

Punyashlok Ahilyadevi Holkar Solapur University, Solapur



Name of the Faculty: Science & Technology

CHOICE BASED CREDIT SYSTEM

**Syllabus: AGROCHEMICALS AND PEST
MANEGEMENT**

Name of the Course: M.Sc. I (Sem.– I & II)

(Syllabus to be implemented from w.e.f. June 2020)

**PUNYASHLOK AHILYADEVI HOLKAR
SOLAPUR UNIVERSITY**

M. Sc. Part – I and II

**Agrochemicals and Pest Management
(Semester I and II)**

1. TITLE : Subject - Agrochemicals and Pest Management Under the Faculty of Science

**2. YEAR OF IMPLEMENTATION:- Revised Syllabus will be implemented from
June, 2020**

3. PREAMBLE:-

Punyashlok Ahilyadevi Holkar Solapur University since its inception, has successfully tried to meet the regional demands for socio-economic development by introducing need based course. Agrochemicals and Pest Management course is introduced by Punyashlok Ahilyadevi Holkar Solapur University from 2006. It is an interdisciplinary subject. The course content includes analysis and formulations of agrochemicals, applied entomology, plant pathology, biocontrol of pests, extension work, use and marketing of agrochemicals, plant protection equipments, sales and services. Moreover students have to complete one month industrial training especially in pesticide and fertilizer industries, extension and marketing agencies, and analytical laboratories, various crop research stations, etc. So that they become acquainted with needs of industries and application of knowledge they have. Today there is a great demand for this applied course, as students have realized that they have better chances of getting jobs in this world of competition, as compared to conventional courses which trained human resources for teaching field only.

4. GENERAL OBJECTIVES OF THE COURSE:

- 1) To create skilled human resource useful for agriculture as well as various industries like fertilizer, micronutrient, seed processing, agrochemicals, pesticide, pharmaceutical etc.
- 2) To train the students in the following aspects-
 - i) Preparation of bio and chemical pesticides
 - ii) Setting of analytical and tissue culture laboratories
 - iii) Setting of crop dispensaries
 - iv) Specific seed and crop standards
 - v) Effect of agrochemicals on soil, water, atmosphere and biota
 - vi) Novel methods of composting , vermicomposting and mass production of biofertilizers
 - vii) To determine the medicinal potential of plants and their plantation

5. DURATION

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

6. PATTERN OF EXAMINATION:-

Pattern of Examination will be Semester system.

7. ELIGIBILITY FOR ADMISSION:-

Admission to the course is open only to the candidates passing B.Sc. degree with Chemistry / Botany / Zoology / Microbiology / Plant protection / Bio-chemistry/ Biotechnology / Horticulture / Agriculture as the principal subject and B. Pharm. Candidates will be selected from the students appeared for entrance test and fulfilling the conditions as per the university rules for the entrance examination

❖ SCHEME OF EXAMINATION:-

- Examination shall be conducted at the end of each semester.
- Theory paper shall carry 80 marks.
- Practical paper shall carry 80 marks.
- The evaluation of the performance of the students shall be on the basis of both theory and practicals.
- Question Paper will be set in the view of the /in accordance with the entire syllabus and preferably covering each unit of syllabus.

The scheme of semester examination is as follows:-

- **M.Sc. I AND II (Semester- I,II,III and IV):-**

Theory Examination (For each semester):-

- **University examination:-**

Theory papers of 80 marks each + College examination 20 marks each

(80 U.A. + 20 C.A.) = 100 marks.

- **Practical Examination:-**

M.Sc. I AND II (Semester- I,II,III and IV)

Total marks per practical paper 100 marks (80 U.A. + 20 C.A.)

U.A. 80 marks:-

(60 marks experiments + 10 journal and oral + 10 Industrial visit / submission).

C.A. 20 marks:-

(10 marks experiments + 10 oral and submission)

(U.A. 80 + C.A. 20) = 100marks.

U.A. - University Assessment

C.A. - College Assessment

❖ SPECIAL INSTRUCTIONS

- (i) **Study Tours:** The students have to participate in study tours organized to visit tissue culture laboratories, Biocontrol laboratory, Agricultural research institutes, field farms, Fertilizer and pesticide industries etc.
- (ii) **Field Visits:** – The students along with their teacher should frequently visit the various crop fields to study the agronomy, pest and diseases of crop plants, soil and water quality.
- (iii) **Industrial Training:** Every student has to complete one month industrial training in pesticides and fertilizer industries, National agricultural research institutes, field survey in Agro based industries.
- (iv) **Laboratory Work:** Students have to perform the entire prescribed laboratory practicals. This work will be done by the student with the collaboration with the other science departments in the campus.
- (v) **Guest Lectures:** The students have to attend the guest lecturers of eminent scientists in the field of agricultural chemistry/ well known farmers/ past students of the department/ Persons in Agricultural and marketing management organized by the department.

PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY

M.Sc. Part-I SEMESTER I

**Agrochemicals and pest Management
Choice Based Credit System Syllabus**

W.e.f. June 2020

Semester	Code	Title of the Paper	Semester exam			L	T	P	Credits
			University (U.A.)	C.A.	Total				
First		Hard Core							
AGPM	HCT1.1	Chemistry of pesticides and their formulations-I	80	20	100	4		-	4
	HCT1.2	Soil Science, Fertilizers, Micronutrients and Plant Growth Regulators	80	20	100	4		-	4
	HCT1.3	Introductory and Industrial Entomology	80	20	100	4		-	4
		Soft core (Any one)							
	SCT1.1	Plant Pathology and Weed Management	80	20	100	4		-	4
	SCT1.2	Microbiology-I	80	20	100	4		-	
		Tutorial / Seminar			25		1		1
		Practical							
	HCP1.1	Chemistry-I	40	10	50	-	-	2	6
	HCP1.2	Chemistry-II	40	10	50	-	-	2	
	HCP1.3	Life Science-I	40	10	50	-	-	2	
		Soft core (Any one)							
	SCP1.1	Life Science-II	40	10	50	-	-	2	2
	SCP1.2	Microbiology	40	10	50	-	-	2	
		Total for first semester	480	120	625				25

PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY

M.Sc. Part-I SEMESTER II

Agrochemicals and pest Management Choice Based Credit System Syllabus w.e.f. June 2020-21

Semester	Code	Title of the Paper	Semester exam			L	T	P	Credits
			University (U.A.)	C.A.	Total				
Second		Hard Core							
AGPM	HCT2.1	Chemistry of pesticides and their formulations-II	80	20	100	4		-	4
	HCT2.2	Analytical Techniques for Agrochemicals	80	20	100	4		-	4
		Soft core (Any one)							
	SCT2.1	Economic Entomology	80	20	100	4		-	4
	SCT2.2	Integrated Pest Management	80	20	100	4		-	
		Open elective (Any one)							
	OET2.1	Agronomy and Biotechnological Aspects in Plant Protection -I	80	20	100	4		-	4
	OET2.2	Microbial Genetics and Plant Breeding	80	20	100	4		-	
		Tutorial / Seminar			25		1	-	1
		Practical							
	HCP2.1	Chemistry-III	40	10	50	-	-	2	4
	HCP2.2	Life Science-III	40	10	50	-	-	2	4
		Soft core (Any one)							
	SCP2.1	Chemistry-IV	40	10	50	-	-	2	2
	SCP2.2	Chemistry-IV	40	10	50	-	-	2	2
		Open elective (Any one)							
	OEP2.1	Life Science-IV	40	10	50	-	-	2	2
	OEP2.2	Life Science-IV	40	10	50	-	-	2	2
		Total for second semester	480	120	625				25

L= Lecture T= Tutorials P= Practical

U.A.= University Assessment

C.A.= College Assessment

4 Credits of Theory = 4 Hours of teaching per week

2 Credits of Practical = 4 Hours per week

HCT=Hard Core Theory

SCT= Soft Core Theory

OET =Open Elective Theory

HCP = Hard Core Practical

SCP = Soft Core Practical

OEP =Open Elective Practical

MP= Major Project

Semester - I

HCT1.1

CHEMISTRY OF PESTICIDES AND THEIR FORMULATIONS-I

UNIT-I:

A) Study of Organic reactions:

(20)

Electrophilic substitution reactions of benzene like nitration, sulphonation, halogenation, Friedel-Craft reaction, alkylation and acylation.

Nucleophilic substitution reactions (SN1 & SN2) with their mechanism and energy profile diagrams.

Elimination reactions:- Elimination E1 and E2

Additions reactions of alkenes & alkynes eg.-Addition of H₂/Ni, Br₂, HBr, H₂O, Ozone.

Nucleophilic reactions of carbonyl (>C=O) compounds with CH₃MgBr, HCN, NaHSO₃, NH₂.NH₂

B) Study of following reactions with their mechanism:-

Perkin's reaction, Knoevenagel reaction, Benzoin condensation, Pinacol-Pinacolone rearrangement, Cannizzaro's reaction, Perkow rearrangement, Reformatsky reaction, Stobbe condensation.

UNIT-II:

Chemistry of Pesticides:

(03)

Pests and Pesticides, Historical development, chemical and botanical pesticides, classification based on chemical, nature and types of targets, Systemic and non-systemic pesticides.

Following classes of pesticides are to be studied with respect to their synthesis, chemistry, metabolites, environmental fate, formulations and possible uses: insecticides, herbicides, fumigants, rodenticides, pheromones, non-toxic insect controlling agents.

a) Pyrethroids and other natural pesticides:

(06)

Synthesis of cyclopropyl carboxylic acids and derivatives, pyrethrins and their synthetic analogues. Synthesis and reactions fenvalerate, fluvalinate, permethrin, deltamethrin, cypermethrin, alethrin.

b) Recent advances in pest control:- Green chemistry in pesticides

(06)

Recent insect attractant, chemosterilants and repellents. Mode of actions and applications of plant based products in plant protection.

Introduction :- Use of plants like Neem for pest control, method of application, water extraction, hexane extraction, formulations, neem water extract for plant protections. Use of Neem extract for pest control. Bioefficiency of neem preparations.

UNIT-III:
Organophosphorus pesticides: (15)

Synthesis, Properties, Uses and environmental fate of Following:-

Schradan , Malathion, Dimethoate, Monocrotophos, Phosphamidon, Chloropyrifos, Finitrothion, Phorate (Thimate), Quinolphos, Diazinon.

UNIT-IV:
Formulations:- Preparations and applications (10)

Purpose of formulation, Adjuvant , Synergism,
Solution concentrate, solubility, limitations, emulsions, emulsifiable oils, suspension,
wettable and flowable powders,
Dusts, Granules, Smokes, Aerosols, attractants and repellents, baits, lures

Reference Books: HCT1.1

- 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) U.S.Sree Ramulu, Chemistry of Insecticides
- 9) Gurudeep Chatwal, Reaction Mechanism and reagents in organic chemistry
- 10) A.G.Agarwal,Goel Publishing House Synthetic Organic chemistry,
- 11) Morison and Boyd,Organic chemistry.
- 12) Finar ,Organic chemistry ,Vol.I and II,I.L.
- 13)Advanced organic chemistry,Jerry March 14, 2011
- 14)Ashgate hand book of pesticides and Agricultural Chemicals ,G.W.A. Milne
- !5) John H. Montgomery Agrochemicals Desk References.
- 16) A.K.De.,Enviromental Chemistry.

HCT 1.2

SOIL SCIENCE, FERTILIZERS, MICRONUTRIENTS AND PLANT GROWTH REGULATORS

Unit- I

Soil Science (15)

Process of soil formation, properties and composition of soil, soil profile, organic matter in soil, soil micronutrients, acid and alkaline soils and soil reclamation, absorption of toxic metals and chemicals by soil, effects of modern agro –technology and pesticides on soil, study of N, P, K , and S transformations,

Unit-II

Fertilizers (15)

Classification and types of fertilizers.

Nitrogenous fertilizers: Introduction, Ammonium nitrate- Raw materials, manufacturing .

Action of urea, calcium cyanamide, calcium ammonium nitrate, sodium nitrate and ammonium chloride as fertilizers,

Phosphate fertilizers: Normal super phosphate, triple super phosphate, Ammonium phosphate.

Potassic fertilizers: Potassium sulphate and the Muriate of potash).

