

# **SHIVAJI UNIVERSITY, KOLHAPUR.**



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Syllabus For

**M.Sc. Part -I**

**AGROCHEMICALS AND PEST MANAGEMENT**

**SEMESTER I AND II**

**(Syllabus to be implemented from June, 2018 onwards.)**

## STRUCTURE OF COURSE

### FIRST YEAR (NO. OF PAPERS = 8 (eight))

	Subjects	Marks
	<b>SEMESTER I</b>	
<b>1</b>	PAPER-I : CHEMISTRY OF PESTICIDES AND THEIR FORMULATIONS-I	100
<b>2</b>	PAPER-II : SOIL SCIENCE, FERTILIZERS AND MICRONUTRIENTS	100
<b>3</b>	PAPER -III : INTRODUCTORY AND INDUSTRIAL ENTOMOLOGY	100
<b>4</b>	PAPER -IV : BASIC CONCEPTS IN PLANT PATHOLOGY	100
	Practical I : Chemical Science	100
	Practical II : Life Science	100
	<b>SEMESTER II</b>	
<b>5</b>	PAPER-V : CHEMISTRY OF PESTICIDES AND THEIR FORMULATIONS-II	100
<b>6</b>	PAPER-VI: ANALYTICAL TECHNIQUES FOR AGROCHEMICALS	100
<b>7</b>	PAPER-VII : ECONOMIC ENTOMOLOGY	100
<b>8</b>	PAPER-VIII: BIOTECHNOLOGICAL ASPECTS IN PLANT PROTECTION	100
	Practical III : Chemical Science	100
	Practical IV : Life Science	100

**SECOND YEAR (NO. OF PAPERS = 8 (Eight))**

<b>SEMESTER III</b>		
9	PAPER-IX : PESTICIDE RESIDUES AND TOXICOLOGY	<b>100</b>
10	PAPER-X : PESTS OF CROP PLANTS AND THEIR CONTROL-I	<b>100</b>
11	PAPER -XI : ANALYSIS OF AGROCHEMICALS	<b>100</b>
12	PAPER -XII : DISEASES CROP PLANTS AND THEIR CONTROL-I	<b>100</b>
	Practical V : Chemical Sciences	<b>100</b>
	Practical VI : Life Science	<b>100</b>
<b>SEMESTER IV</b>		
13	PAPER-XIII : AGRO-BASED MARKETING MANAGEMENT	<b>100</b>
14	PAPER-XIV: PESTS OF CROP PLANTS AND THEIR CONTROL -II	<b>100</b>
15	PAPER-XV : MANUFACTURE OF AGROCHEMICALS	<b>100</b>
16	PAPER-XVI : DISEASES OF CROP PLANTS -II	<b>100</b>
	Practical VII : Chemical Science	<b>100</b>
	Practical VIII : Life Science	<b>100</b>

**SCHEME OF TEACHING AND EXAMINATIONM.**

**M. Sc. I (Semester I and II)**

Sr. No.	Subject/ Paper	Teaching Scheme (Hrs/week)				Examination scheme (Marks)			Credit
		L	T	P	TOTAL	THEORY	TERM WORK	TOTAL	
	<b>SEMISTER I</b>								
1.	PAPER-I : CHEMISTRY OF PESTICIDES AND THEIR FORMULATIONS - I	4	-	-	4	80	20	100	4
2.	PAPER-II : SOIL SCIENCE, FERTILIZERS AND MICRONUTIENTS	4	-	-	4	80	20	100	4
3.	PAPER – III : INTRODUCTORY AND INDUSTRIAL ENTOMOLOGY	4	-	-	4	80	20	100	4
4.	PAPER- IV : BASIC CONCEPTS IN PLANT PATHOLOGY	4	-	-	4	80	20	100	4
	Practical I: Chemical Science	-	-	6	6	80	20	100	4
	Practical II: Life Science	-	-	6	6	80	20	100	4
	<b>SEMISTER II</b>								
1.	PAPER - V: CHEMISTRY OF PESTICIDES AND THEIR FORMULATIONS – II	4	-	-	4	80	20	100	4
2.	PAPER- VI- ANALYTICAL TECHNIQUES FOR AGROCHEMICALS	4	-	-	4	80	20	100	4
3.	PAPER – VII : ECONOMIC ENTOMOLOGY	4	-	-	4	80	20	100	4
4.	PAPER – VIII : BIOTECHNOLOGICAL ASPECTS IN PLANT PROTECTION	4	-	-	4	80	20	100	4
	Practical III: Chemical Science	-	-	6	6	80	20	100	4
	Practical IV: Life Science	-	-	6	6	80	20	100	4

