


 <p>SHIVAJI UNIVERSITY, KOLHAPUR MAHARASHTRA PHONE : EPABX – 2609000, www.unishivaji.ac.in, <a href="mailto:bos@unishivaji.ac.in">bos@unishivaji.ac.in</a> शुद्धी विद्यापीठ, कोल्हापूर - ४१६००४, महाराष्ट्र दूरध्वनी - ईपीएबीएक्स - २६०९०००, अभ्यासमंडळे विभाग दूरध्वनी विभाग २३१-२६०९०९३/९४</p>	<p>SHIVAJI UNIVERSITY, KOLHAPUR - 416004, MAHARASHTRA PHONE : EPABX – 2609000, www.unishivaji.ac.in, <a href="mailto:bos@unishivaji.ac.in">bos@unishivaji.ac.in</a> शुद्धी विद्यापीठ, कोल्हापूर - ४१६००४, महाराष्ट्र दूरध्वनी - ईपीएबीएक्स - २६०९०००, अभ्यासमंडळे विभाग दूरध्वनी विभाग २३१-२६०९०९३/९४</p>	
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SU/BOS/Science/ 152

Date: 18 / 01 / 2023.

To,  
The Head of Department,  
Shivaji University, Kolhapur.

**Subject :- Regarding syllabi of M.Sc. Part- I AGPM degree programme under the Faculty of Science and Technology as per NEP 2020.**

**Sir/Madam,**

With reference to the subject mentioned above, I am directed to inform you that the university authorities have accepted and granted approval to the syllabi and Nature of question paper of **M.Sc. Part –I Agrochemical and Pest Management** under the Faculty of Science and Technology.

This syllabi and nature of question paper shall be implemented from the Academic Year **2022-2023** onwards. A soft copy containing the syllabus is attached herewith and it is also available on university website [www.unishivaji.ac.in](http://www.unishivaji.ac.in) (students Online Syllabus)

You are, therefore, requested to bring this to the notice of all students and teachers concerned.

Thanking you,

Yours faithfully,

  
Dy Registrar

Copy to:

1	The Dean, Faculty of Science & Technology	7	Appointment Section
2	Director, Board of Examinations and Evaluation	8	P.G.Seminar Section
3	The Chairman, Respective Board of Studies	9	Computer Centre (I.T.)
4	B.Sc. Exam	10	Affiliation Section (U.G.)
5	Eligibility Section	11	Affiliation Section (P.G.)
6	O.E. I Section	12	P.G.Admission Section

# **SHIVAJI UNIVERSITY, KOLHAPUR.**



**Estd. 1962**

**'A++' Accredited by NAAC (2021) with CGPA 3.52**

## **Department of Agrochemicals and Pest Management (AGPM)**

**Faculty of Science and Technology**

**M. Sc. Part - I (Sem I & II)**

**REVISED SYLLABUS  
AS PER NATIONAL EDUCATION POLICY 2020**

(To be implemented from Academic Year 2022-23  
(July 2022) onwards.

**1. Title:** M. Sc. in Agrochemicals and Pest Management, Shivaji University, Kolhapur, Revised Syllabus as per NEP 2020.

**2. Faculty:** Faculty of Science and Technology.

**3. Year of Implementation:**

For M. Sc. I (Semester I and Semester II): From July 2022 and for M. Sc. II (Semester III and Semester IV): From July 2023.

#### **4. Vision:**

a) Innovate advanced methods of farming, to cater the need of the Agrochemical Industries.

#### **5. Mission:**

a) Development of Pesticide Residue Testing Laboratory.

b) Development of New Lead molecules with Agricultural Importance.

c) Rearing of Bio-control agents for controlling Insects Pests.

#### **6. Goals:**

a) To develop field laboratory to study the Agronomy, Plantation of Medicinal plants.

b) To provide Consultancy to the farmers for the proper use of Agrochemicals.

#### **7. Program Outcomes (POs):**

1. **Domain Specific knowledge:** Apply the knowledge agrochemicals to the solution of agricultural related issues.

2. In this program, students trained in such a way that they can gain good knowledge of theoretical and practical skill of experimentation.

3. Assigned on entomology, pathology and it deeply covered most of the aspects of modern pest management and control views. It helps to build their career in various fields like development of pest control, rearing of pest, synthesis of pesticides.

4. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern tools including prediction and modeling to identification of various diseases.

5. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the agricultural practice.

6. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

7. **Communication:** Communicate effectively on basic problems and their solution

with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

8. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

### **8. Program Specific Outcomes (PSO's)**

1. Synthesis of new lead molecules as pesticides
2. Development of the methods for Agrochemical residue analysis and new Bio pesticides.
3. Rearing of Bio control agents for Insect Pest Management Micronutrient Research.

### **9. The entire course of M. Sc. will be of four Semesters spread over two years.**

**10. Pattern of Examination:** The Theory Examinations will be conducted Semester wise and Practical Examinations will be conducted Annually.

**11. Fee structure:** As per Shivaji University guidelines.

### **12. Eligibility for Admission:**

Admission to the course for the candidate passing B. Sc. degree with Chemistry/ Botany/ Zoology/ Microbiology/ Biotechnology/ Biochemistry and B. Voc. Agriculture from Non-Agriculture University, and Agriculture and Horticulture form Agriculture University. However, one must be Chemistry/ Botany / Zoology out of three subjects as principal or subsidiary subjects.

Candidate will be selected through entrance exam and fulfilling the conditions laid by as per the University rules.

Merit list will be prepared based on the performance at B. Sc. III level and entrance examination (weightage 50:50), and for other university candidates only entrance exam marks will be considered.

**13. Medium of Instruction:** English

### **14. Structure of course:**

- Total No. of Semester: 4
- (Two semesters per year) Total No. of Papers: 16
- Total No. of Practical course: 04

- No. of papers (theory) per semester: 04
- No. of practicals course per semester: 02
- Maximum marks per paper (practical): 100
- Distribution of Marks – Internal evaluation: 20
- External evaluation: 80
- (Semester exam)
- Total Marks for M.Sc. Degree
- Theory Papers: 1600
- Practical course: 800
- **Total: 2400**
- **Total CGPA Credit: 96**
- **Total Non-CGPA: 08**

### **15. Scheme of Teaching and Examination:**

(Applicable to University Department and University affiliated colleges centers).

- ❖ Each unit in theory course shall comprise 15 lectures, each of 60 minutes' duration and there shall be four lectures per theory course per week.
- ❖ Entire course of M. Sc. AGPM will be of 2400 marks. Every Semester will be of 600 marks [400 marks for theory (four courses) and 200 marks for practical].
- ❖ Examination of each theory course shall be of 100 marks (80 university examination + 20 internal assessments). University examination of 80 marks (3 hours' duration) will be conducted at the end of each Semester. Internal assessment of 20 marks will be done before the semester examination during each semester.
- ❖ Examination of each practical course shall be of 100 marks.
- ❖ Question papers will be set in the view of the entire syllabus and preferably covering each unit of the syllabus.

### **16. Standard of Passing:**

There will be separate passing for theory courses and practical courses. Minimum 40% marks will be required for passing separately for theory and practical courses.

### 17. Nature of Theory & practical question paper and scheme of marking:

#### Theory

There will be five descriptive questions, each question carrying 16 marks.

Question No.	Type of questions	Total marks (80)
01	Descriptive questions (Unit I)	16
02	Descriptive questions (Unit II)	16
03	Descriptive questions (Unit III)	16
04	Descriptive questions (Unit IV)	16
05	Write a note on (Any four out of six) (All Units)	16

#### Practical

Total marks for practical examination are 400 (Semester I & II).

Subject	Marks
Chemical Science (per semester)	100
Life Science (per semester)	100

**18. Special instruction if any:** Passing in Non CGPA courses is mandatory.

## M. Sc. Program structure (NEP) M. Sc. Part - I Syllabus

(With effective from June 2022)

SEMESTER-I (Duration- Six Month)											
	Sr. No.	Course Code	Teaching Scheme			Examination Scheme					
			Theory and Practical			University Assessment (UA)			Internal Assessment (IA) and Practical		
			Lectures (Per week)	Hours (Per week)	Credit	Maximum Marks	Minimum Marks	Exam. Hours	Maximum Marks	Minimum Marks	Exam. Hours
<b>CGPA</b>	1	CC-101- CHEMISTRY OF PESTICIDES AND THEIR FORMULATIONS – I	4	4	4	80	32	3	20	8	1
	2	CC-102- SOIL SCIENCE, FERTILIZERS AND MICRONUTRIENTS	4	4	4	80	32	3	20	8	1
	3	CC-103- INTRODUCTORY AND INDUSTRIAL ENTOMOLOGY	4	4	4	80	32	3	20	8	1
	4	CC-104- BASIC CONCEPTS IN PLANT PATHOLOGY	4	4	4	80	32	3	20	8	1
	5	CCPR-105-PRACTICALS	16	16	8	--	--	--	200	80	*
<b>Total (A)</b>			<b>--</b>	<b>--</b>	<b>24</b>	<b>320</b>	<b>--</b>	<b>--</b>	<b>280</b>	<b>--</b>	<b>--</b>
<b>Non-CGPA</b>	1	AEC-I	2	2	2	--	--	--	20	8	1

