SOLAPUR UNIVERSITY, SOLAPUR

AGROCHEMICALS AND PEST MANEGEMENT

M.Sc. Part-II (SEMESTER-III& IV) Syllabus

Choice Based Credit System Syllabus

(To be Implemented from June, 2016)

Solapur University, Solapur

M. Sc. Part – II

Agrochemicals and Pest Management

(Semester III and IV)

(w. e. f. June 2016)

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

2. YEAR OF IMPLEMENTATION:- Revised Syllabus will be implemented from June, 2016

3. PREAMBLE:-

Solapur University since its inception, has successfully tried to meet the regional demands of socio-economic development by introducing need based course. Agrochemicals and Pest Management course is introduced by Solapur University, Solapur. 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

• The course shall be 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.

SEMESTER- III:

4 Papers, 2 Practical's, Seminars/Field visit/Industrial visit

Students can choose any one paper from Paper XII-A and Paper XII-B

Sr. No.	Paper/Practical	Total Marks
1	PAPER -IX: PESTICIDE RESIDUES AND TOXICOLOGY	100
2	PAPER-X: ADVANCES IN PEST CONTROL-I	100
3	PAPER-XI: ANALYSIS OF AGROCHEMICALS	100
4	PAPER-XII-A: PEST OF CROP PLANTS-I	100
5	PAPER-XII-B: DISEASES OF CROP PLANTS-I	100
6	Practical-V : Chemistry III	100
7	Practical-VI : Life science III	100

SEMESTER- IV:

4 Papers, 2 Practical's, Seminars/Field visit/Industrial visit Students can choose any one paper from Paper XVI-A and Paper XVI-B

Sr. no.	Paper/Practical	Total Marks
	PAPER-XIII: AGRO-BASED MARKETING MANAGEMENT	100
	PAPER-XIV: ADVANCES IN PEST CONTROL-II	100
	PAPER-XV: MANUFACTURE OF AGROCHEMICALS	100
	PAPER-XVI-A: PESTS OF CROP PLANTS-II	100
	PAPER-XVI-B: DISEASES OF CROP PLANTS-II	100
	Practical-VII: Chemistry IV	100
	Practical-VIII: Life Science IV	100

12. SCHEME OF TEACHING AND EXAMINATION:-

Sr. no.	Title of Paper	Teaching Scheme (hrs/week)		Total work load	Uni. Exam Marks	College Exam Marks	Credits
		L	P				
Semester-III							
1	PAPER -IX: PESTICIDE RESIDUES AND TOXICOLOGY	4	--	4	70	30	4
2	PAPER-X: ADVANCES IN PEST CONTROL-I	4	--	4	70	30	4
3	PAPER-XI: ANALYSIS OF AGROCHEMICALS	4	--	4	70	30	4
4	PAPER-XII-A: PEST OF CROP PLANTS-I	4	--	4	70	30	4
5	PAPER-XII-B: DISEASES OF CROP PLANTS-I	4	--	4	70	30	4
6	Practical-V :Chemistry III	--	6	6	70	30	4
7	Practical-VI :Life science III	--	6	6	70	30	4
Semester IV							
8	PAPER-XIII: AGRO-BASED MARKETING MANAGEMENT	4	--	4	70	30	4
9	PAPER-XIV: ADVANCES IN PEST CONTROL-II	4	--	4	70	30	4
10	PAPER-XV: MANUFACTURE OF AGROCHEMICALS	4	--	4	70	30	4
11	PAPER-XVI-A: PESTS OF CROP PLANTS-II	4	--	4	70	30	4
12	PAPER-XVI-B: DISEASES OF CROP PLANTS-II	4	--	4	70	30	4
13	Practical-VII: Chemistry IV	--	6	6	70	30	4
14	Practical-VIII: Life Science IV	--	6	6	70	30	4

M. Sc. Part- II (SEMESTER – III and IV)

13. SCHEME OF EXAMINATION:-

- The examination shall be conducted at the end of each semester.
- The theory paper shall carry 100marks.
- 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. II (Semester- III and IV)

Theory Examination (For each semester)

University examination- 4 Theory papers of 70 marks each + College examination 30 marks each

(70 U.A. + 30 C.A.) x 4= 400 marks

Total Marks: 400

M. Sc. II (Semester - III and IV) Practical Examination:

Chemistry practical: -100 marks

Total marks per practical paper (70 U.A. + 30 C.A.)= 100

70 marks (50 marks experiments + 10 oral and journal + 10 Industrial visit) + C.A. 30 marks (20 marks experiments + 10 oral) = 100marks

Life science practical: 100marks

M. Sc. II (Semester - III)

Total marks per practical paper (70 U.A. + 30 C.A.)= 100

70 marks (50 marks experiment + 10 oral and journal +10 field visit) + C.A. 30 marks (20 marks experiments + 10 oral) = 100marks

M. Sc. II (Semester - IV)

70 marks (University examination)

(Practical work 35 marks + Project work 25 marks + Training 10 marks) + College examination 30 marks (10 marks experiment + 05 marks seminar + 5 marks journal +10 marks field visit) = 100 marks

