

# SHIVAJI UNIVERSITY, KOLHAPUR

## SYLLABUS

For

### **M.Sc. Agrochemical and Pest Management (AGPM)**

(Semester Pattern)

**Sem. III to IV**



Estd. 1962

NAAC 'A' Grade

Choice Based Credit System  
(CBCS)

To be implemented From

**June, 2020 onwards**

## M. Sc. PART-II AGPM

### (SEMESTER III)

#### Paper- IX

### PESTICIDE RESIDUES AND TOXICOLOGY

#### **Unit-I: Residues of Agrochemicals: (15)**

##### **a) Pesticides Residues in the Atmosphere:**

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:**

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:**

Absorption, Retention, Transport and Degradation of pesticides in the soil, Effect on micro-organism 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, 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: (15)**

Effect of pesticide residue on the quality of Human life. 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. Bio-pesticides, 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. Roberts.
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 V. I, II, III by D. H. Hutson and T. R. Roberts.
12. Comprehensive insect physiology, Biochemistry and pharmacology VI, 12, by G. A. Kerkut and L. I. Gilbert.

### PAPER-X

#### PESTS OF CROP PLANTS AND THEIR CONTROL- I

##### Unit-I: Pests of Cereal and millets (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.

**a) Applied Entomology :**

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:**

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:**

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:**

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 insets 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 PhytophagousEd.- T.N.Anatkrisnan.
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 SO<sub>2</sub>, NO<sub>x</sub>, CO, CO<sub>2</sub>, NH<sub>3</sub>, and H<sub>2</sub>S 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,
- c) Fluorescence spectroscopy: Basic principles, Methodology, Applications

**Unit-III** **(15)**

- a) Ultraviolet spectroscopy: Principles, Instrumentation and Applications, Ultraviolet spectrophotometer in the analysis of agrochemical and pesticide residue and metabolites
- b) Infrared spectrometry: Principles, Instrumentation and Applications.

**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.Flemming.
2. Instrumental methods of analysis –Willard and Merittee, 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 Vegetables, Fruit trees, Plantation trees, Forest trees and Ornamental plants.

#### Unit-I: (15)

##### Diseases of Vegetables: (Fungal, Bacterial and Viral Diseases, their Symptoms, Life cycle and Control measures.)

Tomato- Damping off Seedlings, Late blight of tomato, Early blight of tomato, *Fusarium* wilt, Bacterial wilt of tomato, Root knot of tomato.

Brinjal- Leaf spot of Brinjal (*Alternaria* and *Cercospora* spots), *Sclerotinia* blight, Root knot nematode, *Verticillium* wilt.

Bhendi- *Cercospora* leaf spot, *Fusarium* wilt, Powdery mildew, Damping off.

Chillies- Anthracnose, *Cercospora* leaf spot, Powdery mildew, Bacterial leaf spot, Mosaic of chilli.

Turnip (*Brassica campestris*) - Powdery mildew, white rust, Downy mildew.

Carrot- *Alternaria* blight, Powdery mildew, *Cercospora* leaf spot, Carrot yellow.

Cluster bean- Powdery mildew, Anthracnose, Bacterial blight.

##### Cucurbitaceous Vegetables: [Pumpkin, Ash-gourd, Bitter gourd, Snake gourd, Bottle gourd, Ridge gourd and Watermelon]

Powdery mildew, Anthracnose, *Cercospora* leaf spot, *Fusarium* wilt, Bacterial leaf spot, Cucurbit mosaic.

#### Unit-II: (15)

##### Diseases of Fruit Trees:

Mango- Anthracnose, Powdery mildew, Sooty mould, Blight of Mango, Red rust.

Apple- Apple scab, Powdery mildew, Canker and Die back, Fruit rots.

Banana- *Sigatoka* leaf spot, Anthracnose, Panama disease, Bacterial wilt, Bunchy top, Pseudo-stem heart rot.

Cashewnut- Anthracnose, Damping off seedlings, Die back.

Citrus sp. - Gummosis, Powdery mildew, Sooty mould, Anthracnose, Citrus greening.