✚ The syllabus for AEC-I and SEC-I courses is available on university website:  
link: <http://www.unishivaji.ac.in/syllabusnew/On-Campus-Science>.

SEMESTER-II (Duration- Six Month)											
	Sr. No.	Course Code	Teaching Scheme			Examination Scheme					
			Theory and Practical			University Assessment (UA)			Internal Assessment (IA) and Practical		
			Lectures (Per week)	Hours (Per week)	Credit	Maximum Marks	Minimum Marks	Exam. Hours	Maximum Marks	Minimum Marks	Exam. Hours
CGPA	1	CC-201- CHEMISTRY OF PESTICIDES AND THEIR FORMULATIONS – II	4	4	4	80	32	3	20	8	1
	2	CC-202- ANALYTICAL TECHNIQUES FOR AGROCHEMICALS	4	4	4	80	32	3	20	8	1
	3	CC-203- ECONOMIC ENTOMOLOGY	4	4	4	80	32	3	20	8	1
	4	CC-204 AGRONOMY, SEED TECHNOLOGY, PATHOLOGY, WEED SCIENCE AND BIOSTATISTICS	4	4	4	80	32	3	20	8	1
	5	CCPR-205- PRACTICALS	16	16	8	--	--	--	200	80	*
<b>Total(B)</b>			--	--	<b>24</b>	<b>320</b>	--	--	<b>280</b>	--	--
<b>Non-CGPA</b>	1	SEC-I	2	2	2	--	--	--	20	8	1
<b>Total (A+B)</b>					<b>48</b>	<b>640</b>	--	--	<b>560</b>	--	--
<ul style="list-style-type: none"> <li>Student contact hours per week: <b>32</b> Hours (Min.)</li> </ul>						<ul style="list-style-type: none"> <li>Total Marks for M.Sc.-I (Semester –I &amp; II): <b>1200</b></li> </ul>					
<ul style="list-style-type: none"> <li>Theory and Practical Lectures: <b>60</b> Minutes Each</li> </ul>						<ul style="list-style-type: none"> <li>Total Credits for M.Sc.-I (Semester I &amp; II): <b>48</b></li> </ul>					
<ul style="list-style-type: none"> <li>CC-Core Course</li> <li>CCPR-Core Course Practical</li> <li>AEC-Mandatory Non-CGPA compulsory Ability Enhancement Course</li> <li>SEC- Mandatory Non-CGPA compulsory Skill Enhancement Course</li> </ul>						<ul style="list-style-type: none"> <li><b>Practical Examination is annual.</b></li> <li>Examination for CCPR-105 shall be based on Semester I Practicals.</li> <li>Examination for CCPR-205 shall be based on Semester II Practicals.</li> <li>*Duration of Practical Examination as per respective BOS guidelines</li> <li><b>Separate passing (40%) is mandatory for Theory, Internal and Practical Examinations.</b></li> </ul>					



## DEPARTMENT OF AGROCHEMICALS AND PEST MANAGEMENT

### M. Sc. Part I (Semester - I)

#### Paper I (CC-101): CHEMISTRY OF PESTICIDES AND THEIR FORMULATIONS

Unit No.	Content	No. of lectures
I	<p><b>Chemistry of Pesticides:</b> 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.</p> <p><b>Recent advances in pest control:</b> Recent insect attractants, Chemosterilants and Repellents, Applications of Neem in plant protection: Introduction, Chemical constituents and Mode of action, Bioefficacy of neem preparations.</p>	15
II	<p><b>Classification and Study of following pesticides:</b> with respect to structure, Chemical name, Physical and chemical properties, Synthesis, Formulation, Degradation, Metabolism, Mode of action, Uses and Toxicity.</p> <p><b>Organophosphates:</b> Malathion, Monocrotophos, Dimethoate, Phosphamidon Phosalone, Chloropyriphos, Fenitrothion, Phenthoate, Phorate, Quinolphos, Acephate, Ethephon, Temephos and Triazophos.</p> <p><b>Miscellaneous:</b> Fipronil, Buprofezin, Thiachloprid, Acetamiprid Imidachlorprid, Dicofol and 2,4-D.</p>	15
III	<p><b>Formulation</b> 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.</p>	15
IV	<p><b>Formulation packaging:</b> 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</p>	15