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

Sr. no.	Paper No.	Title Of Old Paper	Title Of New Paper
1	Paper-IX	PAPER -IX: PESTICIDE RESIDUES INENVIRONMENT	PAPER -IX: PESTICIDE RESIDUES AND TOXICOLOGY
2	Paper-X	ADVANCES IN PEST CONTROL-I	PAPER-X: ADVANCES IN PEST CONTROL- I
3	Paper-XI	ANALYSIS OF AGROCHEMICALS	PAPER-XI: ANALYSIS OF AGROCHEMICALS
4	Paper-XII	PESTS AND DISEASES OF CROP PLANTS-I	PAPER-XII A: PESTS OF CROP PLANTS – I OR PAPER-XII B: DISEASES OF CROP PLANTS – I
5	Paper- XIII	TOXICOLOGY	PAPER -IX: PESTICIDE RESIDUES AND TOXICOLOGY
6	Paper- XIV	ADVANCES IN PEST CONTROL-II	PAPER-XIV: ADVANCES IN PEST CONTROL- II
7	Paper-XV	MANUFACTURE OF AGROCHEMICALS	PAPER-XV: MANUFACTURE OF AGROCHEMICALS
8	Paper- XVI	PESTS & DISEASES OF CROP PLANTS-II	PAPER- XVI A: PESTS OF CROP PLANTS – II OR PAPER- XVI B: DISEASES OF CROP PLANTS – II

17. SPECIAL INSTRUCTIONS, IF ANY.

(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 Agrobased industries.

(iv) Laboratory Work: Students have to perform the entire prescribed laboratory practical's 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.

AGROCHEMICALS AND PEST MANAGEMENT
To be Implemented From June-2016
M.Sc. Part-II (Semester-III)
Paper-IX:
PESTICIDE RESIDUES AND TOXICOLOGY

Unit-I: Residues of Agrochemicals : **15**

a)Pesticide Residues in the Atmosphere: **(5)**

Pesticides into the atmosphere and their fate , transport of vapors, precipitation, effect of residues on life, Photochemistry of pesticides.

b) Pesticide residues in water system: **(5)**

Nature and origin of pollution of aquatic systems, point and non point pollution. Dynamics of pesticides in aquatic environment.

c)Pesticides residues in the soil: **(5)**

Absorption, retention, transport and degradation of pesticides in the soil, effect on microorganisms and consequent effect on the soil condition, fertility, interaction in the soil, geohydrological aspects.

Unit-II: Penetration and Distribution of pesticide residues and their effects on quality Of human life. . **(15)**

Model ecosystem studies of Bioconcentration, Biomagnifications and Biodegradation. Effect of pesticides on life in general and consequent effects on human life.

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

Concept and Scope of Toxicology-Introduction, General account, Definition of Toxicology, History Of Toxicology, Enlisting of various disciplines of toxicology, Detail account of forensic toxicology-Definition of poison, classification of poisons, their symptoms and treatments.
Mode of Action of toxicants-Introduction, Action of toxicants on Enzymes, Carriers, Coenzymes, Nucleic Acids, Lipids and receptor concept
Mechanism of action of pyrethroids, organochlorine, organophosphate and carbamate insecticides.

Unit-IV: Analysis of pesticide residues and Toxicological Testing Methods: (15)

Analysis of pesticide residues from fruits and vegetables –Protocols for Gas Chromatography (GC) and High Performance Liquid Chromatography(HPLC) Toxicological Testing Methods- Behavioural tests and Functional Tests.

Reference Books:

1.Chemical analysis of the environment by Ahuja.

2.Environmental chemistry by A. K. De.

3.Chemistry of our environment by Home (JW).

4.Analysis of pesticides residues by H. A. Moye (JW)

5.Advance in pest control research by R. L. Methcalf (JW)

6.Chemistry of pesticides by K. H. Buchel (JW).

7.Progress in pesticides biochemistry and Toxicology V. I, II, III by D. H. Hutson and T. R. Robert.

8.Evaluation of pesticides in ground water by W. Y. Garnett, R. C. Honeycatt and others.

9.Chemistry of pesticides by Edward

10.Insecticide biochemistry and physiology by C.F. Wilkinson.

11.Progress in pesticide Biochemistry and toxicology WI.I, II, III by D.H. Hutson and T.R.Roberts.

12.Comprehensive insect physiology, Biochemistry and pharmacoilogy WI, 12, by G.A.Kerkut and L.I.Gilbert.

13. Modern toxicology WI.I, II, III by P.K. Gyota and D.K. Salunkhe.

14.Toxicology by C.D. Kiassen, M. D. Amdur and J. Doull.

15)Environmental Toxicology and Biotechnology,S.K.Dubey,S.Ghosh

16)Fundamentals Of Toxicology,K.Pandey,J.P.Shukla,S.P.Trivedi

PAPER-X

ADVANCES IN PEST CONTROL-I

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:

a)Bioefficacy of some pesticides against major pests: **(7)**

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

b)Host Plant Resistance: **(8)**

Introduction, Classification of resistance, mechanism of resistance, Evaluation of Antixenosis and anti-biosis, Morphological & Biochemical basis of resistance, Insect biotypes, Breeding for insect resistance, Factors affecting plant resistance

Unit-III: Recent advance in pest control: Green Chemistry in pesticides: **(15)**

Recent insect attractants, Chemosterilents and Repellents, Mode of action and Applications. Neem in plant protection:- Introduction, Chemical constituents, Bioefficacy of Neem preparations, Management of pest in Agricultural crops, Management of the forest pest, Management of insects and diseases in stored agricultural commodities, side effects of applications.

Unit-IV

a) Plant protection appliances: **(5)**

Duster, principles of dusting, spraying, Part of typical sprayer, types of sprayer. Types of nozzles and other equipments

b)Controlled release pesticides fertilizers and their formulations **(10)**

Reference Books

1.Text Book of applied Entomology Vol. I & II-K.P.Srivastava.