Custard Apple- Anthracnose, Leaf spot, Fruit rot.

Grape- Downy mildew, Anthracnose, Powdery mildew, Black rot.

Guava- Anthracnose, zinc deficiency, *Rhizoctonia* seedling blight, sooty mould.

Pomegranate- Bacterial leaf spot, Fruit rot, Fruit cracking.

Sapota- Leaf spots (*Phaeophleospora indica*), Sooty mould.

Fig- Fig rust, Fig mosaic.

#### Unit-III: (15)

##### Forest and Plantation Tree diseases:

##### Forest Diseases:

Teak- Powdery mildew, Rust.

Sissoo- Rust, Powdery mildew.

Bamboo- Rust, Tart spot.

Eucalyptus- Foliage diseases

Santalum- Sooty mould, Powdery mildew, MLO disease.

##### Plantation Tree diseases

Arecanut- Leaf spot, Fruit rot (*Koleroga*)

Cocoa- Seedling die back, *Colletotrichum* pod rot, Charcoal pod rot, Sickle leaf of Cocoa, Pink disease, Tree Canker.

Coconut- Bud rot, Root rot or wilt, *Helminthosporium* leaf spot.

Coffee- Rust, Koleroga or Black rot, Anthracnose, Brown eye spot.

Rubber- Abnormal leaf fall and stem rot Powdery mildew, Die back, *Glomerella* leaf disease.  
Tea- Red rust, Blister blight, *Cercospora* leaf spot, Root rot.

**Unit-IV:**

**(15)**

**Diseases of Ornamental plants.**

Aster- Wilt, Downy mildew, Powdery mildew.  
Begonia- Blotch, Powdery mildew, Root and Stem rot.  
Marigold- Powdery mildew, Leaf spots.  
Canna- Rust, Bud rot, Spots leaf.  
Carnation- Leaf spots, Powdery mildew, Rusts.  
Chrysanthemum- Brown rust, Powdery mildew, Ray blight, *Septoria* leaf spot.  
Dahlia- *Sclerotinia* rot, leaf spot, Powdery mildew.  
Geranium- Leaf spot, Blossom blight, Rust, Bacterial spot.  
Gladiolus- *Botrytis* rot, Dry rot, *Fusarium* dry rot.  
Rose- Black spot, Rust, Powdery mildew, Die back.  
Sunflower- Leaf spots, Rusts, Powdery mildew.  
Jasmine- Leaf spot, Crown gall, Rust.  
Lily- Leaf spot, Foot rot, Stump rot.

**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.

## M.Sc-II, Semester- III

### Practical

#### A] Chemical Sciences

1. Saponification and acid values of oil
2. Estimation of phosphate from super phosphate.
3. Estimation of sulphate from super phosphate.
4. Determination of Caffeine from tea leaves.
5. Isolation of lactose from milk.
6. Analysis of soil samples: Estimation of Ca, Mg, carbonate ( $\text{CO}_3^{2-}$ ) and bicarbonate ( $\text{HCO}_3^-$ ) by Titrimetric analysis.
7. Estimation of Malathion content in a given sample.
8. Estimation of Simazine by colorimetric method.
9. Determination of phorate content
10. Estimation of Carbendazim in given formulation.
11. Estimation of Carbaryl in a given formulation.
12. Detection of pesticides residue in food stuffs.
13. Detection of pesticides plants.
14. Estimation of Aminoacids.
15. Determination of bulk density of pesticidal WP/WDG/Dust/SP.
16. Determination of wettability of pesticidal WP/WDG/Dust/SP.
17. Performing wet sieve test of pesticidal WP/WDG/Dust/SP.
18. Determination of Suspensibility of pesticide formulation WP/WDG/SC.
19. Preparation of granules/WDG formulation.
20. Preparation of WP formulation
21. Volumetric determination of acidity/ alkalinity of WP.
22. Estimation of potassium content (Soil/Fertilizer) by Flame Photometer
23. Any suitable experiment may be added whenever necessary.