**M. Sc. II (Semester III and IV)**

Sr. No.	Subject/ Paper	Teaching Scheme (Hrs/week)				Examination scheme (Marks)			Credit
		L	T	P	TOTAL	THEORY	TERM WORK	TOTAL	
	<b>SEMISTER III</b>								
1.	PAPER – IX PESTICIDE RESIDUES AND TOXICOLOGY	4	-	-	4	80	20	100	4
2.	PAPER X- PESTS OF CROP PLANTS AND THEIR CONTROL- I	4	-	-	4	80	20	100	4
3.	PAPERS XI- ANALYSIS OF AGROCHEMICALS	4	-	-	4	80	20	100	4
4.	PAPER XII : DISEASES OF CROP PLANTS AND THEIR CONTROL – I	4	-	-	4	80	20	100	4
	Practical V: Chemical Science	-	-	6	6	80	20	100	4
	Practical VI: Life Science	-	-	6	6	80	20	100	4
	<b>SEMISTER IV</b>								4
1.	PAPER - XIII: AGRO- BASED MARKETING MANAGEMENT	4	-	-	4	80	20	100	4
2.	PAPER- XIV- PESTS OF CROP PLANTS AND THEIR CONTROL -II	4	-	-	4	80	20	100	4
3.	PAPER – XV : MANUFACTURE OF AGROCHEMICALS	4	-	-	4	80	20	100	4
4.	PAPER – XVI : DISEASES OF CROP PLANS AND THEIR CONTROL - II	4	-	-	4	80	20	100	4
	Practical VII: Chemical Science	-	-	6	6	80	20	100	4
	Practical VIII: Life Science	-	-	6	6	80	20	100	4

	<b>SCHEME OF EXAMINATION</b>
	<ul style="list-style-type: none"> <li>• The examination shall be conducted at the end of each semester.</li> <li>• The theory paper shall carry 80 marks.</li> <li>• The theory paper (internal) shall carry 20 marks.</li> <li>• 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)</li> <li>• Question Paper will be set in the view of the /in accordance with the entire Syllabus and preferably covering each unit of syllabi.</li> </ul>
	<b>The Scheme of semester examination is as follows :-</b>
	Total marks per theory paper =100 marks (80 marks external exam + 20 marks internal exam.)
	<b>M. Sc. I (Semester- I and II) Theory Examination (For each semester)</b>
	External examination 4 Theory papers 80 x 4= 320 marks Internal examination 20 x 4= 80 marks <b>400 marks</b>
	<b>M. Sc. I (Semester - I and II) Practical Examination</b> <u>Chemical science practical:</u> 100 marks 60 experiments + 10 seminar + 10 oral and journal = 80marks Internal practical examination= 20marks <b>100marks</b>
	<u>Life science practical:-</u> 100marks 70 mark experiments + 10 marks oral and journal = 80 marks Internal practical examination = 20 marks <b>100marks</b>
	<b>M. Sc. II (Semester – III) Theory Examination</b> External examination 80 x 4 = 320 marks Internal examination 20 x 4 = 80 marks <b>400 marks</b>
	<b>M. Sc. II Semester - III Practical Examination</b> <u>Chemical science Practical:-</u> 60 mark experiment +10marks industrial training +10mark oral and journal = 80marks Internal practical examination.=20 marks <b>100 marks.</b>
	<u>Life Science Practical:</u> - 60 marks experiment +10 marks seminar +10 marks oral and Journals= 80marks Internal practical examination =.20 marks <b>100 marks.</b>