2.Introduction to Insect Pest Management.-Martin & Luckman

3.Textbook of Insets Toxicology.-Matsmura

4.Introduction to Biological Control.-R.Bosch, D.S.Messenger & A.D.Gutierrez.

5. Principles of Insect Pest Management. –G.S.Dhaliwal and R.Arora.

6.Entomology and Pest Management –Larry P.Pedigo.

7.Element of Economic Entomology –B.V.David and T.Kumarswammy.

8.Insect Pest Management –David Dent.

9.Critical issues in Insect Pest Management –G.S.Dhaliwal and E.A.Heinrich. 10.Emerging trends in biology control of phytophagus Ed.T.N.Anatkrishnan. 11.Toxicology of Insecticide-Fumio Matsumura.

12.Biological Pest Suppression –H.C.Coppelend and J.W.Martin.

13.Neem in plant protection: R.T.Gahukar, Agri-Horticultural Pub.Nagpur,2003.

14.Elements Of Entomology- Rajendra Singh

15.Entomology-M.S.Nalina Sundari and R.Santhi

16.Introduction to General and Applied Entomology-V.B. Awasthi

17.A Text Book Of Entomology-R.Mathur

18. A Text Book Of Entomology-B.D. Patnaik

19.Insect Pests Of Stored Grain And Grain Products-R.T.Cotton, 20.Our Household Insects-E.A.Butler

21.Agricultural Insect Pests Of Crops and Their Control-V.P.S.Panwar 22.Insects and Fruits-D.K.Butani

PRACTICAL-VI : Life Science-III

1. Rearing of pest species. (3 to 4 species).

2.Study of life cycles of important pests of crop plants as per syllabus
at least two of each category and laboratory and field diary..

3.Study of the detection of damage caused by
pests. 4.Identification of different casts of termites.

5.Determination of moisture content of Plant material/soil by using IR moisture balance. 6.Determination of parathion residues in food grains / plant materials and vegetables. 7.Collection of Pest stages.
8.Collection and submission of diseased plant parts.

PAPER-XI

ANALYSIS OF AGROCHEMICALS

Unit-I: **(15)**

a) Separation Techniques: Principle, instrumentation applications and Advantages of Thin layer Chromatography, Paper Chromatography and HPLC.

b) Gas analysis :Analysis of SO_2, NO_x, CO, CO_2, NH_3, and H_2S in the effluent gases.

Unit-II **(15)**

a) Radioactivity- Measurement, Applications of radio isotopes in agriculture, Health hazards, activity ratio, Neutron activation analysis and its applications.

b) Polarography, Voltage current curves, analysis of polarogram, applications of ultraviolet spectrophotometer in the analysis of agrochemicals and pest residue and metabolites.

c) Fluorescence spectroscopy: Basic principles, methodology and applications.

Unit-III **(15)**

a) Ultraviolet Spectroscopy: Principle, Theory, instrumentation and applications.

b) Infrared Spectroscopy: Principle of I.R. spectroscopy, Fundamental modes of vibrations, fundamental group regions of I.R. spectrum, functional group region, finger print region, Types of vibrations, Instrumentation of I.R., I.R. Spectrum, Applications of I.R. spectroscopy in structure determination.

Unit-IV **(15)**

a) Nuclear magnetic resonance spectroscopy: Magnetic & non magnetic nuclei, NMR Instrument schematic diagram, shielding & deshielding, chemical shift, measurement by Delta scale,TMS as reference compound & its advantages, Spin –spin coupling(n+1) rule, PMR spectra of Ethanol, Ethyl acetate, Acetophenone, 2-Butanone, Benzoic acid & Applications in pesticide residue.

b)Mass spectrometry: Schematic diagram of mass spectrometer, ionization and fragmentation of molecules. Interpretation and applications in the pesticide residue and metabolites analysis, GC-MS techniques.

Reference Books :

1.Spectroscopic methods in Organic Chemistry –D.H.Williams and I.Flemming.

2. Instrumental methods of analysis –Willard and Merittee, Dean.

3.Application of spectroscopic techniques inorganic Chemistry-P.S.Kalsi.

4. Concept in analytical Chemistry – S. M. Khopkar.

5.Analysis of pesticide residue –H.A.Moye(JW).

6.Advance in pest control research –R.L.Metcalf.

7.Application of absorption in Spectroscopy –J.R.Dyer.

8.Soil and plant analysis –C.S.Piper(Hans pub.)

9.Methods in Environmental Analysis Water,Soil and Air-P.K.Gupta

10. Soil,Plant,Water and Fertilizer Analysis-P.K.Gupta

11. Introductory Soil Science-Dilipkumar Das

12. Industrial chemistry(including chemical engeering)-B.K.Sharma

13. Spectroscopy- B.K.Sharma

14. Basic concepts of Analytical Chemistry-S.M.Khopkar

15. Instrumental methods of chemical analysis-Chatwal and Anand.

16. Instrumental methods of chemical analysis-Gurdeep R.Chatwal,Sham K.Anand

PRACTICAL-V: Chemistry-III

Pesticide analysis:

1.Estimation of Endosulphan iodometrically.

2.Estimation of Dicofol content.

3.Determination of phorate content.

4.Estimation of Malathion residue in given sample

4.Saponification and acid values of oil.

5.Estimation of phosphate from super phosphate.

6.Estimation of sulfate from super.phosphate

7Estimation of Simazine by colorimetric method

8. Estimation of carbendazim in given formulation

9.Estimation of cabaryl in a given formulation

10.Determination of caffeine from tea leaves.

11.Isolation of lactose from milk.

