

Rayat Shikshan Sanstha's
**Yashwantrao Chavan Institute of Science,
Satara
(Autonomous)**

**New Syllabus For
Bachelor of Science
Part – III
Plant Protection**

Academic Year 2023 – 2024

Yashavantrao Chavan Institute of Science, Satara (Autonomous)

Syllabus for Bachelor of Science (B. Sc.) Part – III

1. TITLE: Plant Protection

2. YEAR OF IMPLEMENTATION: 2023 – 2024

3. PREAMBLE:

The B. Sc. III Plant Protection course under autonomy will be effective from the academic year 2023– 2024. It has been prepared keeping in view the unique requirements of B. Sc. Plant Protection students. The contents have been drawn up to accommodate the widening horizons of the discipline of biological sciences. The emphasis is to provide students the latest information along with due weightage to the concepts of classical botany so that they are able to understand and appreciate the current interdisciplinary approaches in the study of plant sciences and its role in societal development. The course content also lists new practical exercises so the students gets a hands on experience of the latest techniques that are currently in use. The course will also inspire students to pursue higher studies in botany, for becoming an entrepreneur and enable students to get employed in plant based industries.

4. GENERAL OBJECTIVES OF THE COURSE:

1. To impart the knowledge of science is the basic objective of education.
2. To develop scientific attitude among the students and to make the students open minded, critical and curious.
3. To develop skill in practical work, experiments and laboratory materials.
4. To understand scientific terms, concepts, facts, phenomenon and their relationships.
5. To make the students aware of natural resource and environment.
6. To enable the students to acquire knowledge of plants and related subjects so as to understand nature and environment in the benefit of human beings.
7. To develop ability for the application of acquired knowledge to improve agriculture and related fields to make the country self-reliant.

5. DURATION: 01 year

6. PATTERN: CBCS Semester

7. MEDIUM OF INSTRUCTION: English

8. STRUCTURE OF COURSE:

1) FIFTH SEMESTER (NO. OF PAPERS – 04)

| Sr. No. | Subject Title | Theory | | | | Paper No. & Paper Code | Practical | |
|---------|----------------------------------|--------------------------|---|--------------------------|---------|---|--------------------------|---------|
| | | Paper No. & Paper Code | Title of Paper | No. of lectures per week | Credits | | No. of lectures Per week | Credits |
| 1 | Botany-Plant Protection (Common) | Paper IX BBPT 501 | Genetics and Plant Breeding | 06 | 04 | Practical BBPP-505 (based on BBPT 501 and 502) | 10 | 04 |
| | | Paper X BBPT 502 | Microbiology, Plant Pathology and Mushroom Cultivation Technology | | | | | |
| 2 | Plant Protection DSC (Elective) | Paper V: BBPT 503 | Plant Diseases and their management | 06 | 04 | Practical BBPP 506 (based on BBPT 503 and 504) | 10 | 04 |
| | | Paper VI: BBPT 504 | Plant-Insect Pest - Insect Management and Toxicological Studies | 06 | 04 | | | |
| 3 | Skill Enhancement | SECCBT 507 | Basic Numerical Skills | 01 | 01 | SECCBP 510 | 03 | 01 |
| 4 | AECC | | | 02 | 02 | | | |

2) SIXTH SEMESTER (NO. OF PAPERS – 04)

| Sr. No. | Subject Title | Theory | | | | Paper No. & Paper Code | Practical | |
|---------|-----------------------------------|------------------------|---|--------------------------|---------|--|--------------------------|---------|
| | | Paper No. & Paper Code | Title of Paper | No. of lectures per week | Credits | | No. of lectures Per week | Credits |
| 1 | Botany- Plant Protection (Common) | Paper XIII: BBPT 601 | Plant Biochemistry and Molecular Biology | 06 | 04 | Practical BBPP 605 (based on BBPT 601 and 602) | 10 | 04 |
| | | Paper XIV: BBPT 602 | Bioinformatics, Biostatistics and Economic Botany | | | | | |
| 2 | Plant Protection DSE (Elective) | Paper VII: BBPT 603 | Field techniques in Plant Protection | 06 | 04 | Practical BBPP 606 (based on BBPT 603 and 604) | 10 | 04 |
| | | Paper VIII: BBPT 604 | Laboratory Techniques in Plant Protection and Pathophysiology | 06 | 04 | | | |
| 3 | Skill Enhancement | SECCBT 607 | Entrepreneurship Development | 01 | 01 | SECCBP 610 | 03 | 01 |
| 4 | AECC | | | 02 | 02 | | | |

2) Structure and titles of papers of B. Sc. Course

B. Sc. III Plant Protection Semester V

Paper IX (BBPT 501): Genetics and Plant Breeding

Paper X: (BBPT 502) : Microbiology, Plant Pathology and Mushroom Cultivation Technology

Paper V (BBPT 503): Plant Diseases and their management

Paper VI (BBPT 504): Plant-Insect Pest - Insect Management and Toxicological Studies

Practical BBPP 505 (based on BBPT 501 and 502)

Practical BBPP 506 (based on BBPT 503 and 504)

Skill Enhancement Paper I SECCBT 507 Basic Numerical Skills

Ability Enhancement Compulsory Course Paper III

B. Sc. III Plant Protection Semester VI

Paper XIII (BBPT 601): Plant Biochemistry and Molecular Biology

Paper XIV (BBPT 602): Bioinformatics, Biostatistics and Economic Botany

Paper VII (BBPT 603) Field Techniques in Plant Protection

Paper VIII (BBPT 604) Laboratory Techniques in Plant Protection and Pathophysiology

Practical BBPP 605 (based on BBPT 601 and 602)

Practical BBPP 606 (based on BBPT 603 and 604)

Skill Enhancement Paper II SECCBT 607 Entrepreneurship Development

Ability Enhancement Compulsory Course Paper IV

3) OTHER FEATURES:

A) LIBRARY:

Reference books, Text books, Journals, Periodicals available in Institute and Departmental Library. (Separate reference lists are attached along with the respective course syllabus)

B) SPECIFIC EQUIPMENTS:

a) Computer, LCD projector, Visualizer, Smart Board

b) Laboratory Equipments:

1. Microscope with digital camera

2. Trinocular Research Microscope
3. Stereo Zoom Microscope
4. Dissecting microscope
5. Laminar Air Flow
6. UV-VIS Double beam spectrophotometer
7. Refrigerated Centrifuge
8. Digital weighing balance
9. pH meter
10. Microtome
11. Autoclave
12. Hot Air Oven
13. Incubator
14. Refrigerator
15. EC meter
16. Colorimeter
17. Thermal Cycler
18. Gel Electrophoresis unit
19. Gel Documentation unit

Yashavantrao Chavan Institute of Science, Satara (Autonomous)

Syllabus introduced from June 2023

Bachelor of Science (B. Sc.) Part – III Plant Protection

Semester: V

Course - BBPT 501 Genetics and Plant Breeding

Course Objectives: The Students will be able to.....