#### Reference Books:

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.



## M.Sc-II, Semester- III

### Practical

#### B) Life Sciences

##### (Plant pathology)

1. Study of vegetable diseases as prescribed in the syllabus.
2. Study of fruit crop diseases as prescribed in the syllabus.
3. Study of forest tree and plantation diseases as prescribed in the syllabus.
4. Study of ornamental crop diseases as prescribed in the syllabus.
5. Estimation of Lycopene under pathogenesis.
6. Colorimetric estimation of free fatty acids under pathogenesis.
7. Determination of iodine value of oil under infection.
8. Determination of peroxide value of oil under pathogenesis.
9. Separation of Sugars by TLC.
10. Estimation of tannins by F. D. Method.
11. Estimation of Amylose under pathogenesis.
12. Separation of organic acids by Chromatography.
13. Separation and detection of IAA by Chromatography.
14. Visit to Horticultural University/ Nursery.
15. Visit to Agricultural University/ College.
16. Any suitable experiment may be added whenever necessary.

##### (Entomology)

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. 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.

## 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.
- d) **Direct marketing:**  
Branding, Globalization & consumer behaviour, Supply chain management, Shoot Analysis, 4Ps – 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.
- e) **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-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 :****(15)****A) Pests of Plantation Crops**

- 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, Thirip.
- 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: Thrips, 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.
- . 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 and Study:**

**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 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, WHO, FAO, ASTM, BIS, ISI Specification and Standards.

b) **Occupational Health Hazard 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.

**Unit-III- (15)**

**Designing and synthesis of pesticides:** Retrosynthetic analysis, Synthons 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, Parathion, Agro-grade sulphur, Dimethyl phthalate, Ethylene oxide, Copper Sulphate, Simazine.

**b) Regulatory Requirements of for Transportation of Agrochemical Products**

1. Transport Worthiness Test (TWT)
2. Container Compatibility Test (CCC)

**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

### Agricultural Biotechnology and Integrated Disease Management.

#### **Unit-I: :** **(15)**

**Tissue Culture:** Definition, Historical events, Basic requirement for tissue culture laboratory, Maintenance of aseptic condition, Totipotency of cell, Nutrient media, Method of tissue culture, Nucleus culture, Embryo culture, Meristem culture, Anther culture, Pollen culture, Suspension culture, Micro-propagation, Somaclonal variation, Somatic embryogenesis, Artificial seeds, Types of artificial seeds, Production and use of artificial seeds, Secondary metabolites, Extraction of secondary metabolites, Biotransformation in plant cells, Elicitor-dependent Biosynthesis, Immobilization of plant cells, Application of tissue culture, Protoplast technology- culture, fusion, in-vitro mutation breeding, isolation and induction of protoplast to uptake cell organelles.

#### **Unit-II:** **(15)**

**Genetic Engineering:** Definition, concept, Methodology of Genetic Engineering, Principles of Recombinant DNA technology, Application of Genetic Engineering: Gene cloning Vectors for plants- *Agrobacterium tumefaciens*, T<sub>i</sub> plasmid, T<sub>i</sub> plasmid on cloning vector, disarmed T<sub>i</sub> plasmid, Binary vectors. Insertion of foreign Gene into T-DNA of T<sub>i</sub> plasmid in *Agrobacterium*. R<sub>i</sub>- plasmids, Cauliflower mosaic virus.

**Transgenic plants:** Herbicide resistant plants. Virus Resistant plants. Insect resistant plants. Resistant to fungi and bacteria. Transgenic Rice with Vit-A, Male Sterility and fertility Restoration.

#### **Unit-III: :** **(15)**

**Genetics of resistance:** Types of disease resistance, Interaction between resistant genes, Molecular marker assisted selection, Breeding for disease resistance- Back cross method, Escape method. Genetics of host-pathogen interaction, gene for gene concept, Physiological specialization, physiological specialization in fungi, Production of new races, Adaption of fungi to different hosts. Antigen, antibody reaction. Immunoglobulins and its application. Defence mechanism in plants- Biochemical defence, induced synthesis of protein and enzyme, Formation of substrates resisting the enzyme of the pathogen. Detoxification of pathogen toxin, altered respiration, Concept of Phytoncides.

