

# **SHIVAJI UNIVERSITY, KOLHAPUR.**



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(2014) with CGPA-3.16

## **Revised Syllabus For Bachelor of Science (part III) Botany- Plant Protection**

**[Syllabus to be implemented from June 2015]**

**A) SHIVAJI UNIVERSITY, KOLHAPUR****Revised Syllabus For Bachelor of Science**

B.Sc. III Botany (Optional), Seed Technology (Vocational), Plant Protection (IDS)

**GENERAL OBJECTIVES OF COURSE**

(As applicable to Degree Course)

**OBJECTIVES: -**

- To impart knowledge of Science is the basic objective of education.
- To develop scientific attitude is the major objective to make the students open minded, critical, curious.
- To develop skill in practical work, experiments and laboratory materials and equipments along with the collection and interpretation of scientific data to contribute the science.
- To understand scientific terms, concepts, facts, phenomenon and their relationships.
- To make the students aware of natural resources and environment.
- To provide practical experience to the students as a part of the course to develop scientific ability to work in the field of research and other fields of their own interest and to make them fit for society.
- The students are expected to acquire knowledge of plant and related subjects so as to understand natural phenomenon, manipulation of nature and environment in the benefit of human beings.
- To develop ability for the application of the acquired knowledge to improve agriculture and other related fields to make the country self reliant and sufficient.
- To create the interest of the society in the subject and scientific hobbies, exhibitions and other similar activities.

**DURATION: -**

- The course shall be of full time course.
- The duration of course shall be of three years.

**PATTERN: -**

- Pattern of Examination will be semester pattern.

**ADMISSION PROCEDURE: -**

As per guidelines obtained from Shivaji University, Kolhapur by following rules and regulations regarding reservations by Govt. of Maharashtra.

**MEDIUM OF INSTRUCTION: -**

The medium of instruction shall be in English.

**STRUCTURE OF COURSE : -****B.Sc. III – Plant Protection (IDS)**

Sr.No.	Semester	Paper Number	Theory	Internal	Total
	Semester-V				
01		Botany paper IX	40	10	50
02		Botany paper X	40	10	50
03		Plant Protection paper V	40	10	50
04		Plant Protection paper VI	40	10	50
	Semester-VI				
05		Botany paper XIII	40	10	50
06		Botany paper XIV	40	10	50
07		Plant Protection paper VII	40	10	50
08		Plant Protection paper VIII	40	10	50
09	Practical's annual pattern	Practical I (Botany)	--	--	50
10		Practical II (Botany)	--	--	50
11		Practical III (PP)	--	--	50
12		Practical IV (PP)	--	--	50
		<b>Total</b>	--		<b>600</b>

**SCHEME OF TEACHING:-****B.Sc. III Plant Protection (IDS)**

Sr. No.	Paper /Practical	Teaching Hrs. Per Week			
		L	T	P	Total
	<b>Semester V</b>				
1	<b>Paper IX (Botany)</b>	3	-	-	12
2	<b>Paper X (Botany)</b>	3	-	-	
3	<b>Paper V (Plant Protection)</b>	3	-	-	
4	<b>Paper VI (Plant Protection)</b>	3	-	-	
	<b>Semester VI</b>				/
05	<b>Paper XIII (Botany)</b>	3	-	-	12
06	<b>Paper XIV (Botany)</b>	3	-	-	
07	<b>Paper VII (Plant Protection)</b>	3	-	-	
08	<b>Paper VIII (Plant Protection)</b>	3	-	-	
09	<b>Practical I (Botany)</b>	-	-	5	20
10	<b>Practical II (Botany)</b>	-	-	5	
11	<b>Practical III (Plant Protection)</b>	-	-	5	
12	<b>Practical IV (Plant Protection)</b>	-	-	5	
	<b>Total</b>	12	-	20	32

**SCHEME OF EXAMINATION: -**

- The theory examination shall be at the end of each semester.
- Each theory shall be carry 40 marks per paper per semester.
- There shall be an internal evaluation of 10 marks per paper per semester.
- The evaluation of performance of the students in the theory papers shall be on the basis of semester examination of 50 marks per paper per semester
- Question papers will be set in the view of the / in accordance with the entire syllabus and preferably covering each unit of the syllabus.

**STANDARD OF PASSING: -**

As prescribed under rules and regulations for each degree course.