	<p>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).</p> <p><b>Application of Pesticides and Devices used:</b></p> <p>Dusters and sprayers, Types of nozzles. Calculation of amount of formulation required for field application.</p>	
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**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. Miyamoto & 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 (CC-102): SOIL SCIENCE, FERTILIZERS AND MICRONUTRIENTS**

Unit No.	Content	No. of lectures
I	<p><b>Soil Science:</b> 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.</p>	15
II	<p><b>Fertilizers:</b> Classification and types of fertilizers, Essential fertility requirements: <b>Nitrogenous fertilizers:</b> Ammonium nitrate, Urea, Calcium Cyanamide, Calcium Ammonium Nitrate, Sodium Nitrate, Ammonium Chloride: Introduction, Raw materials and Mode of action of the fertilizers. <b>Phosphate fertilizers:</b> Normal super phosphate, Triple Super Phosphate, Ammonium Phosphate. Potassic fertilizers, Mixed fertilizers and positions of Fertilizer Industries in India.</p>	15
III	<p><b>Micro nutrients:</b> Definition, Types, Properties and Uses of micronutrients, Deficiency and Reclamation. <b>Plant growth regulators and hormones:</b> 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.</p>	15
IV	<p><b>Manures:</b> 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 Vermiculture and Vermi-composting. <b>Bio-fertilizers:</b> Biofertilizers- Introduction, definition, classification, <i>Rhizobium</i>, <i>Azatobactor</i>, <i>Azospirillum</i>, <i>Azolla</i>, <i>Blue Green Algae</i>, <i>VAM</i>.</p>	15

**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 (CC-103): INTRODUCTORY AND INDUSTRIAL ENTOMOLOGY**

<b>Unit No.</b>	<b>Content</b>	<b>No. of lectures</b>
<b>I</b>	<p><b>Introduction to Insects:</b>                      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.</p>	15
<b>II</b>	<p>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.</p>	15
<b>III</b>	<p><b>General life cycle patterns of insect pests:</b>                      Grasshopper, Spodoptera, Aphid, Lepidopteran Borer, White grub, Red hairy caterpillar, Snails, Slug.</p> <p><b>Insects of Industrial Importance:</b>  <b>Sericulture:</b>                      Mulberry cultivation and Rearing of Silkworms; Pest and Disease management of Mulberry and Silkworm, Economics of Sericulture.</p>	15
<b>IV</b>	<p><b>Insects of Industrial Importance:</b>  <b>Apiculture:</b> Types of honey bees, Life cycle, Bee keeping equipments, Honey quality, Pest and disease management Agriculture and Non-Agricultural Flora and Bee keeping.</p> <p><b>Biocontrol:</b> 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 <b>Biocontrol agents:</b> Production of <i>Trichogramma</i>, <i>Cryptolaemusmontrouzieri</i>, <i>Chrysoperlacarnea</i>, Nuclear Polyhydrosis Virus (NPV).</p>	15

**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. Natiov.
- 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 – KalyaniPublishers, New Delhi.

**Paper IV (CC-104): BASIC CONCEPTS IN PLANT PATHOLOGY**

Unit No.	Content	No. of lectures
I	<p><b>Science of plant Pathology:</b>                      Plant disease, Pathogen (Bacterial, viral, fungal, mycoplasmal, nematode) pathogenesis, symptoms and symptomology, 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.</p>	15
II	<p><b>Virus as pathogen:</b>                      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, Bendi: 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.</p>	15
III	<p><b>Bacteria as pathogen:</b>                      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.</p>	15
IV	<p><b>Fungal pathogen:</b>                      Symptoms of fungal disease and management of fungal diseases of pulses:                      Pigeon pea- Wilt, leaf spot, stem rot, Powdery mildew                      Gram (<i>Pisum sativum</i>)-Powdery mildew, Rust, Downy mildew, Wilt, root rot Green gram - Anthracnose, leaf spot, root rot, blight, powdery mildews.  <b>Cow pea (<i>Vigna sinensis</i>):</b>                      Powdery mildew, anthracnose, die back leaf spot Soybean- leaf spot, rust, Brown spot, downy mildew, pod and collar rot Diseases of oil seed crops:  <b>Groundnut:</b>                      Leaf spot (early &amp; 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</p>	15

of Cash crops- Cotton - Rust, wilt, leaf spot. Sugarcane- Rust, smut, GSD, rot, viral disease Tobacco – Early blight, wilt.	
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**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 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 PRACTICALS (CC-CCPR-105)

### CHEMICAL SCIENCE: PRACTICAL

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 calorimetrically.
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.

