnae*
3. Rearing of *Helicoverpa armigera*
4. Rearing of silkworm
5. Rearing of hairy caterpillars
6. Release techniques of Parasitoids, Predators and NPV in field.
7. Chemical and Cultural control of some crop pests in field.
8. Visit to Apicultural center.
9. Field visits for control trials of Agricultural Pests.
10. Collection of various crop pests and its submission.

Any suitable experiment may be added, whenever necessary.

B) Plant Pathology (Botany)

1. Classification and identification of weeds.
2. Study of fungal, bacterial, viral and MLO diseases of vegetables.
3. Study of fungal, bacterial, viral and MLO diseases of cash crops.
4. Study of fungal, bacterial, viral and MLO diseases of pulses.
5. Estimation of chlorophyll from healthy and infected leaves.
6. Determination of percentage of organic carbon from the compost.
7. Preparation of culture media, dilution technique, inoculation of soil fungi and Identification of soil borne pathogen.
8. Staining techniques in bacteria and MLO's.
9. Study of morphological and biochemical defense mechanism in plants.
10. Classification and identification of weeds.
11. Collection and submission of weed specimens.
12. Collection and submission of affected plant parts of (diseased)
13. Field visits for control trials of diseases and weeds.

Any Suitable experiment may be added whenever necessary

Reference Books

1. Introduction to Entomology by M. S. Mani.
2. A textbook of Entomology by A. D. Imm.
3. Agricultural pest of India and South East Asia by Atwal.
4. Agriculture Entomology by K. M. Smith.
5. A textbook of Applied Entomology by K. Shrivastava.

**REVISED SYLLABUS FOR
DEPARTMENT OF AGROCHEMICALS AND PEST MANAGEMENT**

M. Sc. Part I (Semester –II)

**PAPER-V
CHEMISTRY OF PESTICIDES AND THEIR FORMULATIONS-II**

UNIT-I : a) Chemistry and the applications of the following classes of the compounds: (10)

Nitro and Amino compounds, Hydrazine and Azo-compounds, Phenolic compounds, Ureas, Substituted ureas and Thioureas, Mercaptans, Sulfides, Thiocyanates
Captan, Isoproturon, Propanil, Parquat, Imidacloprid and Acetamiprid, BHC (Lindane), Endosulphan, Dicofol and 2,4-D,

b) Carbamate Pesticides (5)

Carbamates and Thiocarbamic acids, Oximecarbamates, Pendimethalin, Aldicarb, Primicarb, MBC, Zineb, Carbaryl and Carbofuran isomeric model and kinetics, Scheme of mechanism, Mode of action, Structure - Activity relationship etc.

Unit-II : Inorganic pesticides: (15)

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.

Unit-II : Plant protection appliances: (15)

Duster, Principles of dusting, Spraying, Part of typical sprayer, Types of sprayer. Types of nozzles and other equipments.

Unit-IV: Pesticide Formulation:

a) Controlled release pesticides fertilizers and their formulations (10)

The applications of controlled release formulation role of surfactants, Dispersing agents, Stabilizer, Wetting agents in pesticide formulations. Analysis of pesticides Formulation, Establishment of methods of Collaborative testing

b) Computer assisted correlation analysis in the development of pesticide (05)

Formulations: Computer optimization in emulsion formulations. Application of pesticides and devices used, Meteorological implications in planning.

Reference Book:

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. Chemicals in the environment by Miob and Satake.
9. Environmental chemistry by A. K. De.
10. Chemistry of insecticides and fungicides by SreeRamulu.

PAPER-VI

ANALYTICAL TECHNIQUES FOR AGROCHEMICALS

Unit-I

Separation techniques: (15)

Sampling of solids, liquids and gases; Solvent Extraction, Principle, Instrumentation and application of TLC, Paper chromatography, Column chromatography, Ion exchange and Ion chromatography.

Unit-II

Non Instrumental Techniques: (15)

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^{+++} .

Unit-III: Electrochemical Methods: (15)

- a) **Potentiometry:** Measurement of EMF, pH-metry and its applications in the analysis of pesticide residues in Agrochemicals, Food, Juices and Water.
- b) **Electrical conductivity:** Electrical conductivity of electrolyte, Conductivity meter, Specific and Equivalent conductivities, Applications of conductivity measurement in the Analysis of Salinity, Halide and Soil moisture.
- c) **Voltametry:** Principle and Methodology of Stripping voltametry and its applications in Trace analysis.

Unit-IV: Optical Method: Thermal and optical methods of analysis: (15)

- a) **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.
- b) **Polarimetry:** Principle and Application in the analysis of Optically active pesticides.
- c) **Thermal analysis techniques:**
Principle and Modern instrumentation of DTA, TGA and DSC.

Reference book:

1. A text of Inorganic Quantitative analysis by A. I. Vogel.
2. Methods of pesticide analysis by Shree Ramulu.
3. A text book practical organic chemistry including qualitative and quantitative analysis by A. I. Vogel.
4. Instrumental methods of chemicals analysis by Willard, Meritt & Dean.
5. Analytical agricultural chemistry by Chopra & Kanwar.
6. Analysis of pesticide residues by H. A. Moye.

**PAPER- VII
ECONOMIC ENTOMOLOGY**

(Study of the major and minor pests. Biology, Nature of Damage and Control Measures)

Unit-I **(15)****A) Household pests:**

Major: Silverfish, Mosquito, Housefly, Bed bug and Rat.

Minor: Cockroach.

B) Stored grain pests:

Major: Khapra beetle, Rice weevil, Rice moth, Pulse beetle and Rodent.

Minor: Lesser grain borer, Indian meal moth, Saw-toothed beetle.

C) Pests of medicinal plants:

Major: Opium capsule borer, Hadda beetle, Mealy bug, Root knot nematode.

Minor: Pentatomid bug, Ash weevil, Leaf webber.

Unit-II **(15)****A) Pests of Livestock:**

Major: Cattle louse, Stable fly and sand fly.

Minor: Blowfly, Black fly, Horse fly.