**NATURE OF QUESTION PAPER COMMON MENTIONED SPERATELY  
(Syllabus based on semester pattern)****EQUIVALENCE IN ACCORDANCE WITH TITLES AND CONTENTS OF  
PAPERS-(FOR REVISED SYLLABUS)  
(Introduced from June 2015 onwards)**

Old Syllabus (Semester pattern)			New Syllabus (Semester pattern)		
Semester No.	Paper No.	Title of Old Paper	Semester No.	Paper No.	Title of New Paper
V	IX	Biology of Cryptogams.	V	IX	Biology of Non Vascular Plants and Palaeobotany
	X	Microbiology and Plant Pathology		X	Genetics and Analytical Techniques in Plant Science
	Plant protection Paper V	Plant Pathogens and their Management.		Plant protection Paper V	Plant Pathogens and their Management.
	Plant protection Paper VI	Plant Insect Pests and their Management.		Plant protection Paper VI	Plant Insect Pests and their Management.
VI	XIII	Genetics	VI	XIII	Biology of Vascular Plants
	XIV	Microbial Genetics, Plant Breeding and Biostatistics		XIV	Microbiology and Plant Pathology
	Plant protection Paper- VII	Field Techniques In Plant Protection.		Plant protection Paper- VII	Field Techniques In Plant Protection.
	Plant protection Paper-VIII	Laboratory Techniques in Plant Protection.		Plant protection Paper-VIII	Laboratory Techniques in Plant Protection.

**SHIVAJI UNIVERSITY, KOLHAPUR.**  
**SEMESTER PATTERN REVISED SYLLABUS**  
**PLANT PROTECTION**  
**(TO BE IMPLEMENTED FROM JUNE 2015)**

**B.Sc. III/SEMESTER- V**

**PLANT PROTECTION PAPER –V:**  
**PLANT PATHOGENS AND THEIR MANAGEMENT.**

**UNIT 1:- PLANT PATHOLOGY (6)**

**Sub-unit 1.1** Plant Pathology, History, losses due to pathogens, importance of study of plant pathology

**Sub-unit 1.2** Contribution of Indian Plant Pathologists (any four)

**Sub-unit 1.3** Contribution of Research institutes

- a) IARI (Indian Agricultural Research Institute)
- b) ICRISAT (International Crop Research Institute for Semi Arid Tropics).
- c) Agharkar Research Institute Pune

**UNIT 2:-PLANT DISEASES: (Cereals, pulses, vegetables and oil seed crops) (10)**

**Plant diseases with respect to symptoms, causal organism, disease cycle and their management of following plants.**

**Sub unit 2.1:** Cereals : a) Wheat –*Alternaria* leaf blight b) Jowar- Rust

**Sub unit 2.2:** Pulse: Bean-Leaf spot

**Sub unit 2.3:** Vegetables:

- a) Tomato-Early blight of tomato
- b) Chilli-*Cercospora*-leaf spot
- c) Onion- *Aspergillus*- Black rot

**Sub unit 2.4:** Oil seed crop : Sunflower: Powdery mildew

**UNIT 3:-PLANT DISEASES:**

(Cash crops, ornamentals, Fruit Plants and forest trees) (10)

**Plant Diseases with respect to symptoms, causal organism, disease cycle and their management of following plants.****Sub unit 3.1 :** Cash crops: a) Sugar cane- Leaf spot disease.

b) Potato -Early blight

**Sub unit 3.2 :** Ornamentals : a Rose / *Nyctanthus* - Powdery mildew**Sub unit 3.3 :** Fruit plants a) Sigatoka ( Leaf spot) of Banana.

b) Guava -Anthracnose

**Sub unit 3.4 :** Forest trees: a) Rust on Bamboo b) Sooty mold on Teak**UNIT 4:-DISEASES MANAGEMENT:**

(14)

**Sub-unit 4.1:** Definition, classification, characters of an ideal fungicide.**Sub-unit 4.2:** Study of fungicides with respect to Properties, formulations, methods of application, mode of action and uses.

a) Sulphur fungicides – i) Organic – Thiram.

b) Copper Fungicides –i) Copper Oxychloride

c) Mercury fungicides –i)Ceresan

d) Heterocyclic Nitrogenous Compounds - Captan.

e) Benzene Compounds – Dexon.

f) Antibiotics – Streptomycin

g) Systemic Fungicides - i) Carbendazim(Bavistin)

ii) Vitavax

**Sub-unit 4.3:** Biological Control of Plant Diseases

Definition, Importance, Biological control agents and their role in plant disease control

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**Total = 40**

**SEMESTER V****PLANT PROTECTION PAPER VI  
PLANT INSECT PESTS AND THEIR MANAGEMENT****UNIT 1 :- PLANT INSECT PESTS****(14)**

Study of major pests with reference to scientific name, marks of identification, host range, life cycle, perpetuation, nature of damage and management.