1. Impart the basic knowledge of mendelian genetics.
2. Impart the basic knowledge of linkage, recombination and quantitative inheritance.
3. Impart the basic knowledge of variations in chromosome number and structure.
4. Impart the knowledge of crop improvement.

| Unit | SEMESTER – V BBPT 501 Genetics and Plant Breeding | No. of hours per unit/ Credits 45 |
|----------------|--|---|
| Unit-I | Mendelism and extra chromosomal inheritance | 12 |
| | 1.1 Introduction | |
| | 1.2 Principles of inheritance - a) Law of Dominance; b) Law of Segregation; c) Law of Independent Assortment; d) Back Cross and Test Cross | |
| | 1.3 Gene interaction - a) Complementary gene interaction b) Supplementary gene interaction | |
| | 1.4 Epistasis- Introduction, Dominant Epistasis, Recessive Epistasis | |
| | 1.5 Extra-chromosomal Inheritance: Introduction, Plastid Inheritance and Mitochondrial Inheritance (with classical as well as latest examples) | |
| Unit-II | Linkage, Recombination and Quantitative inheritance | 11 |
| | 2.1 Linkage: Definition, Linkage groups, types, Coupling and Repulsion Phase, significance in plant breeding | |

| | | |
|-------------------|--|-----------|
| | <p>2.2 Recombination (Crossing over): Definition, types, mechanism of crossing over, significance in plant breeding</p> <p>2.3 Quantitative inheritance:</p> <p>a) Polygene inheritance – Concept, examples 1] Kernel colour in wheat, and 2] Ear length in Maize along with latest updates</p> <p>b) Population genetics – Hardy-Weinberg’s Law</p> | |
| Unit - III | Variation in Chromosome Number and Structure | 11 |
| | 3.1 Chromosome number: Euploidy, Aneuploidy and Polyploidy | |
| | 3.2 Chromosomal structure: Deletion, Duplication, Inversion and Translocation | |
| | 3.3 Mutation: Spontaneous and Induced mutation. Types of mutagens – Physical and Chemical, Significance of mutations in plant breeding. | |
| Unit – IV | Plant Breeding | 11 |
| | 4.1 Introduction, Definition, Aims and objectives | |
| | 4.2 Methods of Plant Breeding | |
| | <p>a) Introduction and Acclimatization</p> <p>b) Selection: i) Mass Selection; ii) Pure Line Selection; iii) Clonal Selection</p> <p>c) Hybridization techniques in Self- and Cross-pollinated crops</p> <p>d) Male Sterility and its significance</p> <p>e) Mutation Breeding: Gamma Garden</p> | |
| | 4.3 Multiple Allelism: Introduction, Definition, Self-incompatibility in plants, significance in plant breeding. | |

Course outcomes: The students should be able to.....

- 1) Discuss & describe genetic basis of inheritance and extra chromosomal inheritance.
- 2) Describe and point out concept of linkage and recombination and concept of quantitative inheritance.
- 3) Explain the concepts and describe the chromosome structure and variation and explain the concept of mutation and its importance in crop improvement.
- 4) Describe and demonstrate different methods of plant breeding.

References

1. Allard A.W. *Principles of Plant Breeding*. Wiley Publications, 2010.
2. Chahal G.S., Gosal S.S. *Principles and Procedures of Plant Breeding: Biotechnological and Conventional Approaches*. New Delhi: Narosa Publishing Co., 2010.
3. Gardener J., Simmons H.J., Snustad D.P. *Principles of Genetics*. 8th ed., New York: John Wiley & Sons, 1991.
4. Gupta P.K. *Cytogenetics*. Meerut: Rastogi Publications, 2018.
5. Gupta P.K. *Genetics*. Meerut: Rastogi Publications, 1997.
6. Hartl D.L., Jones E.W. *Genetics: Principles and Analysis*. 4th ed., Massachusetts, USA: Jones and Barlett Publishers, 1998.
7. Singh B.D. *A text Book of Plant Breeding: Adynamic View Designed for Under Graduate Courses of Indian Universities*. 3rd ed., New Delhi: Kalyani Publications, 2011.
8. Singh B.D. *Cytogenetics and Plant Breeding, Cytogenetics and Plant Breeding*. New Delhi: Kalyani Publications, 2010.
9. Singh B.D. *Genetics*. New Delhi: Kalyani Publications, 2009.
10. Singh B.D. *Plant Breeding: Principles and Methods*. New Delhi: Kalyani Publications, 2018.
11. Verma, P.S., Agarwal, V.K. S. *Cell Biology, Genetics, Evolution and Ecology*. New Delhi: Chand and Company Ltd., 2001.

Yashavantrao Chavan Institute of Science, Satara (Autonomous)

Syllabus introduced from June 2023

Bachelor of Science (B. Sc.) Part – III Plant Protection

Semester: V

Course - BBPT 502 Microbiology, Plant Pathology and Mushroom Cultivation Technology

Course Objectives: The Students will be able to.....

1. Impart the knowledge of microbes, microbial techniques, and industrial microbiology.
2. Impart the basic knowledge of microbial genetics.
3. Impart the knowledge of plant pathology, plant diseases and their management.
4. Impart the knowledge of mushroom cultivation, storage and its economic importance.

| Unit | SEMESTER – V BBPT 502 Microbiology, Plant Pathology and Mushroom Cultivation Technology | No. of hours per unit/ Credits 45 |
|----------------|---|--|
| Unit-I | Microbiology | 10 |
| | 1.1 General characters of microbes: Bacteria, Viruses, Actinomycetes and Phytoplasma 1.2 Methods in Microbiology: Staining for microbes-bacteria and, PPLO, Sterilization Methods, Pure Culture Techniques 1.3 Industrial Microbiology: Applications of micro-organisms with reference to production of Antibiotics (Penicillin), Organic Acids (Lactic Acid), Alcohol (Ethyl Alcohol), Microbial Pesticides: Concept, Types and Significance | |
| Unit II | Microbial Genetics | 10 |
| | 2.1 Bacterial genome 2.2 Recombination in Bacteria: Transformation and Transduction | |