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

**Entomology (Zoology):**

1. Rearing of predator, *Cryptolaemus montrouzieri*
2. Rearing of *Spodoptera litura*,
3. Rearing of silkworms
4. Dissection of insect (cockroach) digestive, excretory, reproductive, and nervous system
5. Release techniques of Parasitoids, Predators and NPV in field.
6. Chemical and Cultural control of some crop pests in field.
7. Visit to Apicultural, Sericulture and Agriculture centers.
8. Field visits for control trials of Agricultural Pests.
9. Collection of various crop pests, identification, and its submission.
10. Any suitable experiment may be added, whenever necessary.

**Plant Pathology (Botany)**

1. Study of following viral diseases: Bean mosaic virus, Bendi yellow vein mosaic, Mungbean yellow mosaic, Gemini virus, Soybean mosaic poty virus, Tomato leaf curl virus, chili leafcurl, 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 5th 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).

## M. Sc. Part I (Semester - II)

### Paper V (CC-201): CHEMISTRY OF PESTICIDES AND THEIR FORMULATIONS-II

Unit No.	Content	No. of lectures
I	<b>Carbamate Pesticides</b> Carbamates and Thiocarbamic acids, Oximecarbarnates, Pendimethalin, Aldicarb, Primicarb, MBC, Zineb, Carbaryl and Carbofuran Isomeric model and kinetics, Synthesis, Mode of action, Structure - Activity relationship. <b>Inorganic pesticides:</b> 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.	15
II	<b>Pyrethroids and Other Natural Pesticides:</b> Introduction, History, Synthesis of Alicyclic Carboxylic acids and derivatives, Pyrethrins and their synthetic analogues, Fenvalerate, Fluvalinate, Permethrin, Deltamethrin, Cypermethrin, Bio-allethrin, Resmethrin etc.	15
III	<b>Important parameters of pesticides formulations:</b> 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</b> 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.	15
IV	<b>Controlled release pesticides fertilizers and their formulations</b> 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.	15

**Formulations in seed treatment:**

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 Sree Ramulu.
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. Agro-bases 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: Wade Van Valkenburg, B. Sugavanam, Sushil K. Khetan, UNIDO, Year 1998 Edition: 1st Reprint: 2008.
16. Pesticide Formulation and Adjuvant Technology: Foy C. L. and Pritchard D. W. CRC Press (2008).

**Paper VI (CC-202): ANALYTICAL TECHNIQUES FOR AGROCHEMICALS**

Unit No.	Content	No. of lectures
<b>I</b>	<p><b>Separation techniques:</b> Sampling of solids, liquids and gases; Principle, Instrumentation and application of thin layer chromatography, Paper chromatography, Column chromatography, Ion exchange and ion chromatography.</p>	15
<b>II</b>	<p><b>Non-Instrumental Techniques:</b> 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 <math>\text{SO}_4^{2-}</math> and <math>\text{Fe}^{3+}</math>.</p>	15
<b>III</b>	<p><b>Potentiometry:</b> Introduction, Types of electrodes, Instrumentation, Working and measurement of EMF, Applications for measurement of <math>\text{p}^{\text{H}}</math>, salinity of soil, halide and sulphate content of soil.</p> <p><b>pH Metry:</b> Introduction, Instrumentation of pH Meter; glass electrode, reference electrode, Measurement of pH and its application in the pH soil and water sample.</p> <p><b>Electrical conductivity:</b> 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.</p>	15
<b>IV</b>	<p><b>Flame Photometry and Atomic Absorption Spectroscopy:</b></p> <p><b>Flame Photometry:</b> Principle, Instrumentation, Components, Emission measurement techniques, Atomization, Applications in the estimation of Na, K, Ca;</p> <p><b>Atomic Absorption Spectroscopy:</b> Principle, Instrumentation, production of atoms, ions and their applications in the analysis of Soil, Water and Pesticides.</p>	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, Merrit and Dean.
8. Pesticide Analysis- K.G. Das.