	<b>M. Sc. II (Semester- IV) Theory Examination</b>
	External examination $80 \times 4 = 320$ marks Internal examination $20 \times 4 = 80$ marks <b>400marks</b>
	<b>M. Sc. II Semester - IV Practical Examination</b>
	<u>Chemistry Practical</u> 50 marks experiment +25 research project evaluation +5 marks oral and journal = 80 marks Internal practical Examination = 20 marks <b>100 Marks</b>
	<u>Life Science Practical:</u> - 50 marks experiment +25 Marks Project Presentation +5marks oral and journal = 80 marks Internal practical examination = 20 marks <b>100 Marks</b> <b>600 x 4 semesters = 2400 marks</b>
	<b>STANDARD OF PASSING:</b>
	As prescribed under rules and regulation for each degree.
	<b>NATURE OF QUESTION PAPER AND SCHEME OF MARKING :-</b> (Unit wise weightage of marks should also be mentioned) Theory Examination
	<b>Section – I</b>
	Q.NO.1 Is objective and multiple choice type, includes 16 sub questions carries one mark each.
	<b>Section – II</b>
	Q. NO.2 to 6 are descriptive carries 16 marks. Candidate is asked to solve Three questions out of five
	<b>Section – III</b>
	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.
	<b>Practical Examination</b> Which is given in paragraph(13) Scheme of examination experimental wise distribution of marks etc.

### Grades, grade point and average grade point's calculations

Table showing the grades, grade points and marks scored by a student

Grades	Grade points	Marks out of 100
A+	9	91 to 100
A	8	81 to 90
A-	7	71 to 80
B+	6	61 to 70
B	5	51 to 60
B-	4	41 to 50
C+	3	31 to 40
C	2	21 to 30
C-	1	11 to 20
F	0	0 to 10

### 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.	<b>PAPER-I : CHEMISTRY OF PESTICIDES AND THEIR FORMULATIONS-I</b>	<b>PAPER-I : CHEMISTRY OF PESTICIDES AND THEIR FORMULATIONS-I</b>
2.	<b>PAPER-II : SOIL SCIENCE, FERTILIZERS and MICRONUTRIENTS</b>	<b>PAPER-II : SOIL SCIENCE, FERTILIZERS and MICRONUTRIENTS</b>
3.	<b>PAPER-III: INTRODUCTORY AND INDUSTRIAL ENTOMOLOGY</b>	<b>PAPER-III: INTRODUCTORY AND INDUSTRIAL ENTOMOLOGY</b>
4.	<b>PAPER-IV : CROP DISEASES AND WEEDS</b>	<b>PAPER-IV : BASIC CONCEPTS IN PLANT PATHOLOGY</b>
5.	<b>PAPER-V : CHEMISTRY OF PESTICIDES AND THEIR FORMULATIONS-II</b>	<b>PAPER-V : CHEMISTRY OF PESTICIDES AND THEIR FORMULATIONS-II</b>
6.	<b>PAPER-VI: ANALYTICAL TECHNIQUES FOR AGROCHEMICALS</b>	<b>PAPER-VI: ANALYTICAL TECHNIQUES FOR AGROCHEMICALS</b>
7.	<b>PAPER-VII : ECONOMICS ENTOMOLOGY</b>	<b>PAPER-VII : ECONOMIC ENTOMOLOGY</b>
8.	<b>PAPER-VIII : BIOTECHNOLOGICAL ASPECTS IN PLANT PROTECTION</b>	<b>PAPER-VIII : BIOTECHNOLOGICAL ASPECTS IN PLANT PROTECTION</b>



**SEMESTER – III & IV**

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

<b>SPECIAL INSTRUCTIONS, IF ANY.</b>	
<b>i)</b>	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.
<b>ii)</b>	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.
<b>iii)</b>	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.
<b>iv)</b>	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.
<b>v)</b>	To arrange guest lectures of eminent scientists in the field of agricultural chemistry, well known farmers, past students of the department, Persons in Agricultural marketing management.

**DEPARTMENT OF AGROCHEMICALS AND PEST MANAGEMENT**  
**M. Sc. Part I (Semester –I)**  
**PAPER-I**

**CHEMISTRY OF PESTICIDES AND THEIR FORMULATIONS – I**

**Unit-I**

**A. Chemistry of Pesticides:** Introduction: History of pesticides, Innovation in pesticide chemistry, Development of Pesticides. Chemical and Botanical pesticides, Classification of pesticides based on chemicals, nature, 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. **(15)**

**B. Recent advances in pest control**

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

**Unit-II:**

Classification and Study of following pesticides with respect to structure, Chemical name, Physical and chemical properties, Synthesis, Formulation, Degradation, Metabolism, Mode of action, Uses and Toxicity. **(15)**

**Organophosphates:** Malathion, Monocrotophos, Dimethoate, Phosphamidon Phosalone, Chloropyrifos, Fenitrothion, Phenthoate, Phorate, Quinolphos, Acephate, Ethephon, Temephos and Triazophos.