Positions of fertilizer industries in India.

Unit-III (08)

A) Micro nutrients

Definition, types, properties and uses of micro- nutrients, manufacture of micro-nutrients, deficiency and reclamation.

B)Plant Growth Regulators (07)

Introduction, Definition, Classification. Applications of a) Gibberellins b) Auxins c)Cytokinins d) Ethylene and e)Chloro choline Chloride (CCC) in agriculture.

Unit-IV

(A) Manures : (08)

Introduction, Definition, Humus and decomposing organic matter in soils, Natural organic manures such as Farm yard manure, Compost, Vermicompost , Vermiwash and Green manures.

Methods of applications of organic manures to increase the soil fertility

(B) Biofertilizers:

(07)

Introduction, Definition,

Rhizobium as Biofertilizer- Isolation of Rhizobium from root nodules ,Mass culture of Rhizobium, Inoculation of seeds with Rhizobium.

Blue Green Algae as Biofertilizers: Production of BGA by Trough method, Pit Method and Field Method, Application of BGA to crop fields
Merits of Biofertilizers.

Reference Books: HCT 1.2

- 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 .
- 9) Gopal Rao Outline in Chemical Technology .
- 10) Shukla and Pandey Introduction to Chemical. Technology.
- 11) V. Verma, Plant Physiology
- 12) Noggle and Fritz, Introductory Plant Physiology
- 13) P. C. Das, Manures and Fertilizers
- 14) T. D. Biswas and S. K. Mukharjee, A Text Book Of Soil Science
- 15) J. A. Basi. and J. Kadam, A Text Book Of Soil Science
- 16) S. K. Gupta and I. C. Gupta, Management of Saline soil and water.
- 17) D. K. Das, Introductory Soil Science.
- 18) V. N. Sahai, Soil at glance.

HCT 1.3 INTRODUCTORY AND INDUSTRIAL ENTOMOLOGY

Unit-I (15)

Introduction to insects:-

- i . General description and morphology of insects:-Head, Thorax and Abdomen – Generalized structure in brief of their appendages.
- ii. Definition of insect pests, General characters, Habitats, Damage, Economic threshold level, Natural enemies, Parasites and Predators.

Unit- II (15)

Anatomy and Physiology of the insect: -

- i . Classification of pests Based on damage, feeding habits, taxonomy etc
- ii . Digestive system, respiratory system, Circulatory system, Excretory system, Reproductive systems and Nervous system.

Unit-III (15)

General life cycle patterns in insect pests, Grasshopper, Aphids, Jowar stem borer, Mango stem borer, White grubs, Red hairy caterpillar, Termites, Snails, Slug, Nematodes, and Rat.

Unit- IV (15)

Insects of Industrial Importance:-

Sericulture:-Mulberry cultivation and rearing of silkworms; pest and disease management of mulberry and silkworm.

Apiculture: - Types of honey bees,life cycle,bee keeping equipments, honey quality,pest and disease management, Agricultural and non agricultural flora and bee keeping.

Biocontrol: - The production of egg parasitoids of lepidopteran pest. Production of Bioagents: Production of Trichogramma,Production of nuclear polyhydrosis virus (NPV) and muscardine fungal pathogens.

Production of predator: Chrysoperla carnea.

Reference Books: HCT 1.3

- 1) A.S.Atwal, Agriculture pests of India and South East Asia
- 2) K.P.Srivastava, A textbook of applied entomology.
- 3)Larry P.Pdigo, Entomology and pest management
- 4)Sathe and Jadhav Sericulture and pest management –DPH-Delhi.
- 5)S.Pradhan.Agricultural Entomology
- 6) Govt.Maharashtra.Crop pest and how to fight them.
- 7)Pramod Kumar,Entomology.
- 8)B.D.Ratnaik,Text Book Of Entomology.
- 9)R.Mathur Text Book Of Entomology.
- 10)V.B.Avasthi,Introduction to General and Applied Entomology.
- 11)Mathur and Upadhyay,A Text Book Of Entomology.
- 12)K.P.Srivastava, The Text Book Of Applied Entomology.
- 13)Abrol D.P.Honey bee diseases and their management.
- 14.Koul O.and Dhaliwal G.S.Biopesticides and Pest Management
- 15)Krishnaswami S.Silkworm rearing sericulture manual
- 16)Luyuplian, Silkworm disease.

SCT 1.1

PLANT PATHOLOGY AND WEED MANAGEMENT

Unit-1: (A) The concept of plant diseases. Disease causing organisms, their characters and classification. -(Viruses, MLBs, Bacteria and Fungi), significance of plant diseases. Basic procedures in plant disease diagnosis (microscopic, histochemicals and molecular basis), Koch's postulates. Stages in plant disease development. Chemical weapons of plant pathogens. (9)

(B) Epidemiology, assessment and forecasting of plant diseases- Elements of an epidemic, slow and rapid epiphytotic, factors affecting the development of epidemic. Assessment of plant disease and yield loss, measurement of disease intensity, forecasting of plant disease epidemics, disease warning and expert system. (6)

Unit-2 (A)- Viral diseases- Causal organism, Symptomology, Etiology, transmission of plant viruses, purification detection and control of plant viruses.
Study of viral diseases- Papaya ring spots, Sugarcane mosaic, leaf curl of chillies, Yellow vein mosaic of bean, Tobacco mosaic virus w.r. to symptomology, cause, disease cycle and control measures. (9)

(B) MLO diseases- Properties of mycoplasma, Causal organism, Symptomology, Etiology transmission, diseases caused by MLOs- GSD, Sandles spike, little leaf of brinjal w.r. to symptoms, cause, disease cycle and control measures. (6)

Unit-3: (A) Bacterial diseases- Causal organism, Symptomology, of bacterial diseases, Etiology, Dispersal of bacterial pathogens and control of bacterial diseases.
Study of bacterial diseases- Bacterial blight of bean, Crown gall of grapes, Wilt of banana, Citrus greening w.r. to symptoms, causal organisms, disease cycle and control measures. (7)