**Sub-unit 1.1:** Cereals: a) Paddy- Leaf hopper b) Jowar- Army worm.

**Sub-unit 1.2:** Pulses: a) Green Peas- Pod borer.b) Beans- Aphids

**Sub-unit 1.3:** Vegetables : a) Bhendi-Fruit borer b)Cabbage-Caterpillar

**Sub-unit 1.4:** Fruit: a) Custard apple -Mealy bugs b) Guava -White flies

**Sub-unit 1.5:** Ornamentals: a) Rose -Aphids

b) Chrysanthemum /or any flowering plant – Leaf miner

**Sub-unit 1.6:**Polyphagus insect pests :a) Termites b) Jassids

**UNIT 2 :- INSECTICIDES****(09)**

**Sub-unit 2.1:** Definition, classification ,characters of an ideal insecticide.

**Sub-unit 2.2:** Study of major insecticides with respect to properties, formulations, methods of application, mode of action and uses.

A:	Plant origin insecticides- Chlorinated	a) Azadirachtin	b) Nicotin
B:	hydrocarbons –	a) Lindane	
C:	Organophosphate –	a) Malathion	b) Phorate.
D:	Carbamate –	a) Carbaryl	
E:	Synthetic Pyrethroids.	a) Cypermethrin	
F:	Nematicides :	a) Nemagon	b) Vapam
G:	Rodenticides :	a) Bromodiolone	

**UNIT 3:- IMPORTANCE OF TOXICOLOGICAL STUDY****(09)****Sub-unit 3.1: Toxicity**

- a) Definition, types: - acute and chronic
- b) L.D.-50
- c) Colour code
- d) Antidotes
- e) General precautions regarding to uses of pesticides
- f) Effect of pesticides on human being

**Sub-unit 3.2: Hazards of insecticides**

- a) Symptoms of pesticide poisoning during manufacture and application
- b) Food contamination and residue pesticides- vegetables and fruits.

**UNIT 4:- CHEMICAL PEST CONTROL AND ENVIRONMENT****(08)****Sub-unit 4.1 :** Pollution of soil, water and air**Sub-unit 4.2 :** Limitations of Chemical control.**Sub-unit 4.3 :** Biological control of insect pests:**Sub-unit 4.4 :** Pesticide legislation in India**-----  
Total (40)**

**SEMESTER VI**

**PLANT PROTECTION PAPER –VII**  
**FIELD TECHNIQUES IN PLANT PROTECTION**

**UNIT 1:-CONCEPT OF PLANT PROTECTION (11)**

**Sub-unit 1.1: Plant Protection as a technique, scope, importance, equipments used in Plant protection.**

**Sub-unit 1.2: Seed treatment :**

- a) Concept, objectives of seed treatment.
- b) Traditional and modern methods of seed treatment.
- c) Principle, construction and working of seed dressing equipments.(any two)

**Sub-unit 1.3 :Soil sterilization :**

- a) Objectives.
- b) Traditional and modern methods of soil sterilization and soil solarization.
- c) Soil sterilization equipment –soil injector and chemicals used.
- d) Role of soil sterilization in Polyhouse farming.

**UNIT 2:- PESTICIDE APPLICATION EQUIPMENTS (11)**

**Sub-unit 2.1: Study of following sprayers with respect to principle & working.**

- a) Pneumatic air pump – Hand pump
- b) Power operated – Mist blower cum duster
- c) Haudrallic energy pump – Foot pump.
- d) Types of nozzles :Haudrallic energy, kinetic energy,
- e) gaseous energy centrifugal energy.
- f)Ultra low volume sprayer

**Sub-unit 2.2: Care and maintenance of plant protection equipments and their importance.**

**UNIT 3 :-PLANT CLINIC, MUSEUM AND MANAGEMENT (10)**

**Sub-unit 3.1 : Plant Clinic**

- a) Objectives. importance and requirements .
- b) Present status of Plant clinic

**Sub-unit 3.2 : Plant protection museum :-**

- a) Concept, collection and preservation of pathological, entomological specimens and their maintenance.
- b) Role of museum in awareness of farmers.