**Paper VII (CC-203): ECONOMIC ENTOMOLOGY**

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

<b>Unit No.</b>	<b>Content</b>	<b>No. of lectures</b>
<b>I</b>	<p><b>Household pests:</b> Major: Silverfish, Mosquito, Housefly, Bed bug Minor: Cockroach.</p> <p><b>Stored grain pests:</b> Major: Khapra beetle, Rice weevil, Rice moth, Pulse beetle and Rodent. Minor: Lesser grain borer, Indian meal moth, Saw-toothed beetle.</p> <p><b>Pests of medicinal plants:</b> Major: Opium capsule borer, Hadda beetle, Mealy bug, Minor: Pentatomid bug, Ash weevil, Leaf webber.</p>	15
<b>II</b>	<p><b>Pests of Livestock:</b> Major: Cattle louse, Stable fly and Sand fly. Minor: Blowfly, Black fly, Horse fly.</p> <p><b>Forest Pests:</b> Major: Termite, White grub, Teak defoliator and Subabul psylla. Minor: Cut worm, Stem and Root borer, Sesame defoliator</p> <p><b>Pests of Ornamental plants:</b> Major: Cotton white fly, Digger wasp, Spiraling whitefly, Leaf eating caterpillar. Minor: Thrip, Scale insect, Leaf minor, Lawn webworm.</p>	15
<b>III</b>	<p><b>Pests of Polyhouse and Greenhouse plants:</b> Major: <i>Helicoverpa armigera</i>, Mite, Mealy bug, Aphid, White fly, Thrips Minor: Cutworm, Leaf minor and Armyworm.</p> <p><b>Nematode pests of crops (Polyphagous):</b> Migratory endo-parasitic nematodes, Root knot nematode (<i>Meloidogyne spp.</i>), Cyst forming nematode (<i>Heterodera spp.</i>), Seed gall nematode (<i>Anguina spp.</i>) and Molya nematode (<i>Heterodera avena</i>)</p> <p><b>Vertebrate Pests of Agriculture crops:</b> Major: Indian field mouse, Monkey, House sparrow, Wild pig. Minor: Common green bee-eater, Indian desert gerbil, Rose-ringed parakeet.</p>	15
<b>IV</b>	<p><b>Ecology:</b> Concept of ecology, Environment and its components, biotic and abiotic factors and their effects on growth, development, population dynamics, distribution and dispersal of insects.</p> <p><b>Molluscan Pests of Agriculture crops:</b> Snails: <i>Achatina fulica</i>, Slugs: <i>Limax spp.</i></p>	15



**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 & Ananthakrishnan – McGraw Hill Publications.

**Paper VIII (CC-204): AGRONOMY, SEED TECHNOLOGY, PATHOLOGY, WEED  
SCIENCE AND BIOSTATISTICS**

Unit No.	Content	No. of lectures
I	<p><b>Agronomy of crop plants:</b> 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.</p>	15
II	<p><b>Seed Technology:</b> 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.</p> <p><b>Weed science:</b> Definition, classification, dispersal of weeds and management of weeds: physical, chemical and biological method of control, dissemination and assessment of losses.</p>	15
III	<p><b>Diseases of cereals, millets, sugar and fiber crops:</b> Rice- Brown spot, Blast, Bunt, udbatta, stem rot. Wheat- Powdery mildew, <i>Alternaria</i> 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.</p> <p><b>Sugar crops &amp; fiber crops:</b> 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.</p>	15
IV	<p><b>Biostatistics:</b> collection of data, Tabulation, Frequency distribution, Graphic presentation of data, Measure of central tendency, measure of dispersion, standard error, chi square test, T- test.</p> <p>Disease caused by Parasitic algae, Parasitic higher plant. Parasitic nematodes, viroid, infection process and management.</p>	15

**Reference Book:**

1. Seed Programming Management System & concept by Dadheeck P.K., 1997.
2. Handbook of pure seed definition with illustration, by Dadheeck P.K., 1995.
3. Handbook for seedlings Evaluation (2nd Edition) by Schmitt Grob, 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.

## SEMESTER-II PRACTICALS (CC-CCPR-205)

### 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.

**(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, Rice weevil, *Helicoverpa armigera*
- 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 5th 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).