**Miscellaneous:** Fipronil, Buprofezin, Thiachlorprid, Acetamiprid Imidachlorprid, Dicofol and 2,4-D

**Unit-III:**

**Formulation**

Introduction of pesticide formulations: Definition, History, Purpose, Types and Codes, Brief account of main types. Study of conventional formulations: Dusting, Powders/ Dust Formulations (DP), Granules (GR), Water Dispersible Powders/Wettable powders (WDP/WP), Soluble Concentrates (SC), Emulsifiable concentrates (EC), Ultra Low volume (ULV) with respect to their ingredients, advantages and disadvantages. **(15)**

**Unit-IV:**

**A) Formulation packaging:** Introduction, Current trends in single trip containers, Liquid Formulations: Rigid plastics, High Density Polyethylene, (HDPE), Polyethylene Terephthalate (PET), Ethylene Vinyl Alcohol (EVOH), and Polyamide (PA). Solid Formulations: Polyethylene, Laminates–Low Density Polyethylene (LDPE), Aluminum foil, LDPE plus ether, Polypropylene (PP), Polyester (PET), Polyamide (PA) Paper, Water soluble Films Paper on packaging material used to pack pesticides (technical and formulation) like Dust, EC, SC, WP, WDG). **(10)**

- B)** Application of Pesticides and Devices used: Dusters and sprayers, Types of nozzles.  
Calculation of amount of formulation required for field application.

**(05)**

**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. Sree Ramulu
9. Agrow Reports : New Developments in Crop Protection Product Formulation – Alan Knowles,DS243, Pub : T & F Informa UK, 2005.
10. CIPAC Hand Book Volume F Analysis of Technical and Formulated Pesticides Editors : W Dobrat A Martijn Pub : Collaborative International Pesticides Analytical Council Limited England 1994.
11. Pesticide Formulations: Van Wade. Velkenburg- Marcel & Delker, Published by Marcel Dekker, New York, ISBN 10: 0824716957 / ISBN 13: 9780824716950, 1973.
12. Pesticide Formulation: Theory: B. S. Parmar, S. S.Tomar, CBS Publishers and Distributors. (2008)

**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, Acidic and Alkaline soils, Absorption of toxic metals 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 requirements:

**Nitrogenous fertilizers:** Ammonium nitrate, Urea, Calcium Cyanamide, Calcium Ammonium Nitrate, Sodium Nitrate, Ammonium Chloride: Introduction, Raw materials and Mode of action of the 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 micronutrients, Deficiency and Reclamation.

**B) Plant Growth regulators and hormones**

Auxins, Gibberellins, Kinins, Growth inhibitors and ethylenes, their responses, Metabolism assay and Agricultural uses.

Chemistry, synthesis and uses of the following Plant Growth Regulators: Ancymidol, Chloramequat chloride, Chlorpropham, Ethephon, IAA, IBA, Mepiquat, Naphthyl Acetic Acid (NAA).

Plant growth modification dormancy and germination, Breeding and propagation, Retardation of vegetative growth, Flowering, fruit setting and development metabolic effects- Ripening, Yield increasing, Defoliation, Desiccation, Chemical pruning, Abscission and Photosynthesis.

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

Humus and decomposition of organic matter in soils, Compost, 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, Soil fertility and Vermi-culture and Vermi-composting.

**B) Bio-fertilizers**

Biofertilizers- Introduction, definition, classification, *Rhizobium*, *Azotobactor*, *Azospirillum* , *Azolla*, *Blue Green Algae*, *VAM*.

**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. Principles and procedure of plant protection - Chattopadhyay.
11. Chemistry weekly's - Agrochemical Dictionary.
12. Agrochemical handbook - Royal Society.
13. Handbook of Pest Management in Agriculture Vol. I, II -D.Pimentel.