(B) Plant diseases caused by fungi- Causal organism, Symptomology of fungal diseases, Etiology, Dispersal and control of fungal diseases. Study of fungal diseases- Club root of cabbage, *Rhizopus* soft rot of fruits, Banana leaf spots, Ergot of bajara, red rot of sugarcane, w.r. to symptoms, causal organism, disease cycle and control measures. (8)

Unit-4-

(A) Plant quarantine- Introduction and Definition, domestic and international. (2)

(B) Weeds- definition, classification, life cycle, dispersal of weed, growth and development of weeds, assessment of losses, factors affecting competitive ability, associations of weeds with certain crops. Methods of weed controls- physical, chemical and biological. (13)

References SCT 1.1

1. G.N. Agrios, Plant Pathology.
2. M.B.Green, Chemicals for crop improvement and pest management.
3. T.J.Masik (Tata McGraw Hill) Weed biology and control.
4. Mundkar B.B. (1972, Edition), Fungi and plant diseases.
5. Sharma P.D., Plant pathology Rastogi Publication Merrut.
6. Guptoa V.K. and R.C.Sharma, (1988). Integrated disease management and plant health.
7. Marmorosch K., (1982)-Mycoplasma diseases.
8. Taxonomy of plant pathogenic bacteria in India, Journal of Indian phytopathology.
9. A. K. Shriwastav, priciples of plant pathology and diseases.
10. V.S.Rao principles of weed science.
11. L.R.Saha, Hand book of plant protection-Kalyani publishers New Delhi.
- 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. Pl. path.59 153-163.
- 14)Srivastav A.K.,Principles of plant pathology and diseases.
- 15) Bilgarmi and Dube,A Text Book Of Modern Plant Pathology
- 16) Shanmugavelu and Arvindan,Weed management of horticultural crops
- 17)Rao V.S., Principles of weed science
- 18)Shubhrata Mishra,Virus and plant diseases.
- 19)Mandai R.C., Weeds, Weedicidesand Weed control –Principles and Practices
- 20) Jayakumar and Jagannathan,Weed Science Principles.

SCT 1.2

MICROBIOLOGY

UNIT: I **15**

Soil Microbiology

- A) Introduction - Definition, approaches to soil microbiology, current topics in soil microbiology
 - B) Soil as an ecosystem
 - C) Soil formation, structure and properties
 - D) Soil microorganisms, types and their role
- Role of microorganisms in
- A) Carbon cycle B) Nitrogen cycle C) Sulphur cycle D) Phosphorous cycle
- Applications of Biotechnology in Agriculture References A) Surface properties of bacteria and significance

UNIT: II **15**

1) Pathogenesis of Viruses

- Host and virus factors involved in pathogenesis, patterns of infection, pathogenesis of plant [TMV], Satellite viruses and their role in plant virus replication. Insect viruses [NPV], Viruses pathogenic to algae and fungi. Host cell transformation by viruses, oncogenesis by DNA and RNA viruses.
- 2) Outline classification of algae, micro algae, algal cell structure and reproduction and

UNIT: III **15**

- A) Bacterial nomenclature and classification:
- B) Classification of prokaryotic organisms – an overview, Introduction to Bergey’s manual of Determinative Bacteriology and Bergey’ Manual of Systemic Bacteriology Principles of bacterial nomenclature
- C) Outline classification of fungi, structure of fungal cell- hyphae and nonmotile unicells, motile cells and spores.
- D) General characteristics of Lichens and Mycorrhizae.

UNIT: IV **15**

Microbial Diversity

- A) 1)Microbial World : General characteristics and outline classification of Bacteria, Yeasts, Molds, Viruses, Protozoa, Lichens, Mycorrhiza Viroids and Prions and their role in the biosphere
- 2)Differentiation : In Bacillus ,Azotobacter, Candida, Mycoplasma and Aureobasidium spp.
- B) General characteristics and molecular architecture of Mycoplasmas.

List of Reference books SCT 1.2

1. Bacterial cell structure by Rogers, ASM publications.
2. General Microbiology by Stanier et al, 5th Edn.
3. Microbial Ultra structure by Fuller R.
4. Chemical Microbiology by Rose.
5. Microbial and Plant Protoplasts by Peberdy Etal.
6. Biology of Mycoplasma by Smith P. I.
7. Introduction to Fungi by Alexopolus.
8. Bergy's manual of systemic bacteriology Vol. 1, 2, 4 Williams, Wilkins & Baltimore, Academic Press.
9. A Manual of Soil Fungi – Gilman J. C. (1967) Oxford & JBH Publications.
10. A Biologist's guide to principles techniques of Practical biochemistry by K. Wilson and K. H. Goulding, Edward Arnold publications.
12. Chromatographic methods by Brathwaite & White.
13. Analytical Chemistry by Robert B. Dilts, Van Nostrand Publications,
14. Introduction to practical biochemistry by D. Plummer, J. Wiley & Sons.
15. Laboratory methods in biochemistry by J. Jayaraman.
16. Methods in Microbiology by Norris and Ribbons, Academic press.
17. Soil Microbiology – Subbarao, N.S.
18. Microbial dynamics and diversity – Desy Staley
19. Biology of Microorganisms – Brock, Parker, Madigen, 9th edition
20. Agricultural Microbiology- Bagyaraj and Ghosh
21. Plant Diseases- Singh R.S.
22. Soil Microbiology – Alexander.

HCP 1.1 CHEMISTRY: PRACTICAL-I

1. Estimation of copper form copper fungicide.
2. Estimation of sulfur form wettable sulphur powder.
3. Estimation of nitrogen form ammonium sulphate.
4. Estimation of Ca form super phosphate.
5. Estimation of Nitro group from organic pesticides.
6. Determination of carbendazim content.
7. Determination of bulk density of soil samples
8. Determination of electrical conductance of various soil samples.
9. Determination of specific gravity of soil samples
10. Analysis of mixed fertilizers and micronutrients.
11. To study the deficiency symptoms of N ,K, Mg and Fe in plants
12. Determination of pH of various water samples by pH meter.
13. 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.