12.Analysis of soil samples: Estimation of Ca, Mg, carbonate (CO_3^{--}) and Bicarbonate (HCO_3^-) by Titrimetric analysis.

13. Preparation of formulations

14.TLC and Column chromatographic separation of the pesticides or plant products. Pesticide Toxicity

15) Detection of pesticides residue in food stuffs.

16) Detection of pesticides in plants.

REFERANCE BOOKS

1.A Textbook of Inorganic quantitative analysis by A. I. Vogel.

2.Methods of pesticides analysis by Shree Ramulu.

3.A Text book practical Organic Chemistry including qualitative and quantitative analysis by A. I. Vogel.

PAPER-XII-A

PESTS OF CROP PLANTS-I

(Cereals, oil seeds, Pulses, Cash Crops & Fodder Crops)

Unit-I: **(15)**

A)Pest Management: Tacties 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.

B) 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, Ricehispa.

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.

Unit-II Pests of pulses & vegetables: **(15)**

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

I)Major- Gram pod borer, Tur pod bug, Pea aphidsand spodoptera.
II)Minor- Bean fly, Aphids, Thrips, Mites.

Unit-III Pests of oil-seed Crops: (15)

i)Groundnut:
I) Major: Groundnut leaf miner aphid.
II) Minor: Stem borer, Jassid & Bihar hairy caterpillar.

ii)Sunflower:
I) Major: Head borer, Bihar hairy caterpillar.

iii)Safflower:
Major: Aphid & Leaf eating caterpillar.
Minor: Safflower bud fly.

iv)Mustard:
I) Major: Mustard aphid.
II) Minor: Diamond back moth.

v)Soybean:
I) Major: Pod borer, Jassids, Grey weevil,spodoptera.

vi)Caster:
I) Major: caster capsule borer, caster semilooper.
II) Minor: Caster white fly.

vii)Sesame:
I) Major: Til hawk moth, pod sucking bug.

viii)Linseed:
I)Major: Gall-fly
II)Minor: Whitefly & jassids.

ix)Cotton crop:
I) Major: bollworm complex & cotton jassid , Red cotton bug.
II)Minor: Cotton leaf roller, Cotton stem weevil, mealy bug.

Unit-IV- Pests of Forage crops: (15)

a)Lucerne or Alfa-alfa:
I)Major: Aphids, Cutworm, Armyworm. II)Minor:
White spotted flea beetle.

b)Bersim:
I) Major: gram pod borer, Hairy catterpillar, Spotted alfalfa aphid.
II) Minor: Red pumpkin beetle, Grass hopper.

c)Pest of Sugarcane:
I) Major:-Stem borer complex, White grubs, White fly, Sugarcane white woolly aphid
II) Minor:-Army worm, Mites, Pyrilla ,Termites.

Reference Books :

1.Handbook of pest management in Agriculture by Pimental.

2.Principles of insect pest management by Dhaliewal and Arora.

3.Agricultural pest of india & south East Asia by A.Satwal.

4.Introduction to Fungi-S.SundarRajan

5.Mollicutes and Plant Diseases –S.R.Mishra

6.Hand Book Of Agriculture-ICAR Publication

7.Biopesticides and Pest Management-G. S. Dhaliwal and O.Koul

8.Botanical Pesticides in the Management Of Post –Harvest Fruit Diseases-P.Tripathi

9.Alternatives To Chemical Pesticides In Pest Management-H.C.L.Gupta,Ashok Kumar,O.P.Ameta

PRACTICAL-VI : Life Science-III (BASED ON PAPERS XII-A.)

1. Rearing of pest species. (3 to 4 species).

2. Study of life cycles of important pests of crop plants
   (as per syllabu at least 2 of each category and laboratory and field diary).

3. Study of the detection of damage caused by pests.

4. Identification of different casts of termites.

5. Study of insectide appliances.
   - 5.1.Single stroke sprayer
   - 5.2.Hand rotatory duster
   - 5.3.Napsak sprayer
   - 5.4.Engine sprayer

6. Collection of Pest stages.

7.Study of Apiculture.

8.Study of Sericulture.

9.Study of Pheromone traps.

10. Field visits and keeping records of insect pests.

11.Any suitable experiment may be added whenever necessary

PAPER-XII-B

DISEASES OF CROP PLANTS-I

(Cereals, oil seeds, Pulses, Cash Crops & Fodder Crops)

Unit-I: Diseases of the cereal plants: **(15)**

(Study of symptoms, Life cycles, Nature of Damage and management)

a)Cereals:

i)Rice: Blast of rice, Helminthosporium disease of rice, False smut of rice, Seeding blight, Udbatta disease.

ii)Sorghum: Rust, Smut, Downy mildew diseases, Grain mold.

iii)Wheat: Rust & Smut diseases, & Root rot.

iv)Maize: Rust, Smut, Blight, Ear rot.

v)Bajara: Rust, Ergot, Downey mildew & Blast disease.

Unit-II: B) Diseases of Oil seed crops: **(15)**

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

ii)Soybean : Rust, Leaf spot, Brown stem rot, Anthracnose, Pod & Stem blight, Fusarial wilt, Rots, Leaf spot diseases.

iii)Sunflower: Rust, Powdery mildew, Downey mildew, Blight,

iv)Safflower: Rust, Root rot.

v)Mustard: White rust, Powdery mildews, Seedling blight, wilt & Rots.

vi)Castor: Rust, Leaf spot.