B) Forest Pests:

Major: Termite, White grub, Teak defoliator & Subabul psylla.

Minor: Cut worm, Stem and Root borer, Sesame defoliator

C) Pests of Ornamental plants:

Major: Cotton white fly, Digger wasp, Spiraling Whitefly, Leaf eating caterpillar.

Minor: Thrip, Scale insect, Leaf minor, Lawn webworm.

Unit-III **(15)****A) Pests of Polyhouse and Greenhouse plants:**

Major: *Helicoverpa* borer, Mite, Mealy bug, Aphid, White fly,

Minor: Cutworm, Leaf minor and Armyworm.

B) Nematode pests of crops (Polyphagous) :

Migratory endo-parasitic nematodes.

i) Root knot nematode (*Meloidogyne spp.*)

- ii) Cyst forming nematode (*Heterodera spp.*)
- iii) Seed gall nematode (*Anguina spp.*)
- iv) Molya nematode (*Heterodera avena*)

C) Vertebrate Pests of Agriculture crops:

Major: Indian field mouse, Monkey, House sparrow, Wild pig.

Minor: Common green bee-eater, Indian desert gerbil, Rose-ringed parakeet.

Unit-IV

(15)

A) Molluscan Pests of Agriculture crops:

Snails - *Helix spp.*, *Achatina fulica* & *Amarginata*.

Slugs - *Limax spp.*

B) Polyphagous pests:

Major: Termites, Hairy caterpillars, Locusts, White grubs and *Spodoptera sp.*

Minor: Grasshoppers, Wireworms, Fruit flies.

Reference Books:

1. Pests of Stored grain products Burgess by R. T. Cotton.
2. Introduction to Entomology by M. S. Mani.
3. A textbook of Entomology by A. D. Imm.
4. Agricultural pest of India and South East Asia by Atwal.
5. Agriculture Entomology by K. M. Smith.
6. A textbook of Applied Entomology by K. Shrivastava.
7. Principles of Forest Entomology by Graham & Night.
8. Agricultural Entomology by S. Pradhan.
9. Crop pest and How to fight them- Govt. of Maharashtra.

PAPER -VIII

BIOTECHNOLOGICAL ASPECTS IN PLANT PROTECTION

Unit-I : Agronomy of crop Plants

(15)

Introduction to cultivation of important crops

Sugarcane, Paddy, Sorghum, Cotton, Wheat, Coconut, Cashew nut, Soybean, Ground nut, Tobacco, Tomato, Cabbage and Cauliflower in respect to: Soil, Climate, Seed rate & Varieties/ cvs. Fertilizer requirement and Crop Protection.

Unit-II : Seed Technology

(15)

Seed Technology and techniques of producing hybrid seeds for disease resistance and other relevant characters.

Seed legislation and certification, Indian Seed Act, 1966.

Unit-III: Genetics of Resistance

(15)

Genetic resistance to pest, horizontal and vertical resistance of plants, infection, biochemical defence, breeding for disease resistance, back cross method, escape methods of breeding. Isolation and fusion of fungal protoplast. Application of fungal protoplast fusion.

Unit-IV : Plant Tissue culture and Genetic engineering (15)

a) Tissue culture technique, Meristem culture for virus free stock, Single cell cultivation, Protoplast, Isolation and hybridization, Anther culture, Organogenesis, Screening for disease resistance, Hardening technique.

b) Genetic engineering concept, Recombinant DNA technology, *Agrobacterium* mediated gene transfer, Introduction of Bt gene, Glyphosate resistant gene Transgenic plants.

Reference Book:

1. Seed Programming Management System & concept by Dadheek P.K., 1997.
2. Handbook of pure seed definition with illustration, by Dadheek P.K., 1995.
3. Handbook for seedlings Evaluation (2nd Edition) by SchmittGrob, R., 1997.
4. Microbial Biotechnology, by Reddy S.M., 1997.
5. Fungal Protoplast, A Biotechnological Tool by D. Lalithakumari 2000. IBH Publisher, New Delhi.
6. Element of Biotechnology by Gupta, P. K. 2000, Rastogi Publisher, Meerut, India.
7. Plant Biotechnology by Singh, B. D. 1999.

SEMISTER-II

CHEMISTRY PRACTICALS BASED ON PAPERS V & VI.

1. Determination of Alkalinity of water.
2. Determination of Nitrate from water.
3. Analysis of lime materiel.
4. Determination of Malathion content.
5. Determination of Metasystox content.
6. Determination of emulsion stability and cold test of pesticide.
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 hardness of water.
10. Determination of sulphate (SO_4^{2-}) and phosphate (PO_4^{3-}) from given water sample Nephelometrically
11. Separation and detection of pesticide by thin layer chromatography.
12. Determination of ammonium sulphate in a given fertilizer sample spectrophotometrically using Nessler's reagent.
13. Separation and determination of chloride and bromide ion by anion exchange chromatography.
14. Determination of chloride ion in the water sample by precipitation Titration (Mohr's method)
15. Determination of copper from Bordeaux mixture as fungicides by iodometric titration.
16. Determination of dissolved Chlorine gas in a given water sample by iodometric titrations.
17. Determination of calcium carbonate in soil sample.
18. Determination carbonate and bicarbonate in given water sample titrimetrically.

Reference Books

1. A Textbook of inorganic qualitative analysis by A. I. Vogel.
2. Method of pesticide analysis by Shree Ramulu.
3. Textbook of practical organic analysis including qualitative and quantitative analysis by A. I. Vogel.