SEMESTER-I

HCP1.2 CHEMISTRY: PRACTICAL-II

1. Determination of Water Holding Capacity of soil samples
2. Determination of soil pH by pH paper and pH meter method.
3. Determination of salinity of soil by conductometric method.
4. Estimation of phosphorus from soil by colorimetric method.
5. Estimation of potassium from soil by flame photometric method.
6. Estimation of nitrogen from soil by Kjeldahals method.
7. Preparation of FAS.
8. Determination of organic carbon in compost and vermicompost
9. Estimation of iron, sulphur, and boron from soil sample.
9. Analysis of organic manures with respect to i) Moisture content, ii) Organic matter and iii) ash content.
10. To study the effect of plant growth regulators on germination and vegetative growth of crop
11. Effect of IAA & GA on seed germination.
12. Isolation of *Rhizobium* from root nodules.
13. Any other suitable experiment may be added when required
Plants

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.

HCP 1.3

LIFE SCIENCE: PRACTICAL-I

1. Rearing of an egg parasite, *Trichogramma* sp.
2. Rearing of predator, *Chrysoperla carnae*
3. Rearing of *Helicoverpa armigera* / Jowar stem borer.
4. Rearing of Silkworm
5. Rearing of White grub
6. Rearing of Hairy caterpillar.
7. Release techniques in parasites, predators and NPV in field
8. Visit to Apiculture/ Sericulture centre.
9. Collection of various crop pests and their submission

SCP 1.1

LIFE SCIENCE: PRACTICAL-II

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

Any Suitable experiment may be added whenever necessary.

SCP 1.2

MICROBIOLOGY

- 1) Demonstration of: Bacterial and yeast DNA
- 2) Preparation of yeast protoplasts.
- 3) Isolation and purification of lysozyme from egg white and preparation of bacterial protoplasts.
- 4) Isolation of bacterial cell wall and study of cell wall polysaccharide by chromatographic technique.
- 5) Single cell and single spore isolation techniques.
- 6) Study of magnetic and electric field on behavior of microorganisms.
- 7) Isolation and identification of reserved food material from *Bacillus megaterium*
- 8) Isolation and morphological studies of –
 - i.)Algae –spirulina, scenedesmus spp.
 - ii.)Fungi- Aspergillus, Penicillium, Rhizopus, Fusarium, Trichoderma and saccharomyces.
 - iii.)Protozoa – Euglena, Paramecium and Plasmodium.
 - iv.)Mycorrhiza – VAM fungi – demonstration.
 - v.) Lichen- demonstration.
- 14) Induction of ascospore in yeasts of *Saccharomyces cerevisiae*.
- 15) Writing suitable title (Analysis) of research papers.
- 16) Assignments on search of scientific paper using key words, author etc. on PUBMED
- 17) Writing abstract for research paper.
- 18) Search of authors instructions from website of a scientific journal and its analysis/ comparison
- 19) Assignment on analysis of data/ Results/ Conclusion.
- 20) Assignment on Google search for scientific purpose.

Semester - II

HCT 2.1

CHEMISTRY OF PESTICIDES AND THEIR FORMULATIONS-II

UNIT-I (15)

Carbamate Insecticides:

Synthesis, properties & uses of :

Carbamates, thiocarbamic acids, oxime carbamates, phenol carbamates, ziram, zineb, maneb, carbaryl, carbofuran, bendiocarb, propoxure (Begoan) Aldicarb, Methomyl.
Isomerism and kinetic studies of hydrolysis of pesticides.
Structure activity relationship of carbamate with reference to acetyl coline.

UNIT-II:

Chemistry and applications of : (15)

Nitro, amino compounds, hydrazine, azo-compounds, phenolic compounds,
Synthesis and applications of :- ureas, thioureas, mercaptans, sulphides, thiocyanates
Chemistry of Captan, propanil, parquat nitrofen and Tetradifon, Acetamiprid, Dimethyl phalate, Diethyl tolumide(odoms)

UNIT-III:

Synthesis & properties of organochlorine Insecticides (10)

BHC (lindane) 2,4-D, Dicofol, Endosulphan, PCNB, Butachlor, The persistence of the pesticides in environment and biota, resistance by pests.

UNIT-IV:

Inorganic pesticides (10)

Preparations and applications of

Fungicides: Sulphur, copper salts, organomercurials and tin compounds.

Fumigants: Hydrogen cyanide, carbon disulphide.

Rodenticide: Arsenic, zinc oxides, Zinc phosphide and Thallium salts.

Herbicides: Copper compounds, and sodium chlorate.

UNIT-V:

Computers in pesticide development:- (10)

Computer assisted correlations analysis in the development of pesticides. Computer optimization in emulsion formulations, computer based application of pesticide development and formulation development. Use of computer based equipments for pesticide analysis. Development of methods for collaborative testing of pesticides.

Reference Book: HCT 2.1

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 Sypm. 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. Miob and Satake ,Chemicals in the environment by Miob and Satake.
9. A. K. De.,Environmental chemistry
10. Sree Ramulu, Chemistry of insecticides and fungicides
11. Text book of Applied Entomology K.P. Shrivastava
12. Hand book of Medicinal Plants Prajapati, Purohit, Sharma, Kumar.

HCT2.2 ANALYTICAL TECHNIQUES FOR AGROCHEMICALS

Unit- I (15)

Separation techniques:

Sampling of solids, liquids and gases; solvent Extraction, Principle, Instrumentation and application of TLC, paper chromatography, column Chromatography, Ion exchange and Ion chromatography.

Unit- II (15)

Non Instrumental Techniques:

Acid base titrations acid- base indicators; Redox titrations determination halide ions by complexometric titration, precipitation titrations methods of determination of Mg, Zn, Ca, Al, Cu, Metallochromic indicators, Gravimetric estimation of SO_4^{2-} and Fe^{++} .

Unit- III (15)

Electrochemical Methods:

- a) Measurement of EMF, potentiometry, pH- metry and their applications in the analysis of agrochemicals, food, juices, water and pesticide residues.
- b) Electrical conductivity: Electrical conductivity of electrolyte, conductivity meter, specific and equivalent conductivities, applications of conductivity measurement in the analysis of salinity, halide and soil moisture.
- c) Voltametry: Principle and methodology of stripping voltametry and its application in trace analysis.