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

Unit-III- C) Diseases of Cash-cops. **(15)**

i)Cotton : Rust , Wilt, Anthracnose & Blights, Leaf spot ,

ii)Sugarcane: Rust, Smut, Downey mildew, Rots-basal, root, and top, Red rot, GSD

iii) Tobacco: Early blight, Black rot &Shank rot, Wilts

Unit-IV) **(15)**

a) Diseases of Forage crops:

i)Monocots : Maize, sorghum spp., Sudan grass, Pennisetum spp., Fodder grasse (Wild & cultivated)-their diseases like Rusts,Powdery mildew ,Wilts, Blights,,Leaf spots,root rot,root knot.

ii)Legumes : Clover, Lucerne, Bersim, Alfalfa, Sesbania spp, Cow Pea, Leucaen spp.- their **common diseases.** Powdery mildew ,Wilts, Blights, Anthracnose ,root rot, root knot.

b) Diseases of Pulses and vegetables:

Peas-Chickpea, Pigeon pea, CowPea,

Grams- green gram, Black gram,

Beans –Lima,Broad bean,French bean.

Common diseases.: Rusts, Powdery mildew, Wilts, Blights, Anthracnose, Root rots,Root knots.

Reference Books :

1) Plant pathology by G.N.Agrios.
2) Fungi & plant diseases ,by Mundkur B.B.1995.
3) Tropical plant diseases by Turston H.D.
4) Pathological problems of economics crop plants & their management by Paul Khurana, S.M., 1998.
5) Diseases of millets by Ramkrishnan T.S. I.C.A.R.publ. New Delhi.
6) Fungal diseases of rice in India by Padmanabhan S.Y. I.C.A.R.publ., Delhi.
7) Plant Pathology-G.P.Gupta
8) Experiments in Microbiology,Plant Pathology and Biotechnology-K.R.Aneja.
9) Seed Borne Diseases: Ecofriendly Management-Arun Arya,Cecilia Monaco.
10) Introduction to Fungi-S.SundarRajan
11) Mollicutes and Plant Diseases –S.R.Mishra
12) Molecular Plant Pathology- Lakshman Desai
13) Plant Diseases-S.Ahuja
14) Virus and Plant Diseases-S.R.Mishra
15) Text Book Of Plant Diseases-G.P.Gupta
16) Crop Diseases and Their Control-Mangat Rai
17) Plant Diseases-Rajani Sharma
18) Modern Plant Pathology-K. S. Bilgrami and H. S. Dube
19)Integrated Diseases management and plant health by Gupta V.K.& Sharma R.C.
20)Diseases of millets by Ramkrishnan T.S. I.C.A.R.publ. New Delhi.

PRACTICAL-VI :Life Science-III (BASED ON PAPERS XII-B.)

1) Study of Fungal diseases of Cereals: at least 1 or 2 of each crop (locally available.)

2) Diseases of Oil seed crops: at least 1 or 2 of each crop (locally available.)

3) Diseases of Cash-crops: at least 1 or 2 of each crop (locally available.)

4) Diseases of Forage crops, Pulses and Vegetables: at least 1 or 2 of each crop (locally available.)

5) To calculate VI (Virulence index) at least of two plant diseases.

6) Separation and identification of sugars & Organic acids from healthy and infected plant parts.

7) Estimation of Phenol from infected and healthy plant parts.

8) Isolation of Fungi from the air by Agar plate method.

9) Isolation of Microbes from phylloplane.

10) Collection and submission of diseased plant parts.

11)Any suitable experiment may be added whenever necessary.

AGROCHEMICALS AND PEST MANAGEMENT
To be Implemented From June-2016
M.Sc. Part-II (Semester-IV)

SUBJECT:-AGRO-BASED MARKETING MANAGEMNET
Paper-XIII

Unit-1-INTRODUCTION OF MARKETING:- **8**

Meaning, Scope, Importance and function of Marketing.

Marketing Planning,Nature,Process and Content of Marketing Plan

Traditional Marketing Vs Modern marketing.

Unit-2 **14**

Marketing Mix

Product,Price ,Promotion,

Place,People,Process

physical Evidence

Use of 7ps in Agro-chemical and Pest Management.

Unit-3 **14**

ROLE MARKETING IN AGRO-BASED BUSINESS.

Role of marketing in agro-based business.

Problems of Agro-based Marketing.

Essential of effective Agro-based marketing.

Recent trends in Agro-based marketing management.

Factors influencing Agro-based marketing management.

Unit- 4 **13**

MARKETING ENVIRONMENT AND MARKETING SEGMENTATION.

Economic Environment ,Political Environment,Technical Environment,Socio-cultural Environment
Types of market,Bases OF Market segmentation. Target marketing
Impact of changing marketing environment on Agro-based business.
Dealing with competition.

Unit-5 **11**

CONSUMER BEHAVIOUR IN AGRO –BASED BUSINESS.

Factors determining the consumer Behaviour.

Importance of consumer beahviour in Agro-based business

Explain the buying process.

Types of consumer

- **Reference books-**

1)Marketing management-philip kotler

2)Agri-culture marketing-premjit Sharma

3)Marketing Management:-Josph

4)service marketing- vasanti venugopal,raghu

5)Agri-culture marketing-s.s.achraya (oxford publication)

PAPER-XIV

ADVANCES IN PEST CONTROL-II

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

Biorational and other innovative approaches: Introduction, chemicals based on insect cuticle chitine, Protein chemicals: based on Endocrine system- Brain, Juvenile and moulting hormones, chemicals based on communication system: Allelochemicals and pheromones.