## PAPER –III

### INTRODUCTORY AND INDUSTRIAL ENTOMOLOGY

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

##### **Introduction to Insects:**

General characters, General description and morphology of the Insect: Head, Thorax and Abdomen. Anatomy and Physiology of the Insect: Digestive system, Nervous system, Excretory system, Reproductive system and Circulatory system.

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

Definition of Pest, Why Insects assume Pest status, Classification of Pests based on damage, Feeding habitat and Taxonomy etc. Economic Threshold Level, Economic Injury Level

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

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

##### **Insects of Industrial Importance:**

**Sericulture:** Mulberry cultivation and Rearing of Silkworms; Pest and Disease management of Mulberry and Silkworm, Economics of Sericulture

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

##### **Insects of Industrial Importance:**

**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:** Definition, Types of Biological control agents with examples, Entomopathogenic fungi, Successful Biological control programmes implemented in India, Merits and Demerits of biological control, biological control of weeds, Mass Production of

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

##### **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.
- 7 Modern Entomology by D.B.Tembhere
- 8 Biological Pest suppression by R.D.Gautam, Westville Publishers, New Delhi
- 9 Insect Physiology and Biochemistry – James L.Natvov
- 10 Physiological systems in Insects – M.Klawdon
- 11 General and Applied Entomology – David & Anantha Krishnan, Mcgraw Hill
- 12 Integrated Pest Management – Concept and Approaches – Dhaliwal & Arora – Kalyani Publishers, New Delhi

**PAPER-IV**  
**BASIC CONCEPTS IN PLANT PATHOLOGY**

**Unit –I** **(15)**

Science of plant Pathology, Plant disease, Pathogen (Bacterial, viral, fungal, mycoplasmal, nematode) pathogenesis, symptoms and symptomatology, identification of plant diseases (cause of plant diseases) survival of plant pathogen, dissemination of pathogen, epidemiology, diagnosis of diseases modern techniques of disease diagnosis–Immune logical assay and disease forecasting models.

**Unit –II** **(15)**

Virus as pathogen, characteristics, structure of plant viruses, symptoms of plant viral diseases, transmission of viruses, movement of viruses in plants. Sub-viral agents, Detection and diagnosis of plant viruses. Epidemiology of the plant, plant virus diseases. Disease management study of following viral disease. Banana bunchy top BBTv,

Bean common mosaic virus, Bhendi: Yellow vein mosaic virus BYVMV, Ring spot disease of Brinjal EMCV, Mung bean yellow mosaic Genliui virus (MYMV), Soybean mosaic Gemini Potyvirus SMV, Tobacco mosaic virus, Tobacco leaf curl Virus.

**Unit –III** **(15)**

Bacteria as pathogen: Structure of bacteria, Brief classification, Dissemination, Symptoms, and Management of plant bacterial diseases.

Study of following diseases: Angular leaf spot of cotton, Citrus canker, Bacterial leaf blight of Rice, Bacterial spot of Tomato, Black rot of crucifers, Bacterial blight of Beans, Leaf spot of Mango, Halo blight of Beans, Common scab of Potato.

**Unit –IV** **(15)**

Fungal pathogen - Symptoms of fungal disease and management of fungal diseases

Diseases of pulses:

Pigeon pea- Wilt, leaf spot, stem rot, Powdery mildew

Gram (*Pisum sativum*)-Powdery mildew, Rust, Downy mildew, Wilt, root rot

Green gram - Anthracnose, leaf spot, root rot, blight, powdery mildews

Cow pea (*Vigna sinensis*) - Powdery mildew, anthracnose, die back leaf spot

Soybean- leaf spot, rust, Brown spot, downy mildew, pod and collar rot

Diseases of oil seed crops:

Groundnut – leaf spot (early & late), rust, stem rot, collar rot, charcoal rot

Sesamum - Powdery mildew, leaf spot, blight, wilt

Castor- Rust, Seedling blight, pod rot, leaf spot

Sunflower- Rust, charcoal rot, Blight, sclerotiania wilt, headrot

Mustard- White rust, powdery mildew, blight, downy mildew

Diseases of Cash crops-

Cotton - Rust, wilt, leaf spot

Sugarcane- Rust, smut, GSD, rot, viral disease

Tobacco – Early blight, wilt

**Reference Book:**

1. Plant Pathology 5<sup>th</sup> 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 and 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**  
**CHEMICAL SCIENCE: PRACTICAL-I**