**Sub-unit 3.3 : Management :-**

- a) Integrated Pest Management (IPM)
- b) Integrated Disease Management (IDM)

**UNIT 4: BREEDING TECHNIQUE FOR DISEASE RESISTANCE (08)****Sub-unit 4.1 :** Introduction , Selection**Sub-unit 4.2 :** Irradiation and Mutation breeding**Sub-unit 4.3 :** Back cross method - limitations, advantages and achievements of these methods.-----  
**(40)**

**SEMESTER VI****LABORATORY TECHNIQUES IN PLANT PROTECTION  
PAPER VIII****UNIT 1 :- SOIL MICROBIOLOGY & PATHOLOGY (07)****Sub-unit 1.1 Soil Microbiology**

- a) Soil microorganisms, definition, common examples.
- b) Methods of studying soil microorganisms:-
  - i) Respirometer
  - ii) Burried slide method.
- c) Role of soil microorganism in maintaining soil health.

**Sub-unit 1.1 Soil pathology:-**

- a) Soil sickness, causes and remedial measures.
- b) Role of soil pathogens in plant pathology.

**UNIT 2 :- SEED AND MARKET PATHOLOGY (10)****Sub-unit 2.1 Seed Pathology :-**

- a) Concept and importance of seed pathology
- b) Seed borne pathogens ,methods to study seed borne pathogens.
- c) Seed health management

**Sub-unit 2.2: Seedling mortality in nursery, causes and management****Sub-unit 2.3:Market pathology :-**

- a) Concept ,need and significance.
- b) Techniques involved in the study of market pathology.
- c) Study of locally available post harvest diseases of fruits and vegetables

**UNIT 3 :- PATHOPHYSIOLOGY AND CULTURE TECHNIQUES****Sub-unit 3.1 : Pathophysiology :- (10)**

- a) Concept and causes for changes in physiology of diseased plant.
- b) Paper Chromatographic techniques in studying pathophysiology.

**Sub-unit 3.2 :Culture techniques :-**

- a) Importance and utility in plant pathology.
- b) Culture media for isolating specific pathogens (two from each fungi and bacteria).
- c) Axenic culture for rust.



## PLANT PROTECTION

### B.Sc. III- Practical – III

( Based on Paper - V & VI)

#### **Unit 1 :-**

Study of plant diseases as per theory syllabus with respect to host, symptoms, causal organism, any one stage in the life cycle and management.

1. Diseases of cereals.
2. Diseases of pulses.
3. Diseases of vegetables.
4. Diseases of oil seed crops.
5. Diseases of cash crops.
6. Diseases of ornamentals.
7. Diseases of fruit plants
8. Diseases of forest trees.

#### **Unit 2 :-**

Study of fungicides as per theory syllabus with respect to properties, formulations, colour code, methods of application, mode of action, antidote and uses.

9. Sulphur, Copper, Mercury, Heterocyclic nitrogenous compounds.
10. Benzene compounds, Antibiotics, Systemic fungicides.
11. Preparation of Bordeaux mixture, Burgundy mixture and Bordeaux paste.

#### **Unit 3 :-**

Study of plant insect pests as per theory syllabus with respect to marks of identification, life cycle stages ,nature of damage and management.

12. Insect pests of cereals
13. Insect pests of pulses.
14. Insect pests of vegetables.
15. Insect pests of fruits.
16. Insect pests of ornamentals.
17. Polyphagous insect pests.

#### **Unit 4 :-**

18- 20. Study of Insecticides as per theory syllabus.

With respect to active ingredients, properties colour code, formulation, mode of action method of application, antidotes and uses.

21. Study of entomogenous fungi as a biological control agent  
a) *Aspergillus*      b) *Cladosporium*      c) *Beauverria*.
22. Study of insects as biological control *Diphaaphidivora*, *Lady bird beetle*
23. Protective appliances used during pesticide applications.