SEMISTER-II

LIFE SCIENCE PRACTICAL BASED ON PAPER VII and VIII

(Botanical and Microbiology practicals & Study of Pests of Narcotic and other crops) Entomology (Zoology)

Study of the major and minor pests of the different categories as per syllabus and locally available. (One/Two of each category):

1. Pests of medicinal importance.
2. Pests of stored grain.
3. Vertebrate pests of agricultural crops.
4. Nematode pest of agricultural crops.
5. Rearing of pulse beetle.
6. Rearing of cockroach.
7. Rearing of scale insect.
8. Visit to the forest and poultry...etc.
9. Visit to the polyhouse and green house.
10. Submission of pests and field diary.
11. Any suitable experiment may be added, whenever necessary.
12. Pest loss Assessment: Study of stored seed (Pest).Comparative study of the resistant & susceptible cultivars to pathogens (Bacteria, viruses, fungi etc.) – Structural & chemical study of – Susceptible & resistant hosts/cvs.Plant Pathology (Botany):
13. Study of crop plants as per syllabus
14. Study of seed standards: a) Seed germination b) Hybrid seeds and their Characteristics.
15. Pest loss Assessment: Study of stored seed (Pest).Comparative study of the resistant & susceptible cultivars to pathogens (Bacteria, viruses, fungi etc.) – Structural & chemical study of – Susceptible & resistant hosts/cvs.
16. Pesticide degradation & residual analysis
17. Collection of seed or plant of varieties availability and its germination and few growth observations.
18. Study of stored grain fungi (Moist petriplate Method).
19. Preparation of MS media and callus culture(One crop).
20. Visit to Tissue culture lab and report submission.
21. Separation of amino acids by chromatography
22. Any suitable experiment may be added, whenever necessary.

Reference Books

1. Introduction to Entomology by M. S. Mani.
2. A textbook of Entomology by A. D. Imm.
3. Agricultural pest of India and South East Asia by Atwal.
4. Agriculture Entomology by K. M. Smith.
5. A textbook of Applied Entomology by K. Shrivastava.

**REVISED SYLLABUS FOR
DEPARTMENT OF AGROCHEMICALS AND PEST MANAGEMENT
M. Sc. Part II (Semester –III)**

**Paper- IX
PESTICIDE RESIDUES AND TOXICOLOGY**

Unit-I: Residues of Agrochemicals:

- a) Pesticides Residues in the Atmosphere:** (5)
Pesticides into the atmosphere and their fate, Transport of vapours, Precipitation, effect of residues on human life, Photochemistry of pesticides.
- b) Pesticides residues in Water system:** (5)
Nature and origin of pollution of aquatic systems, Point and Non-Point pollution. Dynamics of pesticides in aquatic environment.
- c) Pesticides residues in the Soil:** (5)
Absorption, Retention, Transport and Degradation of pesticides in the soil, Effect on micro-organisms and Consequent effect on the soil condition, Fertility, Interaction in the soil, Geo-hydrological aspects.

Unit-II: Extra microsomal metabolism of insecticides and Selectivity concepts :(15)

Enzymatic conjugation, OP and OC metabolism, Electrophysiology of nervous system and insecticide action. Acetylcholine esterase inhibition, Parameter affecting action of pesticides, Development of pesticide resistance. Ecological and Physiological selectivity, Penetration excretion, Metabolic alterations of toxicants, Poly factorial nature of selectivity, Prospects of selective pesticides, Resistance concept and its significance. Treatment of insecticide poisoning OP, OC, Carbamates Mode of action of Herbicides.

Unit-III: Pesticide residue Penetration and Distribution:

Effect of pesticide residues on the quality of human life. (15)

Model ecosystem, Studies of bio-concentration, bio-magnifications and bio-degradation effect of pesticides on life. In general and consequent effect on human life. The Cases of & affected societies and starving populations facing problems of health and nutrition, Traditional wisdom and Food security.

Unit-IV: Pesticide analysis: (15)

Special techniques, Sample preparation and Pesticide residue analysis methods . Biopesticides, Poisoning effects, Symptoms and Treatment. Further prospects of Research and Technology, Development of safe pesticides. Effluents of Agrochemicals and their disposal.

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. Moyer (JW)
5. Advance in pest control research by R. L. Metcalf (JW)
6. Chemistry of pesticides by K. H. Buchel (JW).
7. Progress in pesticides biochemistry and Toxicology V. I, II, III by D. H. Hutson and T. R. Robert.
8. Evaluation of pesticides in ground water by W. Y. Garnett, R. C. Honeycatt and others.
9. Chemistry of pesticides by Edward
10. Insecticide biochemistry and physiology by C.F. Wilkinson.
11. Progress in pesticide Biochemistry and toxicology WI, I, II, III by D.H. Hutson and T.R. Roberts.
12. Comprehensive insect physiology, Biochemistry and pharmacology WI, 12, by G.A. Kerkut and L.I. Gilbert.
13. Modern toxicology WI, I, II, III by P.K. Gyota and D.K. Salunkhe.
14. Toxicology by C.D. Kiassen, M. D. Amdur and J. Doull.

PAPER-X

PESTS OF CROP PLANTS AND THEIR CONTROL- I

Unit-I: Pests of Cereal Crops (15)

(Classification, Biology, Nature of damage and Control Measures)

A) Pests of Cereals:

- a) **Rice:** I) Major – Brown plant hopper, Yellow stem borer, Swarming Caterpillar.
II) Minor – Rice ear head bug, Armyworm, Pink borer, Rice hispa.
- b) **Sorghum:** I) Major – Midge fly, Aphids, Shoot fly.
II) Minor – Leaf roller.
- c) **Maize:** I) Major- Bug (Deliphacid), Ear head bug, Stem borer, Pink borer.
II) Minor- Pyrilla, Aphid.
- d) **Pearlmillet:** I) Major- Blister beetle.
II) Minor- Surface grasshopper, Armyworm
- e) **Wheat:** I) Major- Jassid, Termite, Stem borer.
II) Minor- Aphid, Nematode.

Unit-II: Pests of Pulses & Sugarcane (15)

a) Pulses: Chickpea, Pigeon pea, Cowpea, Peas, Green gram, Black gram, Kidney bean, Cluster bean, etc.

- I) **Major-** Gram pod borer, Tur pod bug, Pigeon pea pod fly, Pea aphid,
Spodoptera.
- II) **Minor-** Bean fly, Aphid, Tur plum moth, Thrip, Mite.

b) Pest of Sugarcane:

- I) **Major:** Early shoot borer, White grub, White fly.
- II) **Minor:** Stalk borer, Armyworm, Mite, Pyrilla, Sugarcane Woolly Aphid,
Termite, Plassy borer.