Unit- IV: (15)

Optical Methods:

a) Flame emission and atomic absorption spectrometry: Atomization, flame Photometry and its applications in the estimation of Na, K, Ca; Atomic absorption, instrumentation and applications in the analysis of Soil, water, food and environmental samples.

b) Polarimetry: Principle and application in the analysis of optically active pesticides.

c) Nephelometry and Turbidimetry: Introduction, Principle, Turbidimetry and Colorimetry, Choice between Nephelometry and Turbidimetry, Theory and reflection versus scattering, Factors affecting measurement, Instrumentation, Applications of Nephelometry and Turbidimetry.

Reference book: HCT 2.2

- 1) A. I. Vogel, A text of inorganic quantitative analysis
- 2) Shree Ramulu., Methods of pesticide analysis
- 3) A. I. Vogel ,A text book practical organic chemistry including qualitative and quantitative analysis
- 4) Willard, Meritt & Dean, Instrumental methods of chemicals analysis
- 5) Chopra & Kanwar ,Analytical agricultural chemistry.
- 6) H. A. Moyer Analysis of pesticide residues
- 7) Robert Brown, Introduction to Instrumental Analysis
- 8) Ausotosh Kar, Pharmaceutical Drug Analysis
- 9) Colin Banwell and M. McCash, Fundamentals Of Molecular Spectroscopy.
- 10) Gupta P.K., Methods in Environmental Analysis- Water, Soil and Air
- 11) Rastogi S.C. Mendecutta, N., Bioinformatics methods and applications
- 12) Peter Atkins, Physical Chemistry
- 13) Sivasankar, B., Bioseparations Principles and Techniques
- 14) William Merritt, Instrumental methods of analysis
- 15) G.R. Chatwal, Instrumental methods of Chemical analysis
- 16) Sharma B.K., Instrumental methods of Chemical analysis

SCT 2.1 ECONOMIC ENTOMOLOGY

(Study of the major and minor pests. Their biology, nature of damage and control measures)

Unit-I (15)

A) Household pest:

Major: Cockroach, Mosquitoes, Houseflies, bed bug, lizard and Rat.

Minor: Lesser grain borer, Indian meal moth, saw toothed beetle, Silverfish.

B) Stored grain pests:

Major: Khapara beetle, Riceweevil, Ricemonth, and Pulse beetle, rodents.

Minor: Lesser grain borer, Indian meal month, saw-toothed beetle.

C) Pest of medicinal plants:

Major: Opium capsule borer, Hadda beetle, mealy bug, root knot nematodes.

Minor: Pentatomid bug, ash weevil, leaf webber.

Unit-II (15)

A) Pest of Livestock:

Major: Sucking cattle louse, stablefly, and flies sand.

Minor: Blowfly, Black, flies, Horse flies.

B) Forest Pests:

Major: Termite, white grubs, teak-defoliator & subabhul psylla.

Minor: Cut worms, stem and root borers, sesame defoliator

C) Pest of Ornamental plants:

Major: Cotton white fly, Digger wasps, Spiraling white fly, leaf Eating caterpillars.

Minor: Thrips, scale insects, Leaf minors, Lawn webworm.

Unit-III (15)

A) Pest of polyhouse, greenhouse plants:

Major: Helicoverpa borer, mites, mealy bugs, Aphids, white flies,

Minor: Cutworms Leaf minor and Armyworm.

B) Nematode pests of crops (polyphagous) :

i) Migratory endo-parasitic nematodes.

ii) Root knot nematodes (*Meloidogyne* spp.)

iii) Cyst forming nematodes (*Heterodermata* spp.)

iv) Seed gall nematodes (*Anguina* spp.)

v) Molya nematode (*Heterodermata avena*)

C) Vertebrate Pests of agriculture crops:

Major: Indian field mouse, Monkey, House sparrow, wild boar.

Minor: Common green bee-eater, Porecupine, flying foxes.

Unit-IV (15)

A) Molluscan pests of agricultural crops

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

Slugs - *Limax* species.

B) Polyphagous pests:

Major: Termites/ White ants, Hairy caterpillars, Locustsand white grubs-
Leucopholis lepedophora, *Holotrichia serrata*, *Spodoptera* sp.

Minor: Grasshoppers, wire worms, fruit flies.

Reference Books For SCT 2.1

- 1). R. T. Cotton.,Pests of stored grain products
- 2). M. S. Mani.,Introduction to entomology
- 3) A. D. Imm A textbook of entomology
- 4) Atwal.Agricultural pests of India and south East Asia
- 5) K. M. Smith., Agriculture entomology.
- 6) K. Shrivastava A textbook of applied entomology.
- 7) Graham & Night.,Principles of forest entomology.
- 8) S. Pradhan., Agricultural entomology.
- 9) Govt. of Maharashtra Crop pest and how to fight them.
- 10) Khare B.P.,Stored grain pests and their management
- 11) Pramodkumar,Entomology
- 12) Ghosh S.K. and Durbey S.L.Integrated managementof stored grain pests

SCT 2.2 INTEGRATED PEST MANAGEMENT

Unit-I: Introduction to Applied Entomology : (15)

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 .Prophylactic & Curative methods, cultural, mechanical. Physical, legal and biological

Unit-II: (15)

a) Pest Management: Tactics and strategies of pest management (IPM)

Concept and tools of pest management, Ecosystem concept, Ecological Niche concept, Colonization of island, Crop island in ecosystem, Quantitative basis of pest management, sampling and measuring system, Analysis and Modelling in pest management, Monitoring, Forecasting and Field loss assessment, Design making systems, Constrains and Strategies in implementation of IPM, validation of IPM. Host plant resistance.

Unit-III: (15)

a). Biocontrol in Agroecosystem through management & Entamophagous insects:

Introduction, Definition , Role and impact of predators, parasitoids Biological characteristics, Role and impact strategies of biological control, conservation and habitat management.

b) Microbial control of insect:

Introduction, Definition, History principle groups of pathogen, Bacillus thuringensis, fungi, viruses, protozoa, their mode of action and methods of applications.

Unit-IV: (15)

Pests of crops:

(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, Blue beetle, Gall midge, Rice hispa.

b) Sorghum : I) Major – Midge fly, Aphids , Shoofly, Stem borer

II) Minor- White grub

c) Maize: I) Major- Bug (Deliphacids), Ear head bug, stem borer, pink borer.