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|-------------------|---|-----------|
| | 2.3 DNA and RNA viruses 2.4 Importance of microbial genetics | |
| Unit - III | Plant Pathology | 15 |
| | 3.1 Concept and Importance of Plant Pathology, General symptoms of plant diseases 3.2 Transmission of Pathogen: Air, Seed, Soil and Water 3.3 Methods of plant disease management: Physical, Mechanical, Chemical and Biological 3.4 Role of quarantine in plant disease management 3.5 Study of Plant Diseases w. r. t. pathogen, symptoms and management i) Grassy Shoot of Sugarcane (Phytoplasma), ii) Citrus Canker (Bacterial), iii) Yellow Vein Mosaic of Bhendi (Viral), iv) White Rust of Crucifers (Fungal) v) Early leaf spot (Tikka) disease of ground nut (Fungal) | |
| Unit - IV | Mushroom cultivation technique | 10 |
| | 4.1 Introduction, History, General life cycle of mushrooms, Economic importance of mushrooms Types of Mushrooms: Non-edible (Poisonous) mushrooms and Edible (Non-poisonous) - Button, Oyster, Cordyceps, Shiitake and Black ear mushrooms 4.2 Cultivation Technology: Preparation of spawn, Sterilization and preparation of mushroom bed, Spawning, Factors affecting quality of mushroom beds, Harvesting of mushrooms 4.3 Storage: Short Term (Refrigeration), Long Term Storage (Canning, Pickles, Papads) and Drying in Salt Solutions 4.4 Nutritional Value: Proteins, Carbohydrates, Mineral Elements, Vitamins, Crude Fiber Content of Mushrooms. Medicinal value of Mushrooms | |

Course Outcomes Students will be able to.....

- 1) Discuss about microbes, Microbial techniques and different application of microbes in industries.

- 2) Solve the problem related microbial genetics and discuss application of microbial genetics.
- 3) Define concepts regarding chromosome structure and variation and explain the concept of mutation and its importance in crop improvement.
- 4) Identify plant diseases discuss their management.
- 5) Setup mushroom cultivation, storage and predicts its economic importance

References

1. Plant Pathology Agrios. G. N..Academic Press London. 1997.
2. Economics of mushroom cultivation. National Centre for Mushroom Research and Training, Solan, India. Anonymous, 1991
3. Cultivation Technology and Technical standards of components of Integrated Button Mushroom Unit, Protected Production under NHB Scheme. National Horticulture Board. Anonymous, 2011
4. Mushroom cultivation the past and the present of oyster mushroom. Kerteszetes Szoleszet. Balazs, S. 1985.
5. Introduction to the Bacteria. Clifton, McGraw Hill Co., New York. 1958
6. Laboratory Manual in Microbiology. Cunasekaran P New Age International Pvt. Ltd. 1995.
7. An Introduction to Recombinant DNA Techniques: Basic Experiments in Gene Manipulation. Hackett. P.B. Fuchs. J.A. and Messing J.W. The Benjamin /Cummings Publishing Co., Inc., Menlo Park California. 1988.
8. Growing Wild Mushrooms: A Complete Guide to Cultivating Edible and Hallucinogenic Mushrooms. Harris, Bob. Homestead Book Company. Revised edition.
9. Introduction to plant Viruses Mandahar, C. L.. Chand & Ltd., Delhi. 1998
10. Plant Protection. Mehta P.R. and Verma,
11. Theory and Practice in Experimental Bacteriology Meynell, E and Meynell, G.G. University Press, Cambridge. 1970
12. Old R.W. and Primrose, S.B. 1989. Principles of Gene Manipulation. Old R.W. and Primrose, S.B. Blackwell Scientific Publications. Oxford. UK. 1989

13. Microbiology. Peicar and Reid,
14. Diseases of Crop Plants in India. Rangswamy, G. and Mahadevan A. 1999.
15. Mushroom Cultivation in India. Suman B C and Sharma V P, 2007

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Bachelor of Science (B. Sc.) Part – III Plant Protection

Semester: V

Practical BBPP 505- based on theory paper BBPT 501 and 502

Course objectives: The Students will be able to.....

1. Give practical knowledge to students about different concepts in genetics.
2. Give the practical knowledge about various processes in plant breeding.
3. Give the practical knowledge of Microbial techniques (culture media, soil dilution, inoculation and staining).
4. Give the practical knowledge of plant diseases, symptoms and causal organism.

| Section | SEMESTER – V Practical BBPP 505- based on theory paper BBPT 501 and 502 | No. of hours per unit/ Credits 45 |
|------------------|---|---|
| Section-I | Practical's based on Theory paper BBT 501 | |
| | <ol style="list-style-type: none"> 1. Genetic examples on Linkage. 2. Genetic examples on Crossing over 3. Genetic examples on Polygene inheritance 4. Determination of chromosome count in PMCs in <i>Allium / Cyanotis</i>. 5. Detection of meiotic anomalies in chromosomes in <i>Tradescantia</i>. 6. Preparation of ideogram by using karyotype or chromosomal photographs. 7. Methods of emasculation 8. Breeding techniques in a) Malvaceae b) Fabaceae c) Poaceae | |

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| | <p>9. Study of World map to show Vavilov's centers of origin of cultivated plants.</p> <p>10. Visit to Krishi Vidnyan Kendra/ Seed Company and submission of visit reports.</p> | |
| Section-II | Microbiology, Plant Pathology and Mushroom Cultivation Technology | 10 |
| | <p>11. Preparation and sterilization of culture media – PDA (slants and plates).</p> <p>12. Isolation and separation of soil fungi by serial dilution method.</p> <p>13. Methods of inoculation - slants and plates.</p> <p>14. Study of different types of stains: Cotton blue, Dien's stain, Gram's stain and other stains.</p> <p>15. Study of plant diseases - Grassy Shoot disease of Sugarcane.</p> <p>16. Citrus Canker and Yellow Vein Mosaic of Bhendi.</p> <p>17. Study of plant diseases - White Rust of Crucifers and Early leaf spot (Tikka) disease of ground nut.</p> <p>18. Seed treatment by dipping and seed dressing.</p> <p>19. Demonstration of Mushroom Cultivation.</p> <p>20. Demonstration of Harvesting and Storage of mushrooms.</p> <p>21. Submission of local plant /crop diseases (any ten).</p> | |

Course Outcome: Student should be able to.....

1. Understand the knowledge about genetic problems.
2. Practice basic techniques in cytology.
3. Study plant breeding and identify the centers of origin of cultivated plants.
4. Understand the knowledge about basic techniques in genetics and plant breeding.
5. Study companies and research centers and perform microbial techniques (culture media, soil dilution, inoculation and staining).
6. List plant diseases, symptoms and causal organism.

7. Understands knowledge about collection and identification of plant pathological specimens in fields.
8. Understands knowledge about seed treatment by seed dipping and seed dressing.

References:

1. Bendre A. *Practical Botany*. Meerut: Rastogi Publications. 2010.
2. Dawson C. *Practical Research Methods*. New Delhi: UBS Publishers. 2002.
3. Pandey B.P. *Modern Practical Botany*. Vol. I. New Delhi: S. Chand and Company Ltd. 2011.
4. Pandey B.P. *Modern Practical Botany*. Vol. II. New Delhi: S. Chand and Company Ltd. 2011.
5. Sadasivam S., Manickam A. *Biochemical Methods*. 3rd ed. New Delhi: New Age International Publishers. 2008.
6. Wallis C.J. *Practical Botany for Advanced Level and Intermediate Students*. 5th ed. Oxford, UK: Elsevier Science. 2013.