Unit-III:Pests of Oil-seeds & Forage Crops:

(15)

- a) **Groundnut:** I) Major: Groundnut leaf miner, aphid.
II) Minor: Stem borer & Bihar Hairy caterpillar
- b) **Sunflower:** I) Major: Head borer, Bihar hairy Caterpillar.
- c) **Safflower:** I) Major: Aphid & Leaf eating Caterpillar.
II) Minor: Safflower bud fly.
- d) **Mustard:** I) Major: Mustard aphid.
II) Minor: Diamond back moth.
- e) **Soybean:** I) Major: Pod borer, Jassid, Grey weevil.
- f) **Castor:** I) Major: Castor capsule borer, Castor semi-looper.
II) Minor: Castor white fly.
- g) **Sesame:** I) Major: Til hawk moth, Pod sucking bug,
- h) **Linseed:** I) Major: Gall fly
II) Minor: White fly & jassid.
- i) **Cotton crop:** I) Major: Pink bollworm & Spider mite, Red cotton bug.
II) Minor: Cotton leaf roller, Cotton stem weevil, Mealy bug.
- j) **Pests of Forage crops:**
- Lucerne or Alfa-alfa:** I) Major: Aphids, Cutworm, Armyworm.
II) Minor: Whitefly, Spotted flea beetle.
- Bersim** I) Major: Gram pod borer, Hairy caterpillar, Spotted alfalfa aphid.
II) Minor: Red pumpkin beetle, Grasshopper.

Unit-IV

a) Applied Entomology :

(5)

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, Preventive & Curative methods: Cultural, Mechanical. Physical, Legal and Biological.

b)Pest Management:

(6)

Tactics and strategies of pest management (IPM) Concept and tools of pest management, ECO system 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 system, Constrains and Strategic in implementation of IPM, Validation of IPM.*Host plant resistance.

c) Bio-efficacy of some pesticides against major pests:

(4)

Evaluation of toxicity of insecticides, Bioassay methods, Insecticide resistance and Resistance management.

d) Miscellaneous Approaches:

Biorational and other innovative approaches: Introduction, chemicals based on insect cuticle chitin, Protein chemicals: based on Endocrine system, Use of insect growth regulators , Brain, Juvenile and Moulting hormones, Chemicals based on communication system: Allelochemicals, Semiochemicals and Pheromones, Light activated pesticides, Pro-pesticides and Genetic control.

e) Recent advance in pest control: Green Chemistry in pesticides: (15)
Recent insect attractants, Chemosterilants and Repellents, Mode of action and Applications of Neem in plant protection: Introduction, Chemical constituents, Bioefficacy of Neem preparation.

Reference Books

1. Text of applied Entomology Vol I & II -K.P.Srivastava.
2. Introduction to insect Pest Management.
3. Textbook of insects toxicology.
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.
6. Entomology and Pest Management –Larry P.Pedigo.
7. Element of economic entomology –B.V.David and T.Kumarswamy.
8. Insect Pest Management –David Bent.
9. Critical issues in insect pest Management –G.S.Dhaliwal and E.A.Heinrich.
10. Emerging trends in biology control of Phytophagous Ed.- T.N.Anatkrishnan.
11. Toxicology of insecticide- Fumio matsumura.
12. Biological pest suppression – H.C.Coppelend and J.W.Martin.
13. Neem in plant protection: R.T.Gahukar, Agri-Horticultural Pub. Nagpur, 2003.

PAPER-XI

ANALYSIS OF AGROCHEMICALS

Unit-I (15)

- a) Separation Technique:** Principles, instrumentation and application of gas Chromatography (GC) and HPLC.
- b) Gas analysis:** Analysis Of SO₂, NO_x, CO, CO₂, NH₃, and H₂S in the effluent gases.

Unit-II (15)

- a) Radioactivity-** Measurement, Application of radio isotope in agriculture, Health hazard of activity ratio, Neutron activation analysis and Its application.
- b) Polarography:** Voltage current, Curves, Analysis of Polarogram, Application of Ultraviolet Spectrophotometer in the analysis of agrochemical and pesticide Residue and Metabolites.
- c) Fluorescence spectroscopy:** Basic principles, Methodology, Applications.

Unit-III (15)

- a) Ultraviolet spectroscopy:** Principles, Instrumentation and Applications
- b) Infrared spectrometry:** Principles, Instrumentation and Application.

Unit-IV (15)

- a) Nuclear Magnetic Resonance spectrometry:** Nuclear spin and Absorption of Radiofrequency, Chemical shift, Application in pesticide residue analysis NMR Spectroscopy.
- b) Mass spectrometry :** Schematic of mass spectrometer, Ionization and Fragmentation of molecules. Interpretation and application in the pesticide residue and metabolites analysis GC-MS techniques.

Reference Books:

1. Spectroscopic methods in Organic Chemistry –D.H. Williams and I. Fleming.
2. Instrumental methods of analysis –Willard and Meritsee, Dean.
3. Application of spectroscopic techniques inorganic Chemistry-P.S.Kalsi.
4. Concept in analytical Chemistry –S.M.Khopkar.
5. Analysis of pesticide residue –H.A.Moye(JW).
6. Advance in pest control research –R.L.Metcalf.
7. Application of absorption in Spectroscopy –J.R.Dyer.
8. Soil and plant analysis –C.S.Piper(Hans pub.)

PAPER-XII

DISEASES OF CROP PLANTS AND THEIR CONTROL -I

Unit-I Disease Development (15)

Stages in disease development

Pre-penetration, Penetration, Post- penetration, colonization.

Role of environmental factor in disease development. Toxins in plant disease,

Physiological specialization, Dispersal of Plant pathogens

Unit-II Plant Pathogen Interaction (15)

Host- pathogen interaction, Genetics of Host- pathogen interaction, gene for gene hypothesis

Antigen and Antibody reaction, Immunoglobulin and their applications.