1. To estimate amount of Copper from Copper Fungicide.
2. To estimate amount of sulfur from given Sulfur Fungicide.
3. Determination of amount of Nitrogen from given fertilizer sample.
4. Estimation of Calcium from superphosphate sample.
5. Determination of salinity of given soil sample by conductometrically.
6. Estimation of amount of phosphorous from given soil sample by colorimetrically.
7. Determination of concentration of sulphate ions from water by nephelometrically.
8. Estimation of nitro group by stannous chloride method.
9. Estimation of Simazine by colorimetric method.
10. Estimation of Ziram by hydrolysis method.
11. Analysis of organic manures.
  - A) Moisture content
  - B) Organic matter and ash content.
12. Determination of total sulphur in soil sample.
13. Determination of apparent specific gravity or bulk density, particle density or true density of the soil, water holding capacity of the soil.
14. Analysis of mixed fertilizers and micronutrients.
15. Submission of quality analysis of three inorganic and three Major nutrients N, P, K  
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

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

#### **Entomology (Zoology):**

1. Rearing of predator, *Cryptolaemus montrouzieri*
  3. Rearing of *Helicoverpa armigera*, *Spodoptera litura*
  4. Rearing of silkworms
  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, identification and its submission.
- Any suitable experiment may be added, whenever necessary.

#### **Plant Pathology (Botany)**

1. Study of following viral diseases: Bean mosaic virus, Bhendi yellow vein mosaic, Mungbean yellow mosaic, Gemini virus, Soybean mosaic poty virus, Tomato leaf curl virus, chili leaf curl, TMV.
2. Study of the following bacterial disease.  
Angular leaf spot of cotton, Citrus canker, and Bacterial leaf blight of Rice, Leaf spot of mango and Bacterial spot of tomato
3. Study of following fungal diseases (As mentioned in the theory oil seeds, Cash crops)
4. Determination of chlorophyll content under infection.
5. Estimation of polyphenol content under pathogenesis.
6. Measurement of electrical conductivity of soil.
7. Determination of N, P, K. in soil by volumetric/colorimetric methods.
8. Determination of reducing and non-reducing sugars under pathogenesis.
9. Determination of acid value of fats and oils.
10. Determination of vitamin C in fruits.

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.
6. Plant Pathology 5<sup>th</sup> Edition by G. N. Agrios
7. Pathological problems of economic crop plant and their management by Paul and Khurana S. M., 1998.
8. Fungi and plant diseases by Mundkar B. B., 1972.
9. Soil and Plant Analysis by C. S. Piper (Hans Publisher).

## DEPARTMENT OF AGROCHEMICALS AND PEST MANAGEMENT

### M. Sc. Part I (Semester –II)

#### PAPER-V

#### CHEMISTRY OF PESTICIDES AND THEIR FORMULATIONS-II

##### UNIT-I :

##### A) Carbamate Pesticides (08)

Carbamates and Thiocarbamic acids, Oximecarbamates, Pendimethalin, Aldicarb, Primicarb, MBC, Zineb, Carbaryl and Carbofuran Isomeric model and kinetics, Synthesis, Mode of action, Structure - Activity relationship.

##### B) Inorganic pesticides: (07)

Fungicides: Sulphur, Copper salts, Organomercurials and Tin compounds. Fumigants: Hydrogen cyanide, Chloropicrin, Carbon disulphide. Rodenticide: Arsenic, Zinc oxides, Zinc phosphide and Thallium salts. Herbicides: Dalopan, Simazin.

##### UNIT II (15)

##### Pyrethroids and Other Natural Pesticides

Introduction, History, Synthesis of Alicyclic Carboxylic acids and derivatives, Pyrethrins and their synthetic analogues, Fenvalerate, Fluvalinate, Permethrin, Deltamethrin, Cypermethrin, Bio-allethrin, Resmethrin etc.