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Syllabus introduced from June 2023

Bachelor of Science (B. Sc.) Part – III Plant Protection

Semester: V

PLANT PROTECTION PAPER –V

Course - BBPT 503: Plant Diseases and Their Management.

Learning objectives: The Students will be able to.....

1. Impart the knowledge of Plant Pathology, contribution of Plant Pathologists and Research Institutes in India.
2. Learn the knowledge of plant pathogens and important symptoms of plant diseases.
3. Imbibe the knowledge of plant diseases w.r.t. symptoms, pathogen and management.
4. Impart the knowledge of various methods of management of plant diseases.

| Unit | SEMESTER - V BBPT 503: Plant Diseases and Their Management | No. of hours per unit/ Credits 45 |
|---------------|--|--|
| Unit-I | Plant Pathology | 11 |
| | Plant Pathology- Historical account, Effects of plant diseases on human civilization. Importance of plant pathology Contribution of Indian (3) and Foreign (3) plant pathologists. Development of plant pathology in India. Contribution of Research institutes a) IARI (Indian Agricultural Research Institute), New Delhi. b) ICRI (International Crop Research Institute for Semi-Arid Tropics). c) FRI (Forest Research Institute), Dehradun. | |

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|---------------------------------------|---|-----------|
| | <p>d) Weed Research Institute,</p> <p>General Characters of plant pathogens- Algae, Fungi, Bacteria, Viruses, PPL0 and Nematodes. Some important symptoms of plant diseases e.g. smuts, rusts, powdery mildew, downy mildew, damping off, mosaic, yellows, cankers, blights, wilts and anthracnose.</p> | |
| Unit-II | Study of Plant Diseases | 11 |
| | <p>Study of following plant diseases with reference to symptoms, causal organism, disease cycle and management.</p> <p>a) Black stem rust and loose smut of Wheat</p> <p>b) Rust and Head smut of Jowar</p> <p>c) Powdery mildew of green pea</p> <p>d) Anthracnose of bean / chilly</p> <p>e) Leaf spot / Tikka and Rust disease of groundnut</p> | |
| Credit –I Unit - III | Study of Plant Diseases | 11 |
| | <p>Study of following plant diseases with reference to symptoms, causal organism, disease cycle and management.</p> <p>a) Root knot of vegetables</p> <p>b) Early blight of tomato</p> <p>c) Late blight of potato</p> <p>d) Whip smut of sugarcane</p> <p>e) Powdery mildew of Teak and Nyctanthes</p> | |
| Unit - IV | Disease Management | 12 |
| | <p>Biological control of plant diseases- concept of biological control, suitable examples of biological control of plant diseases.</p> <p>Chemical control of plant diseases- Introduction, concept of pesticides, types and their examples, characters of ideal fungicide, need and importance of chemical control.</p> <p>Study of following fungicides with respect to formulation, methods of application, mode of action and uses</p> <p>a) Sulphur fungicides – Thiram.</p> <p>b) Copper Fungicides – Copper Oxychloride</p> | |

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|--|--|--|
| | c) Mercury fungicides – Ceresan d) Heterocyclic Nitrogenous Compounds - Captan. e) Antibiotics – Streptomycin g) Systemic Fungicides – Bavistin and Vitavax | |
|--|--|--|

Learning outcomes: The students should be able to.....

1. Discuss about Plant Pathology, contribution of Plant Pathologists and Research Institutes in India.
2. Identify plant pathogens and discuss important symptoms of plant diseases.
3. learns about plant diseases w.r.t. symptoms, pathogen and management.
4. Explain various methods of management of plant diseases.

Reference Books:

1. Plant Pathology Agrios, G. N., 4th Edn. Academic press, San Diego (1997)
2. Experiments in Microbiology and Plant Pathology and biotechnology Aneja, K. R New Age International (P) Ltd. Publishers, New Delhi. (2005).
3. Textbook of plant pathology Baruah H. K., P Brain and A. Baruah, Oxford and IBH Publ. Co., New Delhi. (1984).
4. Text book of Modern pathology. Bilgrami K. S. and Dube H. C. Vikas Publishing House Pvt. Ltd. New Delhi. (1990).
5. Cytogenetics and Plant Breeding. Chandrashekharan S. N. and S. V. Parthasarthy P. Varadachary and Co. Madras. (1965).
6. Plant Protection Techniques. Chatterjee P. B. Bharti Bhawan. Patana. (1997).
7. Principles and Procedures of Plant Protection. Chattopadhyay, S. P. Oxford and IBH, New Delhi. (1987).
8. Diseases of Field crop. Diskson J. C. McGraw –Hill, New Delhi. (1964)
9. Biological substitutes for pesticides Gerhardson, B *Trends in biotechnology* 20:338-343. ICAE, Publication.:Crop Diseases Calender (2002)..
10. Plant pathology – Principles and practices. Jones D. G. Opren University Press, Stratford. (1987).
11. Plant Pathology. Mehrotra R. S. and Ashok Aggarwal Tata McGraw-Hill publishing Co.Ltd. New Delhi. (2005)
12. Plant pathology. Mehrotra, R. S. Tata McGraw-Hill publishing Co. Ltd. New Delhi. (1980).

13. Plant Diseases and Epidemiology. Nagarajan S. Oxford and IBH, New Delhi. (1999)
14. Dynamics of Plant Diseases. Nagarajan, S. and K. Mualidharan Allied Publishers, New Delhi. (1995)
15. Diseases of Fruit crops. Pathak V. N. Oxford and IBH, New Delhi. (1980).
16. Genetic engineering of plants to enhance resistance to fungal pathogens-a review of progress and future prospects. Punja, Z. K. *Canadian Journal of plant pathology* 23: 216-235. (2001).
17. Diseases of Millets. Ramakrishnan T. S. ICAR, New Delhi. (1974)
18. Diseases of crop plants in India. Rangaswami, G. Prentice-Hall Pub, New Delhi. (1975)
19. Fundamental Plant Pathology. Roberts D. A. and Bothroyd C. W. Freeman & Co (1995)

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Syllabus introduced from June 2023

Bachelor of Science (B. Sc.) Part – III Plant Protection

Semester: V

PLANT PROTECTION PAPER –VI

Course - BBPT 504 Plant Insect Pests, their Management and Toxicological Studies

Learning objectives: The Student will be able to.....