Unit-III Fungal Diseases of Cereals and Pulses: (15)

(Study of symptoms, Life cycles and management)

a) Cereals:

Rice: Blast of rice, false smut of rice, Seeding blight, Udbatta disease.

Sorghum: Rust, Smuts, Downey mildew diseases & rots, Foliage, grain mould.

Wheat: Rusts & Smut diseases, & Root rots.

Maize: Rusts, Smuts, Seeding diseases, Blights, Ear rots.

Bajara: Rusts, Ergot, Downey mildews & Blast diseases.

b) Pulses: (Chickpea, Pigeon pea, Cow- Pea, green gram, Black gram, beans etc.):

Rusts, Powdery mildew, Wilts, Blights, Anthracnose, and Rots etc.

Unit-IV Fungal Diseases of Oil seed and Cash crops: (15)

a) Oil seed Crops:

i) Groundnut: Rust, Early and late leaf spot diseases (Tikka) seed rot (*Aspergillus* spp.) & seedling blight (*Penicillium* spp.) Root rots (*Sclerotium*, *Rhizoctonia* & *Fusarium* spp.)

ii) Soybean : Rust, Leaf spot, Brown stem rot, anthracnose, pod & stem blight, Fusarial wilt, rots, Leaf spot diseases.

iii) Sunflower: Rust, Powdery mildew, Downey mildew, Blight, seeding diseases.

iv) Safflower: Rust, Root rots.

v) Mustard: White rust, powdery mildews, seedling blight, wilt & Rots.

vi) Castor: Rust, Leaf spot, and seedling diseases.

vii) Sesame: Leaf spot, powdery mildews, wilt.

b) Cash-crops:

- i) Cotton: Rust, Wilt, anthracnose & blights, Leaf spot and Seedling diseases.
- ii) Sugarcane: rot, rust, smuts, Downey mildew, rots-basal, root, and top, Red rot and GSD
- iii) Tobacco: early blight, black rot & shank rots, wilts.

Reference Book:

1. Plant pathology 5th Edition by G.N. Agrios.
2. Principles of insect pest management by Dhaliewal and Arora.
3. Pathological problems of economic crop plants & their management by Paul Khurana, S.M., 1998.
4. Fungus & plant diseases, by Mundkur B.B. 1995.
5. Tropical plant diseases by Turston H.D.
6. Integrated Diseases management and plant health by Gupta V.K. & Sharma R.C.
7. Diseases of millets by Ramkrishnan T.S. I.C.A.R. publ. New Delhi.
8. Fungal diseases of rice in India by Padmanabhan S.Y. I.C.A.R. Publ., Delhi
9. Plant Diseases by Singh, R.S. 1963.
10. Diseases of Crop Plants in India 4th Edition by Rangaswami, G. & Mahadevan, A. 2008.

SEMESTER-III
CHEMISTRY PRACTICAL-V

BASED ON PAPERS IX & XI

Pesticide analysis:

1. Estimation of Endosulphan iodometrically.
 2. Estimation of Dicofol content.
 3. Determination of Phorate content.
 4. Estimation of Malathion residue in given sample
 4. Saponification and acid values of oil.
 5. Estimation of Phosphate from Super phosphate.
 6. Estimation of Sulfate from super.phosphate
 7. Estimation of Simazine by colorimetric method
 8. Estimation of Cabendazim in given formulation
 9. Estimation of Cabaryl in a given formulation
 10. Determination of Caffeine from tea leaves.
 11. Isolation of Lactose from milk.
 12. Analysis of soil samples: Estimation of Ca, Mg, carbonate (CO_3^{--}) and bicarbonate (HCO_3^-) by Titrimetric analysis.
 13. Preparation of formulations
 14. TLC and Column chromatographic separation of the pesticides or plant products.
- Pesticide Toxicity
- 15) Detection of pesticides residue in food stuffs.
 - 16) Detection of pesticides plants.
 - 17) Estimation of Aminoacids

Reference Book:

1. A Textbook of Inorganic quantitative analysis by A. I. Vogel.
2. Methods of pesticides analysis by Shree Ramulu.
3. A Text book practical Organic Chemistry including qualitative and quantitative analysis by A. I. Vogel.

LIFE SCIENCE PRACTICAL-VII: BASED ON PAPERS X & XII.

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 two 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. Determination of moisture content of Plant material/soil by using IR moisture balance.
6. Determination of parathion residues in foodgrains / plant materials and vegetables.
7. Study of the plant diseases of the following crops, at least 1 or 2 of each crop- Rice, Sorghum, Bajara, Beans, Oilseeds & Cash-crops. (at least one/two diseases of each crop locally available.)
8. Plant disease their intensity & to calculate VI (Virulence index) at least of two diseases.
9. Separation and identification of sugars & Organic acid from healthy and infected plant.
10. Collection of Pest stages.
11. Collection and submission of discerned plant parts.
12. Estimation of Curcumin from Turmeric
13. Any suitable experiment may be added whenever necessary.

Reference Books

1. Introduction to Entomology by M. S. Mani.
2. A textbook of Entomology by A. D. Imm.
3. Agricultural pest of India and South East Asia by Atwal.
4. Agriculture Entomology by K. M. Smith.
5. A textbook of Applied Entomology by K. Shrivastava.

**REVISED SYLLABUS FOR
DEPARTMENT OF AGROCHEMICALS AND PEST MANAGEMENT**

M. Sc. Part II (Semester –IV)

Paper XIII: AGRO-BASED MARKETING MANAGEMENT

Unit-I **(15)**

a) Marketing definition, concepts, scope, Importance:

Types, Approaches, Models, Principles. Agricultural growth, Development, Policy, Role of NABARD, APEDA, RBI.

b) Market process & planning Concept:

Creating & Delivering customers value Marketing mix, Marketing environment & Approaches, Future marketing.

Unit-II **(15)**

A) Indian marketing environment,

Challenges, Economy Scope, Importance, Scenario

b) Marketing strategies:

Marketing planning & strategies, Analysing industry & Competition. Competitive advantage & Market risk, Problems & Agri.-Marketing.