#### **Unit-IV: :** **(15)**

**Integrated disease management:** Cultural, biological and chemical methods.

VAM Technology- *Trichoderma viridi*, *T. harzianum*, *Pseudomonas fluorescense*, *Glomus sp.*

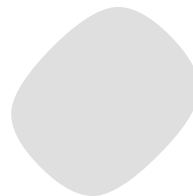
Phytopesticides- concept and application (Neem, Tulsi, Karanj, Marigold, Tobacco, Turmeric, Chrysanthemum, Nirgudi).

Biofertilizers- Definition. *Rhizobium*- Mass production of *Rhizobium* and field application of *Rhizobium* inoculants, Crop response. Azotobacter- Production and field application. *Azospirillum*- Production and application of inoculants. Genetics of nitrogen fixation. Nif- gene of *Klebsiella pneumoniae*, Nif-gene of Azotobacter, Gene transfer for nitrogen fixation. Blue-

Green algae- Production of BGA inoculants. Field uses of BGA inoculants. Nostoc- Mass production and utilization of Nostoc inoculants, Phosphate, Biofertilizers uses.

**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.



**M.Sc-II, Semester- IV  
Practical**

**A] Chemical Sciences**

1. Synthesis:
  - a) 2, 4-D, b) Phthalamide, c) Phthalanilic acid, d) Phenyl benzoate,
  - e) Acetanilide, f) Ziram, g) 1-Napthoxy acetic acid h) Dimethyl phthalate,
  - i) Nabam/ Ferbam/ Zineb/ Maneb
2. Analysis
  - a) Colorimetric determination of vanadium in soil sample
  - b) Estimation of vanadium content from soil.
  - c) Determination of Quinolphos content
  - d) Colorimetric estimation of Parathion.
  - e) Isolation of Caffeine from tea dust.
  - f) Isolation of limonine from Citrus fruit/ Isolation of eugenol from clove oil.
  - g) Gas Chromatographic analysis of pesticides.
  - h) Estimation of copper from copper oxy chloride.
  - i) Estimation of copper in copper sulphate pentahydrate.
3. Spectroscopic characterization  
Interpretation of IR, PMR, UV and Mass spectra of organic compounds and pesticides.
4. Any other suitable experiment may be added when required.

**Reference 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.
- 5) Methods of pesticides analysis- U.S. Sree Ramulu, Oxford-IBH.
- 6) Pesticides, Plant Growth Regulators and Food Additives, Vol I to VI- Gunter Zweig- Academic Press.



**M.Sc-II, Semester- IV  
Practical**

**B] Life Sciences**

**(Plant pathology)**

1. Preparation of culture media, Sterilization technique, inoculation techniques.
2. Protoplast isolation, anther culture, preparation of synthetic seeds
3. Study of antifungal activity from plants.
4. Study of antibacterial properties of some plants.
5. Isolation of DNA under pathogenesis.
6. Estimation of cellulose under pathogenesis.
7. Estimation of maltose under pathogenesis.
8. Separation of sugars by silica gel by TLC
9. Separation of amino acids by TLC
10. Estimation of protein under pathogenesis
11. Estimation of carbohydrate under pathogenesis
12. Estimation of fat under pathogenesis
13. Separation of chlorogenic acid by chromatography
14. Estimation of proline under pathogenesis
15. Calorimetric estimation of total free amino acids under pathogenesis
16. Study of enzyme peroxidase and Acid phosphatase under pathogenesis by Spectrophotometer method
17. Separation of protein by electrophoresis method (Paper)
18. Estimation of Methionine under pathogenesis by Spectrophotometer method
19. Visit to tissue culture (Biotech) laboratory

**(Entomology)**

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 thuringiensis
  - b. Beauveria bassiana
  - c. Apanteles sp.
  - d. Bracon sp.
  - e. Nematodes.
6. 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.