##### UNIT-III

##### A) Important parameters of pesticides formulations : (08)

Factors affecting quality of pesticides: Particle size, Bulk density, Flowability, Electrostatic charge, Sorptivity, Compatibility and their effects on the stability, rainfastness and shelf life of formulation, Rheological properties

##### B) Tests for quality control (07)

A brief introduction on specifications of pesticides: Technical and formulations (WHO/ FAO/BIS), Methods of analysis, Physical properties of formulations- Suspensibility, Wettability, Emulsion stability, Wet sieve test, Acidity, Alkalinity, Moisture content, Flash Point, Specific gravity, Persistent foaming, Water runoff test, Dry sieve test etc. and their significance during the field application.

##### UNIT-IV

##### A) Controlled release pesticides fertilizers and their formulations (07)

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

**B) Formulations in seed treatment:****(08)**

Brief study of Dry powder Seed Treatments (DS), Water Slurriable Powders (WS), Liquid Solution Seed Treatments (LS), Flowable Seed Treatments (FS), Emulsion Seed Treatments (ES), Microcapsule Seed Treatments (CF), Gel For seed Treatments (GF), Water dispersible Granules and Seed Treatments (WG).

**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.
11. Botanicals and Biopesticides - Ed. B. S. Parmar and C. Devakumar, New Delhi Westvill Publishing House, 1993.
12. Pesticides – Ed. G.S. Dhaliwal and B. singh.
13. Agrobases industries & pesticide formulations (Modern pesticides industry & their formulations) : S.B. Shrivastava & V.K.Agrawal – Small Business Pub.
14. Pesticide formulations & Agro based, chemical, food & paper product : R.K.Goel & R.K.Gupta - Small Business Pub
15. Pesticide formulation- recent development and their application in developing countries : WadeVan Valkenburg, B. Sugavanam, Sushil K. Khetan, UNIDO, Year : 1998 Edition : Ist Reprint : 2008.
16. Pesticide Formulation and Adjuvant Technology : Foy C. L. and Pritchard D. W. CRC Press (2008)

**PAPER-VI**  
**ANALYTICAL TECHNIQUES FOR AGROCHEMICALS**

**Unit-I****Separation techniques: (15)**

Sampling of solids, liquids and gases; Principle, Instrumentation and application of Thin layer chromatography, 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  $\text{SO}_4^{2-}$  and  $\text{Fe}^{3+}$ .

**Unit-III:**

- A) Potentiometry:** Introduction, Types of electrode, Instrumentation, Working and measurement of EMF, Applications for measurement of  $p^H$ , salinity of soil, halide and sulphate content of soil. (5)
- B) pH Metry:** Introduction, Instrumentation of pH Meter; glass electrode, reference electrode, Measurement of pH and its application in the pH soil and water sample. (5)
- C) Electrical conductivity:** Electrical conductivity of electrolyte, Conductivity meter, Specific and Equivalent conductance, Applications of conductivity measurement in the analysis of salinity and salt content of the soil (5)

**Unit-IV:****Flame Photometry and Atomic Absorption Spectroscopy:**

Flame Photometry: Principle, Instrumentation, Components, Emission measurement techniques, Atomization, Applications in the estimation of Na, K, Ca; Atomic Absorption Spectroscopy: Principle, Instrumentation, production of atoms, ions and their applications in the analysis of Soil, Water and Pesticides. (15)

**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. Moyer
7. Instrumental Methods of Chemical Analysis- Willard, Merritt and Dean.
8. Pesticide Analysis- K.G. Das.

## 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 & Subabulpsylla. 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, Thrips. 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) Ecology

Concept of ecology, Environment and its components-biotic and abiotic factors and their effects on growth, development, population dynamics, distribution and dispersal.

**B) Molluscan Pests of Agriculture crops:**

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

Slugs: *Limax* spp.

## 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. Store grain pests and their management – Khare, S.P., Kalyani Publications
10. A text book of Plant Nematology – Upadhyay and David – Aman Publishing.
11. General and Applied Entomology – David & Ananthkrshnan – McGraw Hill Publications.

**PAPER-VIII**  
**BIOTECHNOLOGICAL ASPECTS OF PLANT PROTECTION**

**Unit-I** **(15)**

**Agronomy of crop plants:** Introduction, cultivation of important crops:- paddy, sorghum, wheat, sugarcane, cotton, soybean, groundnut, tobacco, tomato, cabbage and cauliflower with respect to soil, climate, seed rate, varieties, fertilizer requirement and crop protection.