1. Impart the knowledge of plant insect pests.
2. Imbibe the knowledge of methods of management of pests.
3. Learn the knowledge of various insecticides in management of crop pests.
4. Impart the knowledge of toxicological study of pesticides during application.

| Unit | SEMESTER - V BBPT 504 Plant Insect Pests, their Management and Toxicological Studies | No. of hours per unit/ Credits 45 | | | | | | | | | | |
|---|---|---|-------------------------------|-----------------------|---------------------------------|---------------------------|--------------------------|------------------------|----------------------------|--|--------------------------------|-------------------------|
| Unit-I | Plant Insect Pests | 12 | | | | | | | | | | |
| | <p>Study of following pests with reference to scientific name, marks of identification, host range, life cycle, perpetuation, nature of damage and management.</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">1. Brown plant hopper of rice</td> <td style="width: 50%;">2. Army worm of jowar</td> </tr> <tr> <td>3. Blister beetle of pigeon pea</td> <td>4. Pod borer of green pea</td> </tr> <tr> <td>5. Fruit borer of bhendi</td> <td>6. Cabbage caterpillar</td> </tr> <tr> <td>7. Leaf miner of groundnut</td> <td></td> </tr> <tr> <td>8. Mealy bugs of custard apple</td> <td>9. White flies of guava</td> </tr> <tr> <td colspan="2">10. Stored grain pests: Indian mealworm, Saw toothed beetle</td> </tr> </table> | | 1. Brown plant hopper of rice | 2. Army worm of jowar | 3. Blister beetle of pigeon pea | 4. Pod borer of green pea | 5. Fruit borer of bhendi | 6. Cabbage caterpillar | 7. Leaf miner of groundnut | | 8. Mealy bugs of custard apple | 9. White flies of guava |
| 1. Brown plant hopper of rice | 2. Army worm of jowar | | | | | | | | | | | |
| 3. Blister beetle of pigeon pea | 4. Pod borer of green pea | | | | | | | | | | | |
| 5. Fruit borer of bhendi | 6. Cabbage caterpillar | | | | | | | | | | | |
| 7. Leaf miner of groundnut | | | | | | | | | | | | |
| 8. Mealy bugs of custard apple | 9. White flies of guava | | | | | | | | | | | |
| 10. Stored grain pests: Indian mealworm, Saw toothed beetle | | | | | | | | | | | | |

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| | Polyphagous pests: Termites, Aphids and Jassids | |
| Unit-II | Management Methods of Crop Pests | 11 |
| | <p>A) Biological control- Suitable examples</p> <p>B) Biotechnological approaches- suitable examples</p> <p>C) Chemical control- Study of following insecticides with respect to formulations, mode of action and uses.</p> <p>Pesticide formulations: solid, liquid and gaseous Limitations of chemical control.</p> <p>1: Botanicals- a) Pyrethrum b) Rotenone</p> <p>2: Synthetic pyrethroids – Permethrin, Cypermethine,</p> | |
| Unit - III | Chemical Control of Crop Pests | 11 |
| | <p>Study of following insecticides with respect to formulations, mode of action and uses. Chlorinated hydrocarbons: Toxaphene, Chlordane</p> <p>Organo phosphorus compounds: Monocrotophos, Phorate,</p> <p>Carbamets: Carbaryl, Carbofuran</p> <p>Nematicides: Methyl bromide, DD mixture Rodenticides: Strychnine, Warfarin</p> | |
| Unit - IV | Toxicological Study | 11 |
| | <ol style="list-style-type: none"> 1. Explanation of following terms: Toxicity, Acute, Chronic, LD-50, Antidotes, Colour code and Pesticide residue 2. Precautions during use of pesticides 3. Symptoms of pesticide poisoning 4. Pesticide pollution of soil, water and air 5. Pesticide legislation in India | |

Learning outcomes: The students should be able to.....

1. Identify plant insect pests, damage caused by them and life cycle.
2. learns about various ecofriendly methods of management of pests.
3. Choose and apply various insecticides in management of crop pests.
4. Identify and discuss and Create awareness about pesticide toxicology

References Book:

1. Plant Pathology Agrios, G. N., 4th Edn. Academic press, San Diego. (1997).
2. Agricultural Pest of India and South East Asia. Atwal, A. S. Kalyani Publishers, New Delhi (1936)
3. Plant protection techniques. Chatterjee, P. B. Bharati Bhawan Publishers and Distributors Patna. (1997)
4. Principles and Procedures of Plant Protection. Chattopadhyaya, S. P. Oxford and IBH, New Delhi. (1987)
5. Trends in Agricultural Pest Management. Dhaliwal, G. S. and Arora Ramesh Commonwealth Publishers, New Delhi. (1994)
6. Biological substitutes for pesticides. Gerhardson, B *Trends in biotechnology* 20:338-343. ICAE, Publication.:Crop Diseases Calender (2002).
7. Applied Agricultural Entomology. Jha, L. K. New Central Book Agency, Culcutta. (1987)
8. Destructive and Useful Insects. Metcalf, C. L. and Flint, W. P. Tata McGrew-Hill publishing Co. Ltd. New Delhi. (19830)
9. Entomology and pest Management. Pedigo, L. P. Prentice-Hall Pub. Englewood cliffs NJ (1996)
10. A Textbook of Applied Entomology. Shrivastava, V. P. Kalyani Publ. New Delhi (1988).
11. Journal of Entomological Society of India.

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Bachelor of Science (B. Sc.) Part – III Plant Protection

Semester: V

Practical BBPP 506 (based on BBPT 503 and 504)

Course objectives: The Student will be able to.....

1. Give the practical knowledge of plant diseases w.r.t. symptoms, pathogen and management.
2. Give the practical knowledge of management of plant diseases by fungicides.
3. Give the practical knowledge of Bordeaux mixture, Burgundy mixture and Bordeaux paste
4. Give the practical knowledge of plant insect pests and damage caused by them.
5. Give the practical knowledge of various insecticides in management of crop pests.
6. Give the practical knowledge about safety measures during application of pesticides.
7. Give the practical knowledge about working and contribution of research stations/ institutes/ insecticide industries by visiting them.