Unit-III **(15)**

a) Analysing Consumer & Selecting Market:

Buyers behaviour, Indian consumer, Target marketing, STP Segmentation, Target, Positioning.

b) Distribution channels: Types, Definition, Channels.

c) Direct marketing: Branding, Globalization & consumer behaviour, Supply chain management, Shoot Analysis, 4P_s – Product, Price, Place, Promotion. Product life cycle & pricing, New product development, Advertising / Promotion,

d) Sales & Distribution:

Demand measurement, Market Research & Methodology, Market evaluation & Controls, Sales Characters Definition, Types.

Unit-IV **(15)**

a) Marketing ethics & Audit: Storage, After & before sales service

b) Rural marketing in India cooperatives in Agribusiness Marketing.

c) Agriculture export & import process: Policies, Taxation, Laws, Packing Norms, etc. Use of It or export market.

d) International marketing: WTO, GATT, etc. Laws.

e) Details studies on marketing process in the Netherlands, Israel, Japan USA, Australia. Present status of Indian export in comparison to developed countries.

f) Agricultural project analysis Agri-food, Service, Industry.

g) Case studies: Agri. Input industry, Food, Whole selling, Retailing, mall.

h) Group discussion, & group presentation.

Reference books:

- 1) Marketing : Philip Kofler
- 2) Marketing : V.S Management by Ramaswami
- 3) Marketing of – Richard L.
- 4) Agricultural Kohls & Products Joseph N. D.

PAPER-XIV

PESTS OF CROP PLANTS AND THEIR CONTROL – II

Unit-I

(15)

a) Bio-control in Agro-ecosystem through management & Entomophagous insects:

Introduction Role and impact of Predators, Parasitoids, Biological characteristics, Role and impact strategies of biological control, Conservation and Habitat management.

b) Microbial control of insect:

Introduction, History principle groups of pathogen, *Bacillus thuringiensis*, Fungi, Viruses, Protozoa, Their mode of action and methods of applications.

Unit-II :

A) Pests of Plantation Crops

(15)

a) Coconut:

- I) Major: Rhinoceros beetle, Red palm weevil, Black headed caterpillar, Mite.
- II) Minor: White grub, Rodent.

b) Cashew nut: I) Major: Leaf miner, Tea mosquito bug, Thrip.

- II) Minor: Stem borer, Scale insect.

c) Rubber trees:

- I) Minor: Stem borer, Bark Eating Caterpillar, Scale insect, Termite.

d) Tea plants: I) Major: Mosquito bug, Bunch Caterpillar.

- II) Minor: Thrip, White grub & leaf feeder.

B) Pests of Spices and Condiments:

a) Tobacco: I) Major: Leaf eating Caterpillar, Stem borer, Aphid.

- II) Minor: Cut worm, Flea beetle, Bud borer & Nematode

b) Turmeric & Ginger: I) Minor: Rhizome fly, Caster capsule borer.

c) Coriander: I) Major: Cotton white fly, Pentatomid bug.

- II) Minor: Indigo Caterpillar.

d) Black paper: Mealy bug, Scale insect.

e) Cardamom: I) Major: Banana, Aphids, Thrip.

- II) Minor: Castor capsule borer, Rhizome weevil.

f) Cinnamon: I) Major: Butterfly, Tussock Caterpillar.

- II) Minor: Leaf minor

g) Chili: I) Major: Thrip, Mite.

- II) Minor: Aphid, Fruit borer, Termite, Nematode.

h) Onion & Garlic: I) Major: Onion Thrip.

- II) Minor: Onion fly, Cutworm.

i) Betel vine: I) Major: Whitefly, Nematode.

- II) Minor: Aphid.

Unit-III: A) Pests of vegetables

(15)

a) Cabbage, Cauliflower, Knol-Khol, Radish & other cruciferous Vegetable:

- I) Major: Diamond back moth, Cabbage Semi looper, mustard aphid.
- II) Minor: Leaf Webber & Cabbage borer.

b) Brinjal: I) Major: Shoot & Fruit borer, Jassid, Aphid.
II) Minor: Stem borer, Tingid bug, Melon fruit fly.

c) Tomato: I) Major: Fruit borer, Aphid, Cotton white fly.
II) Minor: Thrip, Leaf hopper, Mealy bug.

d) Potato: I) Major: Tuber moth, Golden cyst nematode.
II) Minor: Aphid, Thrip.

e) Lady's finger: I) Major: Spotted bollworm, Aphid, Cotton Jassid.
II) Minor: Leaf roller.

f) Cucurbits: I) Major: Red Pumpkin beetle, Fruit fly.
II) Minor: Blister beetle, Red vegetable mite, Aphid.

g) Sweet potato: I) Major: Weevil.

h) Sugar beet: I) Major: Army worm, Leaf Webber, Rodent.
II) Minor: Painted bug, Cutworm, Aphid, Thrip.

i) Leafy vegetables: (Coriander, Spinach, Fenugreek, Lettuce, Amaranthus, etc)
I) Major: Aphid, Flea beetle, Stem weevil, Leaf miner.
II) Minor: Grass hopper, Leaf hopper.

Unit IV: Pests of Fruits & Fruit Trees

(15)

a) Mango:

- I) Major: Mango hopper, Stem borer, Giant mealy bug, Stone Weevil, Fruit fly
- II) Minor: Leaf and shoot gall insect, Red ant, Termite.

b) Grape vine: I) Major: Thrip, Flea beetle, Mealy bug.
II) Minor: Leafhopper, Two spotted spider mite

c) Chikoo: I) Major: Leaf Webber, Mealy bug, Chikoo moth

d) Pomogranate: I) Major: Anar butterfly, Fruit sucking moth.
II) Minor: Shoot borer, Mite, Thrip, Scale insect

e) Citrus: I) Major: Black fly, Psylla, Mite, Cottony cushion scale.
II) Minor: Fruit sucking moth, Lance nematode, Aphid.

f) Apple: I) Major: Woolly apple aphid, Peach leaf curl aphid.

g) Guava: I) Major: Guava fruit fly, Mealy bug, Spiraling whitefly.
II) Minor: Scale insect.

h) Papaya: I) Major: Aphid, Cotton white fly.
II) Minor: Red spider mite.

i) Banana: I) Major: Aphid, Tingid bug & Burrowing nematode.
II) Minor: Root stock weevil, Snail.

j) Fig: I) Major: Jassid, Mealy bug.
II) Minor: Fig borer, Fruit fly.

k) Ber: I) Major: Fruit fly, Fruit borer, Jassid.
II) Minor: Ber beetle.

l) Pineapples: I) Major: Thrip.

m) Jackfruit: I) Major: White tailed mealy bug, Bark borer.
II) Minor: Pink waxy scale.