II) Minor- Pyrilla, Aphids.

d) Pearl millet: I) Major- Blister beetle.

II) Minor- Surface grasshopper, Armywarm.

e) Wheat: I) Major- Jassids, Termites, Stem borers.

II) Minor- Aphids, Nematodes.

Reference Books : SCT 2.2

1. Biological insect control chapter 10-14, by M.S. Quraishi.
 2. Biological insect pest suppression by H.C.Cooper (spingler verlag)
 3. Agriculture use of anti-biotics by W.A. Moats.
 4. Pesticide chemistry by j.Miyamoto and P.C.Kearney (Pergamon)
 5. Hand book of pest management in agriculture Wi.II by D. pimentel.
 6. Biological pest control by N.W. Hussey and N. Scopes (Glandford press)
 7. Safer pesticides by E. Hodgson and R.J.Kuber (Dekker)
 8. Insect sex pheromones by M.Jacobson (AP).
 9. Control mechanisms in plant development by A.W. Gloston and P.J.Davies.
- Insect pathogenic fungi as pest control agent in “Biological plant & Health Protection” by Zimmermann,G.
10. Chemicals with Noval mode of action-Isshac.
 11. Biopesticides and Pest Management-G. S. Dhaliwal and O.Koul
 12. Handbook of pest management in Agriculture by Pimental.
 13. Principles of insect pest management by Dhaliwal and Arora.
 14. Agricultural pest of india & south East Asia by A.Satwal.

OET 2.1

AGRONOMY AND BIOTECHNOLOGICAL ASPECTS IN PLANT PROTECTION-I

Unit-I (15)

Cultivation of important crops

Sugarcane, Bajra, Sorghum, Cotton & Wheat, Cocounut, Pomegranate, Soybean, Ground nut, Tobacco, Tomato, Brinjal, Cabbage and cauliflower, in respect to : Soil & climate, seed rate & sowing, varieties/ cvs. Fertilizer, requirement and protection.

Unit-II (15)

Seed Technology

Introduction, Definition, Classes of seeds and techniques of producing hybrid seeds for disease resistance and other relevant characters.

Unit-III (15)

Genetic engineering and Applications of tissue culture

a) Genetic engineering : Introduction, Methodology – Physical, Chemical and Biological methods (*Agrobacterium* mediated gene transfer), Pest resistance – Bt cotton, r-DNA technology, Enzymes involved in r-DNA technology.

b) Tissue culture : Introduction, Definition, Terminologies in tissue culture, Sterilization methods, Inoculation and incubation, Hardening of plants, Techniques of tissue culture – Anther culture, Protoplast isolation and Culture, Somatic hybridization.

Unit-IV (15)

Genetic resistance –

Types of disease resistance (horizontal and vertical resistance), Interaction between resistance genes, Molecular marker assisted selection, Back cross method and Escape method.

Reference Books : OET 2.1

- 1) Dadheek P.K., 1997. Seed Proqrament Management System & concept
- 2) Dadheek P.K., 1995. Handbook of pure seed definition with illustration,
- 3) SchmittGrob, R., 1997Handbook for seedlings Evaluation (2nd Edition)
- 4) Reddy S.M., 1997. Microbial Biotechnology.
- 5) M.K.Razdan,Introduction to Plant Tissue Culture
- 6) K.K.De,Plant Tissue Culture
- 7) T.B.Jha and B.Ghosh,Plant Tissue Culture Basic and Applied
- 8) P.S.Verma and V.K. Agarwal, Genetics
- 9) Jogdand S.N.,Gene Biotechnology

- 10) H.Gautam, Genetical modification of plants
- 11)Gupta P.K.,Elements of Biotechnology
- 12)R.C.Dubey,A Text Book Of Biotechnology

OET 2.2

MICROBIAL GENETICS AND PLANT BREEDING

Unit; 1:- (15)

Basic concepts of microbial genetics A) Structural organization of Escherichia coli chromosome, folded fiber model B) Replication of DNA: Enzymes involved and mechanisms of replication C) Transcription: RNA polymerase enzyme, process and post transcriptional modification D) Operon concept – Lac Operon

Genome organization in prokaryotes and eukaryotes-

size and structure of genome

in viruses, plasmids, bacteria, yeast and higher organisms. Variation in genome size and its organization in prokaryotes, eukaryotes and organelles. Architectural differences of the genome.

Unit 2:-Organization of gene in prokaryotes and eukaryotes- (15)

structure and organization of the gene in

plasmid, viruses, bacteria and eukaryotes. Gene conversion, amplification, mobile genetic elements and their significance. Gene families.

Unit 3:-Genetic Recombination and Genetic Mapping- (15)

Independent Assortment and Crossing Over, Recombination, Molecular Mechanism of Recombination, Role of Rec A and Rec B,C,D Enzymes. Proteins Involved in Eukaryotic Recombination, Recombination Nodules, Site Specific Recombination, Chromosome Mapping, Linkage Groups, Genetic Markers-Conventional and Molecular Markers Used in Construction of Molecular Maps. Correlation of Genetic and physical maps, somatic cell genetic-an alternative approach to gene mapping. Electrophoresis of DNA. DNA sequencing – Maxam and Gilbert's method .DNA finger printing- method and applications

Unit 4:-Modern methods of plant breeding- (15)

Somaclonal variations, Somatic hybridization-protoplast isolation, fusion and regeneration, hybrids.

Genetic engineering of plants- aims and methods for development of transgenics, *Agrobacterium*- a natural genetic engineer, t-DNA mediated genetic transformation. Hybridoma technology.

IPR (Intellectual property right) - concept, importance, ecological risk and ethical concerns.