| Section | SEMESTER - V Practical BBPP 506 (based on BBPT 503 and 504) | No. of hours per unit/ Credits 45 |
|------------------|---|--|
| Section-I | Practicals based on BBPT 503 | |
| | 1. Study of plant diseases as per theory a) Black stem rust and loose smut of Wheat b) Rust and Head smut of Jowar c) Powdery mildew of green pea d) Anthracnose of bean / chilly e) Leaf spot / Tikka and Rust disease of groundnut | |

| | | |
|-------------------|---|--|
| | <ul style="list-style-type: none"> f) Root knot of vegetables g) Early blight of tomato h) Late blight of potato i) Whip smut of sugarcane j) Powdery mildew of Teak and Nyctanthes <p>Study of fungicides as per theory</p> <ul style="list-style-type: none"> a) Sulphur fungicides – Thiram. b) Copper Fungicides – Copper Oxychloride c) Mercury fungicides – Ceresan d) Heterocyclic Nitrogenous Compounds - Captan. e) Antibiotics – Streptomycin f) Systemic Fungicides – Bavistin and Vitavax <p>Preparation of Bordeaux mixture, Burgundy mixture and Bordeaux paste.</p> | |
| Section-II | Practicals based on BBPT 504 | |
| | <ul style="list-style-type: none"> 1. Study of plant insect pests as per theory <ul style="list-style-type: none"> a. Brown plant hopper of rice b. Army worm of jowar c. Blister beetle of pigeon pea d. Pod borer of green pea e. Fruit borer of bhendi f. Cabbage caterpillar g. Leaf miner of groundnut h. Mealy bugs of custard apple i. White flies of guava j. Stored grain pests: Indian mealworm, Saw toothed beetle k. Polyphagus pests: Termites, Aphids and Jassids 2. Study of biological control agents (one example from each each | |

| | | |
|--|--|--|
| | <p>group, eg- viruses, bacteria, fungi and insects)</p> <ol style="list-style-type: none"> 3. Study of Insecticides as per theory <ol style="list-style-type: none"> a. Botanicals- Pyrethrum, Rotenone b. Synthetic pyrethroids –Cypermethine, c. Chlorinated hydrocarbons: Toxaphene, Chlordane d. Organo phosphorus compounds: Monocrotophos, Phorate e. Carbamets: Carbaryl, Carbofuran f. Nematicides: Methyl bromide, DD mixture g. Rodenticides: Strychnine , Warfarin 4. Preparation of botanical pesticides (Nicotine, Neem, Dasahaparni Ark) 5. Study of some common antidotes (3-4 examples as per book) 6. Use of colour codes in pesticide industry. 7. Study of pesticide residue and its analysis. 8. Demonstration of pesticide pollution of soil and water. 9. Visit to pesticide industry or Agriculture University and submission of report. | |
|--|--|--|

Learning outcomes: The students should be able to.....

1. Learns about plant diseases w.r.t. symptoms, pathogen and management.
2. Apply the knowledge of management of plant diseases by fungicides.
3. Formulate the knowledge of Bordeaux mixture, Burgundy mixture and Bordeaux paste
4. Discuss various plant insect pests and damage caused by them.
5. Learns about various ecofriendly methods of management of pests.
6. Apply the knowledge of insecticides in management of insect pests of crops.
7. Learns about precautions and various safety measures used during application of pesticides.

References Book:

1. Agricultural Pest of India and South East Asia. Atwal, A. S. Kalyani Publishers, New Delhi. (1936)

2. Biological substitutes for pesticides. Gerhardson, B *Trends in biotechnology* 20:338-343. ICAE, Publication.: Crop Diseases Calender (2002).
3. Experiments in Microbiology and Plant Pathology and biotechnology. Aneja, K. R New Age Intenational (P) Ltd. Publishers, New Delhi. (2005).
4. Plant protection techniques. Chatterjee, P. B. Bharati Bhawan Publishers and Distributors Patna. (1997)
5. Principles and Procedures of Plant Protection. Chattopadhyya, S. P. Oxford and IBH, New Delhi. (1987)
6. Morphology of Plant and Fungi Bold, H.C., Alexopoulos, G. J. and Delevoryas, T. (4th Edition) Harper and Foul Co., New York. 1980.
7. Laboratory Manual in Microbiology Cunasekaran.P.. New Age International Pvt. Ltd. 1995.
8. Techniques with Bacteria-A Guidebook for Teachers. Pawsey. R.K. Hutchinson Educational. 1974.
9. Laboratory Exercies in Microbiology. Pelezor.M.J. and Chan. E.C.S. : McGraw Hill Book. Co. 1972.
10. Theory and Practice in Experimenta Bacteriology Meynell, E and Meynell. G.G. University Press, Cambridge. 1970.
11. Laboratory Exercises in Microbiology. Wistreich G.A. and Lechtman. M.D. Flencoe Press New York, Deverly Hills Collier Macmillan Publishers, London. 1973.
12. Plant Pathogenic Bactaria: Laboratory Guide for Identification of Plant Pathogenic Bacteria Schaad N.W. Academic Press. 1988.

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Bachelor of Science (B. Sc.) Part – III: Plant Protection

Semester V

Theory Paper I (SECCBT 507) Basic Numerical Skills

Learning Objectives: The Student will able to.....

1. Impart the basic knowledge of mathematics.
2. Impart the knowledge of application of mathematics in biological studies.

| Unit | SEMESTER - V (SECCBT 507) Basic Numerical Skills | No. of hours per unit/ Credits 45 |
|----------------|--|---|
| Unit-I | Basics of Mathematics | 8 |
| | 1.1 Number systems: Natural numbers, Whole Numbers, Integers, Rational numbers, Irrational numbers, Real Number, Even Numbers, Odd Numbers, Prime Numbers, Composite Numbers, Perfect Numbers. | |
| | 1.2 Rules of calculation: Division on numbers, Rules of Divisibility, factors and multiples, VBODMAS Rule, Basic formulae for real numbers. | |
| | 1.3 H.C.F and L.C.M. 1.4 Unitary Method | |
| Unit-II | Fractions, Decimal System and Roots | 3 |
| | 2.1. Fractions: Concept and types, Addition, subtraction, multiplication and division of fractions | |
| | 2.2 Decimal System: Concept, types, recurring and non- recurring decimals, Addition, subtraction, multiplication and division of decimals. 2.3 Powers and Roots | |
| | Probability, Average and percentage | 3 |

| | | |
|-------------------|---|----------|
| Unit - III | 3.1 Probability: concept, types, application in biological sciences 3.2 Average: Concept, types, applications in biological sciences 3.3 Percentage: Concept, applications in biological sciences | |
| Unit - IV | Logarithms, Factorials, Absolute value, Matrices and Venn Diagrams 4.1 Logarithms and Anti- Logarithms: Concept, applications in biological sciences 4.2 Factorials: Concept, applications in biological sciences 4.3 Absolute Value: Concept, applications in biological sciences 4.4 Matrices: Concept, applications in biological sciences 4.5 Venn Diagrams: Concept, applications in biological Sciences | 6 |

Learning Outcomes: The students should be able to.....

1. Understand the basic mathematical concepts.
2. Define concepts of mathematics.
3. Apply mathematical concepts in his academics.
4. Formulate and solve problems in plant science using mathematical concepts.

References

1. Mathematics, Class IX, NCERT, Delhi
2. Mathematics. Class X, NCERT, Delhi
3. Mathematics, Class XI, NCERT, Delhi
4. Mathematics, Class XII, NCERT, Delhi

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Bachelor of Science (B. Sc.) Part - III: Plant Protection

Semester V

Practical SECC Paper I (SECCBP 510) Practical's based on Basic Numerical Skills

Learning objectives: The Student will be able to.....