Unit-III **(15)**

a) Miscellaneous Approaches:

Light activated pesticides, Pro-pesticides, genetic control, and chemosterilants ,Chemicals with new mode of action.

b)Current status of Biorational use- insect growth regulators &semiochemicals.

Unit-IV **(15)**

Biotechnology approaches in pest management: Introduction, recent advance in use of fungi, viruses and Bt. Methodology in Biotechnology, somaclonal variability and genetic engineering, transgenic plants microbial origin & protenase inhibitor.

Reference Books

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 And Books Mentioned In Paper-X

PRACTICAL-VIII : Life Science-IV

(Zoology)

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 thuriengnisis
- b.Beauveria bassiana
- c.Apenteles sp.
- d.Bracon sp.
- e.Nematodes.

6..Any suitable experiment may be added whenever necessary

PRACTICAL- VII: Chemistry-IV

Pesticide synthesis (Chemistry)

1. Preparation of 2,4-D.
2. Dimethyl Phthalate
3. Synthesis of Phthalimide
4. Benzal acetophenone
5. 1-Naphthoxyacetic acid
6. Phenyl Urea
7. Preparation p-Nitroacetanilide.
8. Phenyl hydrazide
9. Preparation of Phthalanilic acid.
10. Preparation of Ziram.
11. Preparation of Salicylanilide.
12. Preparation of Nabam, Ferbam, Zineb, Maneb.
13. Colorimetric determination of parathion.
14. Colorimetric determination of vanadium in soil sample.
15. Ion exchange chromatographic analysis of Copper, Zinc and Cobalt.
16. Estimation of Vanadium content from soil.
17. Determination of Quinalphos content.
14. Isolation of caffeine from tea dust.
18. Isolation of β-carotene from carrots
19. Isolation of eujenol from clove oil.
20. Isolation of limonene from citrus fruits.
21. Interpretation of IR and PMR spectra of pesticides.
22. Any other suitable experiment may be added when required.

REFERANCE BOOKS

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

PAPER-XV

MANUFACTURE OF AGROCHEMICALS

Unit-I: **(15)**

Types of unit operations & the study of the following:

Extraction: Principles, equipment of solid-liquid and liquid-liquid extraction.

Evaporation: Purpose, operation of multiple effect evaporators.

Distillation: Fractional distillation, plate and packed columns steam distillation of Azeotropes.

Absorption: Gas absorption in towers.

Filtration: Types of filters, working of centrifuge.

Crystallization: Purpose, Batch and contaminates crystallizers.

Drying: Types of dryers, working of compartment tray and spray dryers.

Unit-II **(15)**

a) Quality control and R&D: Quality control concept, R&D laboratory specifications, ASTM, BIS and ISI specifications and standards.

b) Small Scale Industry: Administration, planning of small scale units economics, licenses, marketing of Agrochemicals, marketing research, man-power, HRD.

c) Neonicotinoid Insecticides: Study of following w.r.t. synthesis, mode of action, environmental effects and applications of: 1) Imidacloprid 2) Thiacloprid 3) Acetamiprid 4) Thiamethoxam.

Unit-III: **(15)**

a) Retrosynthetic analysis and synthesis of pesticides: Retrosynthetic analysis, synthon approaches, synthetic equivalents, types of disconnections, chemo selectivity, Retrosynthesis of : 2,4-D, Endosulphan, IAA and Captan.

b) Study of following fungicides w.r.t. synthesis, mode of action, environmental effects and applications of: Metalaxyl, Thiophenate methyl and Chlorothalonil.

Unit-IV: **(15)**

a) Manufacture of Pesticides and other Agrochemicals:

(Unit processes are to be discussed as they occur in the sequences) typical representative compounds like Captan, dimethoate, Phosphamidon, Maneb and Agro grade sulfur be chosen for detailed study.

b) Occupational Health Hazards and their control in Agrochemicals

Industries: Handling of chemicals and Pesticides, Occupational Hazards like Asthma and pulmonary diseases, Dermatitis & Cancer. First Aid Treatment, Medical organization for major accident hazard control, importance and various kinds of first aids. Health education for workers. Occupational Health Management and Industrial safety.

Reference Book

1.Unit Operations: W.L.Badger.

2.Unit processes in organic synthesis: P.H.Groggins.

3.Encyclopedia of chemical technology: Kirk and Othmar.

4.A text book of chemical technology: S.D.Shukla &G.N.Pendey.

5.Industrial chemistry by James Kent & Reigel.

6.Survey of industrial chemistry 2 Ed. by P.J.Chenier

7.Industrial chemicals: F.A.Lowheim and M.A.Moran.

8.Encyclopedia of pesticides Manufacture.

9.Industrial organic chemistry

10.Advances in chemical Engeenering-James Wei

11.A Text Book of Chemical Technology-G.N.Pandey

12.Introduction to chemical Engeenering-Walter L Badgar,Juliust T.,Banchero.

13.Shreve's Chemical process industries 5th edition-George T. Austin.

14.Organic Synthesis: The Disconnection Approach 2nd Edition- Stuart Warren and Paul Wyatt (Wiley)

PAPER-XVI-A
PESTS OF CROP PLANT-II
(Fruits, Vegetables & Plantation Crops)

(Pests Biology, Classification, Nature of Damage and integrated control measures)

Unit-I-Pests of Plantation Crops: (15)

a)Coconut:
I) Major: Rhinoceros beetle, Red palm weevil, black headed caterpillar ,mites.
II) Minor: Coconut weevil, White grubs, Rodents.

b)Cashew nut:
I)Major: Leaf miner, Tea mosquito, Thrips.
II) Minor: Stem borer, Scale insects.

c) Rubber trees:
I) Minor: Stem borer, Bark , Scale insects, Termites.

d)Tea plants:
I)Major: Mosquito bug, Bunch Caterpillar.
II) Minor: Thrips, White grub & Leaf feeder.