#### **Unit 5:-**

24. Report of a visit to Pesticide industry / Agricultural institute./Green house.

**Practical – IV**  
**(Based on Paper – VII & VIII)**

**Unit 1:-**

1. Study of plant protection equipments with respect to principle, parts, working, uses and maintenance – any two available spray pumps.(excluding knap sack sprayer and duster.)
2. Study of seed dressing techniques by using traditional methods and seed dresser .
3. Study of techniques involved in collection, killing, preservation and preparation of insect boxes ( collection and submission of pests of local crops is expected.)
4. Study of life cycle of any suitable pest by rearing in laboratory (two or three Life cycle stages.)

**Unit 2:-**

5. Study of Hybridization technique with respect to emasculation, pollination, bagging, labelling in Maize ,*Hibiscus* / Cotton / Bhendi.
6. Use of Aerobiological technique to study fungal flora of different localities ( by gravity slide method.)
7. Study of rhizosphere fungi by culture technique from different soil samples.
8. Study of any two diseases of nursery plants.

**Unit 3 :-**

9. Study of Relative Water Content (RWC) of healthy and infected leaf tissue.
10. Measurement fungal spore by the technique of Micrometry and Data entry in computer, it's presentation by various statistical diagrams.
11. Sketching of fungal spores with Camera Lucida technique.
12. Detection of sugars from healthy and infected leaves by using circular paper chromatography technique.
13. Detection of organic acids from healthy and infected leaves by using circular Paper chromatography technique.
14. Estimation of chlorophylls and carotenoids with the help of colorimeter from healthy and infected leaf tissue.
15. Microphotography technique and it's presentation in computer

**Unit 4 :-**

16. Study of fungi from locally available seed samples.
17. Study of market pathology of fruits from local market.
18. Study of *Trichoderma* culture.
19. Preparation of special culture media for isolation of soil fungi.
20. Agricultural recent techniques in insect management –Pheromone traps, E.M. Solution and other botanical pesticides.
21. Effect of fungicides Thiram and Blitox on culture of soil mycoflora.

**Unit 5 :-**

23. A report on survey of local diseases and pests by using field visit note book.

### Practical Examination Instructions:-

- A) Each candidate must produce a certificate from the Head of the Department stating that he /she completed practical course in satisfactory manner recommended by Board of Studies and laboratory journal has been properly maintained. Every candidate must have recorded his /her observations in the laboratory journal and written report on each exercise performed. Every journal is to be checked and signed periodically by a teacher in-charge and certified by the Head of the Department at the end of the year. Candidates are to produce their journals at the time of practical examination. Without which he /she shall not be allowed to appear for practical examination.
- B) Excursions for the study of plant diseases and pests in local areas should be arranged. One of the excursions shall be to a Research Institute or Agricultural centers actively engaged in plant protection studies for not more than five days. There shall be one teacher in-charge for not more than 16 students and one additional lady teacher, one field collector and one peon are to be allowed for study Tour. T.A. and D.A. be paid to the concerning staff as per University rules.
- C) Candidates shall be required to present the following at the time of Practical examination.
1. Certified Laboratory Journal.
  2. Tour report / visit report / Field visit book.
  3. Submission of preserved or dry specimens of diseased plants; preserved insect pests and herbaria of weeds.
  4. The candidates will be orally examined in their submission work.

### D) Distribution of marks for Practical's.

#### Practical III Marks

1.	Plant diseases.	10
2.	Plant pests.	07
3.	Preparation of fungicide	04
4.	Identification	14
5.	Report of Industrial or Agricultural Institute visit.	05
6.	Journal	05
7.	Submission of Pests, diseases of crops And weeds.	05
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		50

#### Practical –IV Marks

1.	Pathophysiology	18
2.	Microphotography/ Micrometry/Camera Lucida	05
3.	Market pathology / Soil pathology/ Seed pathology / Aerobiology.	05
4.	Identification	12
5.	Field visit notebook	05
6.	Journal	05
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		50

**SHIVAJI UNIVERSITY, KOLHAPUR**  
**B.Sc. III (SEMESTER PATTERN) EXAMINATIONS,**  
**MARCH / APRIL 2016 onwards**

**PLANT PROTECTION PRACTICAL - III**  
(based on paper V & VI)

Time :- 5 hours

Total Marks : 50

11.00 a.m. onwards

N.B.:- Draw neat labelled sketches wherever necessary.