1. Give practical knowledge to students about applications of mathematics in biological sciences.
2. Give the practical knowledge about use of computers in solving the mathematical applications in biological sciences.

| Section | SEMESTER – V | No. of hours per unit/ Credits 45 |
|-------------------|--|---|
| Section –I | (SECCBP 510) Practical's based on Basic Numerical Skills | |
| | <ol style="list-style-type: none"> 1. Calculations of percent (%), molar (M), normal (N) and PPM solutions. 2. Preparation of standard curves. 3. Use of Excel Software for solving mathematical problems related to Addition, Subtraction, Division and Multiplication. 4. Use of Excel Software for solving mathematical problems related to percentage and Average. | |

Learning Outcomes: The students should be able to.....

1. Understand the molar (M), normal (N) and PPM solutions
2. Apply Excel Software to mathematical problems related to percentage and Average.

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Bachelor of Science (B. Sc.) Part – III Plant Protection

Semester: VI

**Theory Paper XIII (BBPT 601) Plant Biochemistry and Molecular
Biology**

Learning objectives: The Student will be able to.....

1. Impart knowledge of carbohydrates.
2. Impart the basic knowledge of lipids.
3. Imbibe basic knowledge of proteins.
4. Impart the knowledge of Molecular biology. .

| Unit | SEMESTER - VI (BBPT 601) Plant Biochemistry and Molecular Biology | No. of hours per unit/ Credits 45 |
|-----------------|---|--|
| Unit-I | Carbohydrates | 11 |
| | 1.1 Introduction, broad classification and properties of carbohydrates. | |
| | 1.2 Isomerism: definition, types of isomers: epimers, anomers and enantiomers with suitable examples. | |
| | 1.3 Structure of monosaccharides (pentose and hexose), oligosaccharides (sucrose and lactose), and polysaccharides (starch and cellulose) | |
| | 1.4 Functions of carbohydrates in biological system | |
| Unit -II | Lipids | 12 |
| | 2.1 Introduction and Classification of Lipids | |
| | 2.2 Structure and properties of saturated fatty acids (Stearic and Palmitic | |

| | | |
|-------------------|---|-----------|
| | acid) and unsaturated fatty acids (Oleic acid, Linoleic and Linolenic acids) 2.3 Beta Oxidation: Gluconeogenesis and its role in mobilization of fatty acids during seed germination 2.4 Significance of Lipids in plants. | |
| Unit - III | Proteins | 11 |
| | 3.1 Introduction, structure, properties and classification of amino acids 3.2 Brief outline of biosynthesis of amino acids - proline 3.3 General structure, classification of proteins 3.4 Protein biosynthesis in eukaryotes 3.5 Significance of proteins in plants. | |
| Unit - IV | Nucleic Acids | 11 |
| | 4.1 Composition and structure of nucleotides 4.2 DNA as carrier of genetic information (early experiments) 4.3 DNA: Watson and Crick Model, forms of DNA (A, B and Z) 4.4 DNA replication in eukaryotes 4.5 RNA: types, structure and role of RNA 4.6 Regulation of gene expression- Lac Operon, Tryptophan Operon | |

Learning Outcomes: The students should be able to.....

1. Describe the concept plant biochemistry and carbohydrates, classification and their significance.
2. Study concepts regarding molecular biology and explain the lipids synthesis, oxidation and biological significance.
3. Understand structure, properties and classification of amino acids and explain the general classification of protein and their synthesis.
4. Understand concepts of nucleic acids and their types and write answers and brief notes about plant biochemistry and molecular biology.

References

1. Essentials of Biochemistry, Ahmad, M., Merit Publisher Multan Ltd.

2. Molecular Biology of Cell; Alberts B., et al., 6th edition; Garland Science, Taylor. (2014)
3. The Cell: Molecular Approach; Cooper, G.M., Housemen, R.E 7th edition. ., (2015)
4. Fundamentals of Biochemistry, Jain, J.L., Jain, S., Jain, N., S. Chand & Company Ltd.
5. Principles of Biochemistry. Lehninger, A.L., 4th Edition, W.H. Freeman Ltd. (2004)
6. Cell Biology Lewis, J., Sarup and sons, New Delhi. (2004)
7. Biochemistry Simplified Textbook of Biochemistry for Medical Students, Manjeshwar, P.R.: Paras Medical Publishers.
8. Elements of Molecular Biology Mitra, S., McMillan India Ltd., N. Delhi. Cell Biology; Powar, C.B., Himalaya Publishing House. (1992)
9. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology, Verma, P.S., Agarwal, V.K.: S. Chand & Company Ltd.
10. Biochemistry. Voet, D., Wiley Ltd. (1995)

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Bachelor of Science (B. Sc.) Part – III Plant Protection

Semester: VI

**Theory paper XIV (BBPT 602) Bioinformatics, Biostatistics and
Economic Botany**

Learning objectives: The Student will be able to.....

1. Imbibe different bioinformatics databases and tools.
2. Study Bioinformatics tools in biological research.
3. Impart use biostatistics concepts in their academics and research.
4. Impart economic aspects of plants and their use in day-to-day life.

| Unit | SEMESTER - VI (BBPT 602) Bioinformatics, Biostatistics and Economic Botany | No. of hours per unit/ Credits 45 |
|---------------|--|--|
| Unit-I | Bioinformatics | 14 |
| | 1.1 Introduction, Aim, Scope and Branches of Bioinformatics 1.2 Biological Databases: Classification Format and Retrieval system of Biological Database, National Center for Biotechnological Information (NCBI), Basic Local Alignment Search Tool (BLAST) 1.3 Protein Information Resource (PIR) - Concept, Resources, Databases and Data Retrieval 1.4 Genome Information Resources (GIR) – Concept, Resources, Databases 1.5 Applications of Bioinformatics- BLAST, Molecular Phylogeny (Concept, Methods, Analysis and Consistency, use of MEGA 6 software) | |