Unit-II-Pests of Spices and Condiments: (15)

a)Tobacco:
I) Major: Leaf eating Caterpillar, Stem borer, Aphids.
II) Minor: Cut worm, Flea beetle, Bud borer & Nematodes

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

c)Coriander:
I)Major –Cotton white fly, Pentatomid bug
II) Minor: Indigo Caterpillar.

d)Black paper:
Pollu beetle, Mealy bug, Scale insect.

e)Cardamom:
I) Major: Banana aphid, Thrips.
II) Minor: Castor capsule borer, Rhizome weevil.

f) Cinnamon:
I) Major: Butterfly, Tussock Catterpillar.
II) Minor: Leaf miner

g) Chile:
I) Major: Thrips, Mites.
II) Minor: Aphids, Fruit borer, Termites, Nematodes.

h) Onion & Garlic:
I) Major: Onion Thrips.
II) Minor: Onion fly, Cutworms.

i)Betlevine:
I) Major: White fly , Nematodes.
II) Minor: Aphids.

Unit-III-Pests of vegetables: (15)

a) Cabbage, Cauliflower, Nol-Khol, Radish & other cruciferous Vegetable:
I)Major: Diamond back month, Cabbage Semi looper mustard aphid .
II) Minor: Leaf Webber & Cabbage borer.

b) Bringal
I) Major: Shoot & Fruit borer, Jassids aphids.
II) Minor: Stem borer, Melon fruit fly.

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

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

e) Ladys finger:
I) Major: spotted bollworm, Aphids, Cotton Jassids.
II) Minor: Leaf roller.

f) Cucurbits:
I) Major: Pumpkin beetle (red, black & yellow), fruit fly.
II) Minor: Blister beetle, red veg mite, aphids,

g)Sweet potato:
I) Major: Weevils.

h)Sugar beet:
I) Major: Army worm, Leaf Webber, Rodents
II) Minor: Painted bug, Cutworm, Aphids, Thrips.

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

Unit-IV-Pests of fruits & fruit Trees: **(15)**

a)Mango:
I) Major: Mango hoppers, Stem borer, Giant mealy bug, Stone Weevil, Fruit fly
II) Minor: Leaf and Shoot gall insects, Red ants, Termites.

b)Grape vine:
I) Major: Thirps, Flea beetle, Mealybugs.
II) Minor: Leaf hopper, Two spotted spider mite

c) Chicku:
I) Major: Leaf Webber, Mealy bugs,Chiku moth.

d)Pomogranate:
I) Major: Anar butterfly, Fruit sucking moth.
II) Minor: Shoot borer, Mites, Thrips, Scale insects

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

f)Apple:
I) Major: Wooly apple aphid, (Eriosoma spp), Peach leaf curl aphid.

g) Guava:
I) Major: Guava fruit fly, Mealy bugs, Spirling white fly.
II) Minor: Scale insect.

h) Papaya:
I) Major: Aphids & Cotton white fly.
II) Minor: Red spider mite.

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

j) Fig:
I) Major: Jassids, Mealybugs.
II) Minor: Fig borer, Fruit fly.

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

l) Pineapple:
I)Major: Thrips.

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

Reference Books:

1.Agriculture pest of India and Southeast Asia by A. S. Atwal.

2.A textbook of applied Entomology by K. P. Srivastava.

3.Agricultural pest of india & south East Asia by A.Satwal.

4.Hand Book Of Agriculture-ICAR Publication.

5.Biopesticides and Pest Management-G. S. Dhaliwal and O.Koul

6.Botanical Pesticides in the Management Of Post –Harvest Fruit Diseases-P.Tripathi

7.Alternatives To Chemical Pesticides In Pest Management-.C.L.Gupta,Ashok Kumar,O.P.Ameta

8.Books Mentioned in Paper-X and XII-A

PRACTICAL- VIII : Life Science-IV
(BASED ON THE PAPER XVI-A)

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. **Mass production of some important parasitoids** -

5.1. Mass production of *Bracon brevicornis*

5.2. Mass production of *Chelonus blackburnii*

5.3. Mass production of *Trichogramma sp*

6. Study of Ecosystem-
- 6.1.Grassland
- 6.2.Forest
- 6.3.Pond

7.Study of insect association-
- 7.1.Interspecific
- 7.2.Intraspecific

8.Study of Phytophagous Nematode.

9.Study of life cycles of following insect pest groups-
- 9.1.Pest of cereals
- 9.2.Pulses
- 9.3.Sugarcane
- 9.4.Fibre crops
- 9.5.Spices and Narcotics
- 9.6.Fruits and fruit trees

10.Any suitable experiment may be added whenever necessary

PAPER XVI-B
PLANT PATHOLOGY

Unit-I-Fungal diseases of vegetable crops, their symptoms, Life cycle, nature of damage & control measures: (15)

a) Tomato:
1) Blight- *Alternaria solani*
2) Wilt- *Fusarium oxysporium*.

b) Potatoes:
1) Wart of potato- *Synchytrium endobioticum*.
2) Black scurf of tubers –*Rhizoctonia solani*

c)Bhendi:
1) Powdery mildew- *Odium* spp
2) Cercospora disease- *Cercospora* spp.