Reference Books:- OET 2.2

1. Benjamin Lewin- Genes VIII-,
2. James Darnell, Harvey Lodish and David Baltimore- Molecular Cell Biology.
3. Albert et.al.-Cell Molecular Biology.
4. C.J.Avers-Genetics.
5. Strickbergr- Genetics.
6. E.J.Gardner- Principles of Genetics.
7. J.Jahier- Techniques of Plant Cytogenetic.
8. Sharma A.K. & Sharma A – Chromosome: Theory and Practice.
9. Genetics – P.K.Gupta 2010
10. Genetics classical to modern - – P.K.Gupta 2008
11. Genetics – Verma and Agrawal -2008
12. Cytogenetics evolution biostatistics and Plant Breeding – Shukla and Chandel
13. Cell Biology ,Genetics ,Molecular biology ,evolution and ecology -Verma and Agrawal – 2008
14. The world of cell – Backer and Klein Smith (Pearson publication)/
15. Biotechnology - Satyanarayana.
16. Biotechnology –R.C.Dubey
17. Biotechnology –P.K.Gupta.
18. General microbiology – Stanier
19. General microbiology – Pawar and Daginawala Vol I and II
20. Biochemistry – Lehninger
21. Molecular Biology of Gene – J.D. Watson
22. Recombinant DNA – J.D. Watson
23. Microbiology - Davis
24. Biochemistry - Purohit
25. Genetics of bacteria and their viruses – William Hays

SEMESTER-II
HCP2.1 CHEMISTRY: PRACTICAL-III

1. Determination of Alkalinity of water.
2. Determination of nitrate from water.
3. Analysis of lime material.
4. Determination of Malathion content.
5. Determination of Metasystox content.
6. Determination of hardness of borewell sample by using EDTA method.
7. Determination of acidity or alkalinity of given pesticide sample.
8. Ion exchange chromatographic separation and determination of Zn(II) and Mg(II).
9. Determination of calcium carbonate in soil sample.
10. Determination of Fe⁺⁺⁺ ion from given solution by using colorimetric method.
11. Estimation of Dicofof content.
12. Determination of phorate content.
13. Any other suitable experiment may be added when required

Reference Book

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

SEMESTER-II
SCP2.1 CHEMISTRY: PRACTICAL-IV

1. Determination of hardness of water.
2. Determination of sulphate (SO_4^{2-}) and phosphate (PO_4^{3-}) from given water sample Nephelometrically.
3. Separation and detection of pesticide by thin layer chromatography.
4. Determination of ammonium sulphate in a given fertilizer sample spectrophotometrically using Nessler's reagent.
5. Separation and determination of chloride and bromide ion by anion exchange chromatography.
6. Determination of chloride ion in the water sample by precipitation titration (Mohr's method)
7. Determination of copper from Bordeaux mixture as fungicides by iodometric titration.
8. Preparation of Tetramine Cu(II) sulphate.
9. Determination of dissolved Chlorine gas in a given water sample by
10. Determination carbonate and bicarbonate in given water sample titrimetrically.
11. Determination of normality of acid by titration against alkali by conductometric method.
- 10..Any other suitable experiment may be added when required

Reference Book

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

SCP 2.2 CHEMISTRY: PRACTICAL-IV

1. Colorimetric determination of parathion.
2. Colorimetric determination of vanadium in soil sample.
3. Estimation of carbaryl in a given formulation
4. Determination of emulsion stability and cold test of pesticide.
5. Ion exchange chromatographic analysis of Copper, Zinc and Cobalt.
6. Determination of potassium in commercial sample of muriate of potash by
i) Cobaltinitrite method and ii) Perchlorate method
7. Estimation of Vanadium content from soil.
8. Isolation of limonene from citrus fruits
9. Any other suitable experiment may be added when required

Reference Book

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

PRACTICAL- HCP 2.2 LIFE SCIENCE-III

- 1.Determination of LC50 and LC90 in given insects.
- 2.Rearing of two to three pests in laboratory. (As per syllabus)
- 3.Field collection of pests stages and its submission.
- 4.Field visits(Minimum four) & field diary.
- 5.Large scale production of
 - a. Bacillus thuriengnis
 - b.Beauveria bassiana
 - c.Apanteles sp.
 - d.Bracon sp.
 - e.Nematodes.
- 6.Study of life cycles of important pests of crop plants as per syllabus at least two of each category and laboratory and field diary..
- 7.Study of the detection of damage caused by pests.
- 8.Identification of different casts of termites.
locally available.)
9. Collection and submission of pests.

OEP 2.1 LIFE SCIENCE : PRACTICAL-IV

1. Study of crop plants as per syllabus

2. Study of seed standards:

a) Seed germination

b) Hybrid seeds and their Characteristics.

3. Pest loss Assessment:

Study of stored seed (Pest).Comparative study of the resistant & susceptible cultivars to pathogens

(Bacteria, viruses, fungi etc.) – Structural & chemical study of –

Susceptible & resistant hosts/cvs.

4. Pesticide degradation & residual analysis

5. Collection of seed or plant of varieties availability and its germination and few growth observations.

6. Study of stored grain fungi (Moist petriplate Method).

7. Preparation of MS media.

8. Sterilization methods and inoculation technique.

9. Separation of chlorophyll pigments from diseased and healthy crops.

10. Plant breeding techniques in Maize and Cotton.

11. Isolation of DNA.

12. Visit to Agro-based industry and report submission.

13. Visit to seed processing unit and make a report on it.

14. Any suitable experiment may be added, whenever necessary.

OEP 2.2 LIFE SCIENCE : PRACTICAL-IV

1. Karyotype Studies in Plants using photographs and slides.

2. Banding Studies-“O” Banding in *Allium cepa*.

3. Isolation of DNA.

4. Meiotic Studies in Structural Hybrids.

5&6 Genetic Problems on Mapping of the Genes in

Higher Organisms. 7 Culture of *Agrobacterium*

tumefaciens.

8 *Agrobacterium* Mediated Genetic

Transformation of Plants. 9 Submission of

Application for Patent.

10 Demonstration of Elisa.

11 &12 Protoplast Isolation, viability testing, Fusion, and

Regeneration. Reference Book

1. Genetics – Verma and Agrawal -2008

2. Cytogenetics evolution biostatistics and Plant Breeding – Shukla and Chandel

3. Cell Biology ,Genetics ,Molecular biology ,evolution and ecology - – Verma and Agrawal - 2008

4. The world of cell – Backer and Klein Smith (Pearson publication)/

5. Biotechnology - Satyanarayana.

6. Biotechnology –R.C.Dubey

7. Biotechnology –P.K.Gupta.

8. Genetics – P.K.Gupta 2010

9. Genetics classical to modern - – P.K.Gupta 2008