Reference Books:

1. Biological insect control chapter 10-14, by M.S. Quraishi.
2. Biological insect pest suppression by H.C.Cooper (spinglervelag)
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. Control mechanisms in plant development by A.W. Gloston and P.J.Davies.

PAPER-XV

MANUFACTURES OF AGROCHEMICALS

Unit-I: (15)

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.

Crystallization: Purpose, Batch and Contaminates Crystallizes.

Drying: Types of Dryers, Working of compartment tray and Spray Dryers.

Reactors: Diagrams and Working of a Batch reactor.

Unit-II: (15)

a) **Quality control and R&D:** Quality control concept, Specification and Analytical procedures, Control of Quality of Raw material, Intermediates and Finished goods, Batch inspection, R&D laboratory specifications, ASTM, BIS, ISI Specification and Standards

b) **Small Scale Industry:** Pesticides industries in India, Norms, Governments policy, Benefits regulations, Administration, Marketing and management, Planning of small scale units economics, Licenses marketing of Agrochemicals, Marketing research know-how, Man-Power, HRD.

Unit-III: (15)

Designing of synthesis of pesticides: Retrosynthetic analysis, Synthon approaches, Synthetic equivalence, Types of disconnection, Chemo selectivity, Retrosynthesis of agrochemicals, pheromones and Synthetic plant products.

Unit-IV: (15)

a) Manufactures of Pesticides and other Agrochemicals:

(Unit processes are to be discussed as they occur in the sequences) :Manufacture of Captan ,Dimthoate, Phosphamidon,Parathion, Maneb,Agro-grade Sulfur .

b) Occupational Health Hazards and their control in Agrochemical Industries:

Handling of chemicals and Pesticides Hazards Occupational Asthma and Pulmonary diseases, Dermatitis & Cancer. First Aid Emergency medical Response, Medical organization for major accident hazard control, Importance and Various kinds of first Aids. Health education for workers. Occupational Health Management, Industrial safety.

Reference Book:

1. Unit Operations: W.L. Badger.
2. Unit processes in organic synthesis: P.H. Groggins.
3. Encyclopedia of chemical technology: Kirk and Othmar.
4. A text book of chemical technology: S.D. Shukla & G.N. Pendey.
5. Industrial chemistry by James Kent & Reigel.
6. Survey of industrial chemistry 2 Ed. by P.J. Chenier
7. Industrial chemicals: F.A. Lowheim and M.A. Moran.
8. Encyclopedia of pesticides Manufacture.
9. Industrial organic chemistry

PAPER-XVI

DISEASES OF CROP PLANT AND THEIR CONTROL -II

Unit-I Diseases of Vegetables

(15)

Fungal diseases of vegetable crops, their symptoms, Life cycle & control measures:

- a) Tomato: Blight- *Alternaria solani*, Wilt- *Fusarium oxysporium*.
- b) Potatoes: Wart of potato- *Synchytrium endobioticum*. Black scurf of tubers – *Rhizoctonia solani*
- c) Bhendi: Powdery mildew- *Oidium* spp. Cercospora disease- *Cercospora* spp.
- d) Chillies: Powdery mildew- *Oidium* spp. Leaf spot disease- *Cercospora capsicae* & *Alt. solani*
- e) Crucifies: Downey mildew- *Peronospora parasitica*. Whit rust- *Albugo candida*.
- f) Onion: Downey mildew- *Peronospora destructor*, Smut troughs coulee.
- g) Peas: Downey mildew- *Peronospora pisi*.
- h) Sweet potatoes-: Dry Rot- *Rhizoctonia nigricans*. Fusarial wilt, Pox or soil rot, Java black rot.
- i) Cucurbitaceous vegetables: Downey mildew, Powdery mildew, Stem rot: *Diplodia*, Root rots, Seedling blight, Wilts, Anthracnose.
- j) Sugar beet: Leaf spot (*Cercospora* & *Ramularia*), Black root disease, Downey mildew, Foliage Rhizoctonia blight, Rusts Fusarium yellows Sclerotium root rot, Other root rot (Storage), Texas root rot.
- k) Peas, beans & other leafy vegetables:
(Coriander, Spinach Fenugreek, Amaranthus, Lettuce etc)
Rot-Stem, root & fruit, anthracnose, Powdery & Downey mildews, Blights.

Unit II Fruit trees & their diseases:

(15)

- i) Mango: a) Anthracnose of mango- *Colletorichum gleosporioides*.
b) Fruit rot of mango- *Gleosporium ampelofagum*
- ii) Apples- Rots: Blue, black, soft, bitter, pink of fungal origin, Powdery mildew, apple scab, Whit root rot.
- iii) Guava: Fruit Rot *Gleosporium* sps. Black spot disease- *Colletorichum psidicurzi*
- iv) Grapes: Anthracnose- *Gleosporium ampelofagum* Bitter rot- *Melanconium fulgenium* Botrytis rot- *Botrytis cinerea*, Downey & Powdery mildew, Black root of fruits, Cotton root Rot, Wilts, foot root.
- v) Citrus, lemon & Oranges: Brown rot – *Gleosporium citri*, Brown watery rot – *Phytophthora palmivora* Orange rot- *Fusarium moniliformis*, Orange fruit rot

- vi) Coconut: Gray leaf spot – *Pestalotia palmivora*, Bud rot- *Phytophthora palmivora*
Wilt- *Ganoderma lucidum*
- vii) Chickoo: Leaf spot- *Phamoploeospora indica*
- viii) Papaya: Anthracnose- *Colletorichum gleosporioides* Wilt, oily spot, Fruit rot- *R nigricans*
- ix) Banana: Fruit rot – *Colletorichum musae* f. *roseum* (Diamond spot fruit rot)
Leaf spot – *Alternaria alternata*, *Deightoniella torulora*, *F. Oxysporium*, *Nigrospora oryzye*.
- x) Pomegranate: Brown rot (Storage) – *Phomapsis varsoniana*. Sacc,
- xi) Figs: Fruit decay- *R. nigricans* Pink rot- *Trichothecium roseum* (Pers.) Link
- xii) Ber: Foliage disease & fruit storage diseases.