d) Chilies:
1) Powdery mildew- *Odium* spp.
2) Leaf spot disease- *Cercospora capscia* & Alt. solani

e) Crucifies:
1) Downey mildew- *Peronospora parasitic*.
2) Whit rust- *Alb candida*.

f) Onion:
1) Downey mildew- *Peronospora destructor*, Smut troughs coulee.

g) Peas: 1) Downey mildew- *Peronospora pisi.*

h) Sweet potatoes- Dry Rot- *R.nigricans*.
Fuserial wilt, Pox or soil rot, Java black rot.

i) Cucurbitaceous vegetables: Downey mildew, Powdery mildew, Fruit rot: *Pythium* rot, Stem rot: Diplodia, Root rots, Seedling blight, Wilts, Anthracnose.

j) Suger beet: Leaf spot (*Cercospora*, Ramularia), Black root disease, Downey mildew, Foliage *Rhizoctonia* blight, Rusts *Fusarium* yellows *Sclerotium* root rot, Other root rot (Storage), texas root rot.

k) Peas, Beans & Other Leafy vegetables:
(Coriander, Spinach Fenugreek, Amaranths, Lettuce etc)
Rot-Stem, root & fruit, Anthracnose, Powdery & Downey mildews, Blights wilts.

Unit-II-Fruit trees & Fruit diseases: (15)

i) Mango:

a) Anthracnose of mango- *Colletotrichum gleosporioides.*

b) Fruit root of mango- *Gleosporium ampelofagum*

ii)Apples: Rots: Blue, black, soft, bitter, pink of fungal origin, Powdery Mildew, apple scab, White root rot.

iii) Guava-

Fruit Rot *Gloeosporium pseudo* Delacrox

Black spot disease- *Colletotrichum psidi* Curzi

iv) Grapes:

Anthracnose- *Gloesporium ampleophagum* (Pass) Sacc. (*El.ampelina*) Bitter rot- *Melanconium fulgenium* Botrytis rot- *Botrytis cinerea*.

Doweny and powdery mildew, Black root of fruits, Cotton root Rot, Wilts.

v) Citrus, Lemon & Oranges:

Brown rot – Gloesporium citri Brown watery rot –*Phytopthera palmivora*

Orange rot- *Fusarium .moniliformis*, Orange fruit rot

vi)Coconut: Gray leaf spot – *Pestalotia palmivora*

Wilt- *Ganoderma lucidum*

vii) Chickoo: Leaf spot- *Phamoploeospora indica*

viii) Papaya: Anthacnose- *Colletotrichum gloesporioidus* (Penz) Sacc, Wilt, oily spot Fruit rot- Rhizophus nigricans,

ix)Banana:

Fruit rot –*Colletotrichum musae*, *Fusarium. roseum* (Diamond spot fruit rot),Cigatokka

Leaf spot –*Alternaria alternata*, *Deightoniella torulora, Fusarium oxysporium ,Nigrospora oryzye.*

x)Pomegranate: Brown rot (Storage) –*Phomapsis varsoniana* Sacc, wilt, oily spot.

xi) Figs: Fruit decay- *Rhizophus nigricans* Pink rot- *Trichotheium roseum* (Pers.) Link

xii)Ber: Foliage disease & fruit storage diseases.

Unit-III- Diseases of Forest trees: **(15)**

a)Teak- Rust & Powdery mildew

b)Sisso: Rust, Powdery mildew

c)Bamboo: Rust & Star spot diseases.

d)Eucalyptus: Foliage diseases & Seedling diseases at nursery.

e)Santalum: Powdery mildew & Asterina diseases.

f) Lacuna: Seedling blights.

Unit-IV-Diseases of Ornamental plants: **(15)**

1.Roses: Black spot, Powdery mildew, Cankers, Anthracnose.

2.Gladiolus: Rot of corm, root, Flower blights.

3.Chrysanthemum: Powdery mildew, Rust, Leaf spot, Wilt, Petal blights.

Reference Books:

1.Plant pathology by G.N.Agrios.

2.Pathological problems of economics crop plants & their management by Paul Khurana, S.M., 1998.

3.Fungi & plant diseases ,by Mundkur B.B.1995.

4.Tropical plant diseases by Turston H.D.

5.Integrated Diseases management and plant health by Gupta V.K.& Sharma R.C.

6.Diseases of millets by Ramkrishnan T.S. I.C.A.R.publ. New Delhi.

7.Fungal diseases of rice in India by Padmanabhan S.Y. I.C.A.R.publ., Delhi.

8.Plant Pathology-G.P.Gupta

9.Introduction to Fungi-S.SundarRajan

10.Seed Borne Diseases: Ecofriendly Management-Arun Arya,Cecilia Monaco

11.Plant Diseases-S.Ahuja

PRACTICAL- VIII : Life Science-IV (Based on the Paper-XVI-B)

1.Estimation of protein content under pathogenesis.

2.Estimation of Ascorbic acid under pathogenesis.

3.Estimation of carbohydrates from healthy and infected leaves.

4.Biological oxygen demand and dissolved oxygen.

5.Chemical oxygen demand.

6.Study of Karl-Fisher titration.

7.Study of fungal diseases(at least one/two of the plants as per syllabus.)

- 7.1.Field diseases of fruits and fruit trees.
- 7.2.Plantation crops
- 7.3.Forest trees
- 7.4.Ornamentals

8.Large scale production of Entomopathogenic Fungi-

- 8.1.*Beauveria bassiana*

9.Collection of diseases from field and its submission.

10.Estimation of Lycopene contents

11. Field visits and keeping record books.

12. Any suitable experiment may be added whenever necessary