**Unit –II**

- A) Seed Technology** – characteristic of improved seed, seed certifying agencies in India. Seed Act 1966 and seed certification, certified seeds procedure, receipt and scrutiny of application. Field inspection, seed sampling, seed analysis or seed testing. **(8)**
- B) Weed science** - Definition, classification, dispersal of weeds and management of weeds: physical, chemical and biological method of control, dissemination and assessment of losses. **(7)**

**Unit–III** **(15)**

**Diseases of cereals, millets, sugar and fiber crops:**

Rice- Brownspot, Blast, Bunt, udbatta, stem rot.

Wheat- Powdery mildew, *Alternaria* leaf blight, Loose smut, Rusts, Ear Cockle.

Maize -Downy mildew, Brown spot, seed and seeding blight, wilt anthracnose.

Sorghum – Downy mildew, Ergot, smut, anthracnose, leaf blight.

Bajara – Green ear, Ergot, rusts, leaf blight

Barley – Smut, powdery mildew, root rot, fruit rot, barley stripe mosaic.

**Sugar crops & fiber crops:**

Sugar beet- leaf spot, powdery mildew, downy mildew, phoma, root rot.

Jute- Anthracnose, macrophomia disease, bacterial wilt, stem gall.

Sun hemp - wilt, rust, phylloidy, leaf curl

**Unit –IV**

- A) Biostatistics** - collection of data, Tabulation, Frequency distribution, Graphic presentation of data, Measure of central tendency, measure of dispersion, standard error, chi square test, T- test **(8)**
- B) Disease caused by Parasitic algae, Parasitic higher plant. Parasitic nematodes, viroid,** infection process and management. **(7)**

**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**



## CHEMICAL SCIENCE PRACTICAL

1. Determination of total hardness of water.
2. Determination of sulphate ion from given water.
3. Determination of amount of Calcium from given lime sample.
4. Determination of percentage purity of given sample of soda ash.
5. Determination of chloride ion in water sample by precipitation method.
6. Determination of percentage purity of boric acid using supplied sodium hydroxide.
7. To estimate copper from given soil sample by colorimetrically.
8. To determine phosphate from given water sample by colorimetrically.
9. To determine alkalinity of water sample.
10. Determination of percentage purity of 2, 4-D using alkali sodium hydroxide.
11. Determination of calcium carbonate in soil sample.
12. Determination carbonate and bicarbonate in given water sample titrimetrically.
13. Determination of emulsion stability and cold test of pesticide.
14. Determination of acidity or alkalinity of given pesticide sample.

Any Suitable experiment may be added whenever necessary.

### Reference Books

- a. A Textbook of inorganic qualitative analysis by A. I. Vogel.
- b. Method of pesticide analysis by Shree Ramulu.
- c. Textbook of practical organic analysis including qualitative and quantitative analysis by A. I. Vogel.

## SEMISTER-II

### LIFE SCIENCE PRACTICALS

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

#### Entomology

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

Collection and Identification of following pests:

- 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, *Spodoptera litura*
- 6 Visit to the forest and poultry...etc.
- 7 Visit to the polyhouse and green house.
- 8 Submission of pests and field diary.
- 9 Any suitable experiment may be added, whenever necessary.

#### Pathology

1. Study of Agronomy of crop plant – As mentioned in theory.
2. Study of weeds-Dicot weeds, monocot weeds, poisonous weeds, noxious weeds, weed dispersal.
3. Seed viability test by TTC method (At least 3-4 diff seeds)
4. Seed scarification methods
5. Study of diseases from cereals, millets, fiber crops (As mentioned in theory syllabus)
6. Bio-stat: mean, median, mode S.D. with graphical presentation.
7. Determination of organic carbon in soil
8. Determination of calcium in soil.
9. Separation of amino acid by paper chromatography.
10. Determination of soluble sulfates from soil.
11. Estimation of sucrose percentage by Refractometer.
12. 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.
6. Plant Pathology 5<sup>th</sup> Edition by G. N. Agrios
7. Pathological problems of economic crop plant and their management by Paul and Khurana S. M., 1998.
8. Fungi and plant diseases by Mundkar B. B., 1972.
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