Unit-III Disease Plantation trees and Ornamental plants: (15)

A) Plantation trees:

- a) Rubber: Foliage diseases & seedling diseases.
- b) Coffee: Rust, Leaf spot & Berry anthracnose.
- c) Tea: Blister & rots
- d) Cashew nut: Foliage diseases & storage's spoilage.

B) Forest trees:

- a) Teak: Rust & powdery mildew
- b) Sisso: Rust, powdery mildew
- c) Bamboo: Rust & star spot diseases.
- d) Eucalyptus: Foliage diseases & seedling diseases at nursery.
- e) Santalum: Powdery mildew & *Asterina* diseases.

C) Diseases of Ornamental plants:

- a) Roses: Black spot, Powdery mildew. Rust brown, Cankers, Anthracnose.
- b) Gladiolus: Rot & corm, root, leaf, flower blights.
- c) Chrysanthemum: Powdery mildew, rust, leaf spot, Wilt, Petal blights.

Unit-IV Integrated Disease Management (15)

Cultural and Chemical methods for plant disease control.

Role of biological control agents- VA- Mycorrhiza, *Tricoderma viride*, *T. harzianum*, *Pseudomonas fluorescens*, *Glomus* sps.

Use of Botanicals and other Biopesticides in plant disease control.

Reference Books:

1. Plant pathology 5th Edition by G.N. Agrios.
2. Principles of insect pest management by Dhaliewal and Arora.
3. Pathological problems of economics crop plants & their management by Paul Khurana, S.M., 1998.
4. Fungire & plant diseases, by Mundkur B.B. 1995.
5. Tropical plant diseases by Turston H.D.
6. Integrated Diseases management and plant health by Gupta V.K. & Sharma R.C.
7. Diseases of millets by Ramkrishnan T.S. I.C.A.R. publ. New Delhi.
8. Fungal diseases of rice in india by Padmanabhan S.Y. I.C.A.R. Publ., Delhi
9. Plant Diseases by Singh, R.S. 1963.
10. Diseases of Crop Plants in India 4th Edition by Rangaswami, G. & Mahadevan, A. 2008.

SEMESTER- IV
PRACTICAL- VII:
CHEMICAL SCIENCE BASED ON THE PAPERS XIII & XV.

Pesticide synthesis (Chemistry)

1. Preparation of 2,4-D.
2. Dimethyl Phthalate
3. Preparation Phthalimide
4. Benzal Acetophenone
5. 1-Naphoxyacetic acid
6. Preparation p-Nitroacetanilide.
7. Preparation of Phthalanilic acid.
8. Preparation of Ziram.
9. Preparation of salicylanilide.
10. Preparation of Nabam, Ferbam, zineb, maneb etc.
11. Colorimetric determination of Parathion.
12. Estimation of formalin
13. Colorimetric determination of vanadium in soil sample.
14. Ion exchange chromatographic analysis of copper, Zn and Cobalt.
15. Estimation of vanadium content from soil.
16. Determination of Quinolphos content.
17. Isolation of caffeine from tea dust.
18. Isolation of B-carotene from carrots, limonene from citrus fruits, Isolation of eugenol from clove oil.
16. Isolation of limonene from citrus fruits.
18. Interpretation of IR, PMR & spectra of pesticides.
19. Any other suitable experiment may be added when required.

Ref.Books:

- 1)Text book of practical Organic Chemistry by A.I.Vogel
- 2)Practical Organic Chemistry by Mann Saunders
- 3)Spectroscopic Identification of Organic Compounds by Silverstein & Bassler
- 4) Spectroscopic methods in Organic Chemistry –D.H.Williams and I.Flemming.

SEMESTER-IV
PRACTICAL- VIII:
LIFE SCIENCE (BASED ON PAPER NO. XIV & XVI)

(Zoology)

1. Determination of LC50 and LC90 in given insects.
2. Rearing of three to four pests in laboratory. (As per syllabus)
3. Field collection of pests stages and its submission.
4. Field visits (Minimum four) & field diary.
5. Large scale production of
 - a. Bacillus thuriengnis
 - b. Beauveria bassiana
 - c. Apanteles sp.
 - d. Bracon sp.
 - e. Nematodes.
6. Any suitable experiment may be added whenever necessary

(Botany)

6. Estimation of protein content under pathogenesis.
7. Estimation of Ascorbic acid under pathogenesis.
8. Estimation of carbohydrates from healthy and infected leaves.
9. Biological oxygen demand and dissolved oxygen.
10. Chemical oxygen demand.
11. Study of Karl-Fisher titration.
12. Study of fungal diseases (at least one/two of the plants as per syllabus.)
 - a. Field diseases of fruits and fruit trees.
 - b. Plantation crops
 - c. Forest trees
 - d. Ornamentals
13. Collection of diseases from field and its submission.
14. Field visits.
15. Estimation of Lycopene contents
16. Any suitable experiment may be added whenever necessary

Reference Books

1. Introduction to Entomology by M. S. Mani.
2. A textbook of Entomology by A. D. Imm.
3. Agricultural pest of India and South East Asia by Atwal.
4. Agriculture Entomology by K. M. Smith.
5. A textbook of Applied Entomology by K. Shrivastava.