1. Identify and describe symptoms and causal organism of specimens A and B. Leave your slide for inspection. (10)
2. With the help of marks of identification, identify and describe specimen C and D . Comment on nature of damage and life cycle stage. (7)
3. Prepare the fungicide E as per instructions. (4)
4. Identification.
  - i) Comment on the mode of action and uses of specimen E & F. (5)
  - ii) Identify and comment on specimen G. (2)
  - iii) Comment on the use of specimen H. (2)
  - iv) Comment on slide / specimen I & J. (5)
5. Report of a Visit and Journal. (10)
6. Submission. (5)

**SHIVAJI UNIVERSITY, KOLHAPUR**  
**B.Sc. III (SEMESTER PATTERN) EXAMINATIONS,**  
**MARCH / APRIL 2016 onwards**  
**PLANT PROTECTION PRACTICAL- IV**  
(based on paper VII & VIII)

Time :- 5 hours

Total Marks : 50

11.0 a.m. onwards

1. With the help of paper chromatography technique spot out organic acids / sugars from the given leaf extracts **A** and **B**. (10)
2. Estimate the Chlorophyll's / Carotenoids from the given samples '**C**' and '**D**' (8)
3. Sketch the Camera Lucida drawing / Measure the fungal spore dimension of sample '**E**' by using Micrometry method/ Microphotography technique (5)
4. Identify and describe fungal specimens from culture '**F**' of fruit / seed /air (5)
- 5 Identification. (12)
  - i) Comment on working and uses of '**G**'.
  - ii) Identify and describe the stage '**H**' in hybridization technique.
  - iii) Identify and comment on uses of stain '**I**'.
  - iv) Comment on the plant protection technique '**J**'.
- 6 **Field visit notebook.** (5)
- 7 **Journal.** (5)

## References :-

1. Principles and Procedures of Plant Protection –S.B. Chattopadhyay.
2. A Hand book of Plant Protection - D. Seshagiri Rao.
3. Chemistry of Insecticides and Fungicides – U.S. Sreeramulu.
4. Plant Protection - Mukundan -
5. Systemic Fungicide - S.C. Was
6. Fungicides by- Nene & Thapliyal.
7. Fungi and Plant diseases –B.B. Mundkur.
8. Text book of Modern Plant Pathology - K.S. Bilgrami and H.C. Dube.
9. Plant diseases - R.S. Singh.
10. Essentials of Plant Pathology – V.N. Pathak.
11. Plant Pathology –R.S. Mehrotra.
12. Introduction to principle of Plant Pathology- R.S. Singh.
13. Plant Pathology – Agrios.
14. Principles of Plant breeding – H.K. Choudhary.
15. Weed Science – Thakur.
16. Modern Weed Science – O.F. Gupta & P.S. Lamba.
17. Principles of Weed Science - V.S.Rao.
18. Manual of Weed Science – N.C. Joshi.
19. Elements of Economic entomology– Vasantraj Devid and T. Kumar swami.
20. Agricultural Pests of India and South East Asia – A.S. Atwal.
21. General and applied Entomology – K.E. Nayar, B. V. David.
22. Crop protection recommendations published by Department of Agriculture M.S.Pune
23. Plant protection recommendations for Horticulture crops-Directorate of Horticulture M. S. Pune –411005.
24. Crop production and field experiments- Vaidya , Sahastrabudhe and Khuspe.
25. Plant diseases in India- G. Rangaswami.
26. Diseases of cereals and millets – T.S. Ramkrishna.
27. Principles of Plant disease control- S.A. J. Tarr,1971.
28. Scientific principles of crop protection – Mortin, Hubert & David Woodcock – Edward Ashold USA.
29. Entomogrow nematodes- Ficheer G. O. Jr.
30. Applied plant Biotechnology – Rao, Dr. S. Ignacimlie, Tak Maegrere.
31. Advances in Mycology & Plant Pathology – R. Chaudhari
32. Text book of Fungi O.P. Sharma – Tata McGraw
33. Elements of Economic Entomology-David & Kumar Swami.
34. Text book of toxicology – Shrivastava.
35. Toxicology of Insecticides – Matsmura.
36. Plant orgin insecticides.
37. Recent Advances in Host Plant Resistance –S. S. Dhahiliwal
38. Introduction to In Pest management – G.S. Ahaliwal.
39. Emerging trends in Biological control – T.N. Ananthkrisham