| | | |
|-------------------|--|-----------|
| Unit II | Biostatistics | 11 |
| | <p>2.1. Introduction, definition, terminology.</p> <p>2.2. Collection and presentation of data- Types of data, techniques of data collection- Census method, sampling method- simple random, stratified and systematic sampling. Classification, tabulation, graphical representation- Histogram and polygon</p> <p>2.3. Measures of central tendency and Dispersion- Arithmetic mean, Mode, Median, Range, Deviation, Mean deviation, Standard Deviation, Coefficient of Variation.</p> <p>2.4. Statistical methods for testing the hypothesis- i) Students' T-test; ii) Chi-square test.</p> | |
| Unit - III | Economic Botany: Cereals, Legumes and Oils | 10 |
| | <p>3.1 Origin of Cultivated Plants - Concept of centres of origin, their importance with reference to Vavilov's work.</p> <p>3.2 Cereals: Origin, Botanical Name, Morphology, Sources and Economic importance of Jowar and Wheat.</p> <p>3.3 Legumes: Origin, Botanical Name, Morphology, Sources and Economic importance of Gram and Pigeon Pea.</p> <p>3.4 Oils and Fats: Origin, Botanical Name, Morphology, Parts used and uses of Ground nut and soybean.</p> | |
| Unit - IV | Economic Botany: Spices, Beverages and Fibers | 10 |
| | <p>4.1 Spices and Condiments - Origin, Botanical Name, Morphology, Parts used and uses of Ginger and Chilly</p> <p>4.2 Beverages – Origin, Botanical Name, Morphology, Parts used and uses of Tea and coffee and Garcina</p> <p>4.3 Fibre yielding Plants - Origin, Botanical Name, Morphology, Parts used and uses of Cotton and <i>Agave and Hemp</i></p> | |

Learning Outcomes: The students should be able to.....

1. Understand bioinformatics tools and databases and Use of different bioinformatics databases and tools in biological research.

2. Understand Biostatistics and do data collection, analysis and use of different statistical programmes in their research work.
3. Study the centers of origin of crop plants and explain the different classes of economically important crop plants.
4. Understand the significance of economically important crops with their representative examples and learn the scope of economic uses of the plants.

References

1. Introduction to Bioinformatics. Attwood, T.K., Perry-Smith, D.J., Phukan, S., Pearson Education. (2008)
2. Statistical Methods for Biologists. Deshmukh, S.D., Vision Publications. (2008)
Genetics. Gupta, P.K., Rastogi Publications, Meerut. (1997)
3. Economic Botany in Tropics Kocchar, S.L., 2nd edition. MacmillanIndia Ltd., New Delhi. (1998)
4. A Textbook of Economic Botany Sambamurthy, A.V.S.S., Subramanyam, N.S., Wiley Eastern Ltd., New Delhi. (1989)
5. Sharma, O.P., (1996) Hill's Economic Botany. Sharma, O.P., Tata McGraw Hill Publishing Company Ltd., New Delhi. (1996)
6. Economic Botany - Plants in Our World. Simpson, B.B., Conner-Ogorzaly, M., McGraw Hill, New York. (1986)
11. Introduction to Bioinformatics; Sundara Rajan, S., Balaji, R.: Himalaya Publishing House.

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Bachelor of Science (B. Sc.) Part - III: Plant Protection

Semester VI

Practical Paper VII BBPP 606 (based on BBPT 601 and 602)

Course objectives: The Student should be able to.....

1. Give practical knowledge to students about different concepts in plant biochemistry.
2. Give the practical knowledge about concepts in molecular biology.
3. Give practical knowledge about the bioinformatics and biostatistics applications in plants sciences.
4. Give practical knowledge about the economic uses of the plants around them.

| Section | SEMESTER - VI Practical Paper VII BBPP 606 (based on BBPT 601 and 602) | No. of hours per unit/ Credits 45 |
|------------------|--|---|
| Section-I | Practical's based on Theory paper BBPT 601 | |
| | 1-2. Qualitative test for sugars, proteins and lipids in plant material 3. Estimation of sugars by DNSA method 4. Estimation of proteins by Lowry's method 5. Determination of fatty acid value of oil sample 6. Separation and identification of amino acids by TLC (Thin Layer Chromatography). 7. Isolation of genomic DNA 8. Estimation of genomic DNA 9. Estimation of carotene and anthocyanin pigments 10. Visit to molecular biology laboratory and report submission. | |

| Practical's based on theory paper BBPT 602 | |
|---|--|
| Section- II | <ol style="list-style-type: none"> 1. Study of biological databases NCBI, DDBJ, EMBL and UniProt 2. Nucleotide sequence retrieval from NCBI database 3. Study of molecular phylogeny using Mega 6 software. 4. Study of measures of central tendency, frequency distribution of given data and its graphical representation 5. Determination of Standard deviation and standard error of the given data. 6. Study of Botanical Name, Morphology, Parts used and Economic importance of Jowar and Wheat. 7. Study of Botanical Name, Morphology, Parts used and Economic importance of Gram and Pigeon pea. 8. Study of Botanical Name, Morphology, Parts used and Economic importance of Ginger, Chilly, Tea and Coffee and Garcinia 9. Study of Botanical Name. Morphology, Parts used and Economic importance of Groundnut and Soybean. 10. Study of Botanical Name. Morphology, Parts used and Economic importance of Cotton and <i>Agave and Hemp</i> 11. Assignment based on Biostatistics/ Bioinformatics |

Learning Outcomes: The students should be able to.....

1. Analyze the nutritional composition of plants.
2. Understand the isolation and estimation of nucleic acid.
3. Understand the knowledge of separation techniques used in plant sciences.
4. Understand the knowledge of computational biology.
5. Apply knowledge of biostatistics and data analysis in plant sciences.
6. Understand the knowledge of utilization of economically important plants.

References

1. Bendre A. *Practical Botany*. Meerut: Rastogi Publications. 2010.
2. Dawson C. *Practical Research Methods*. New Delhi: UBS Publishers. 2002.
3. Pandey B.P. *Modern Practical Botany*. Vol. I. New Delhi: S. Chand and Company Ltd. 2011.
4. Pandey B.P. *Modern Practical Botany*. Vol. II. New Delhi: S. Chand and Company Ltd. 2011.
5. Sadasivam S., Manickam A. *Biochemical Methods*. 3rd ed. New Delhi: New Age International Publishers. 2008.
6. Wallis C.J. *Practical Botany for Advanced Level and Intermediate Students*. 5th ed. Oxford, UK: Elsevier Science. 2013.

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Bachelor of Science (B. Sc.) Part – III Plant Protection

Semester: VI

PLANT PROTECTION PAPER –VII

Course - (BBPT 603) Field Techniques in Plant Protection

Learning objectives:The Student will be able to.....

1. Impart the knowledge of Plant Protection techniques w.r.t. Seed and Soil treatment and Instruments used.
2. Give knowledge of care and maintenance of Plant Protection equipments.
3. Give the practical knowledge of about Plant clinic, Plant Protection Museum and IPM & IDM.
4. Give the practical knowledge about plant breeding techniques to improve plant resistance.

| Unit | SEMESTER – VI Course - (BBPT 603) Field Techniques in Plant Protection | No. of hours per unit/ Credits 45 |
|---------------|---|---|
| Unit-I | Plant Protection Techniques | 12 |
| | Importance of plant protection, various equipment's used in Plant protection. Seed treatment: Concept, objectives and importance, Traditional and modern methods, seed dressing equipments: simple seed dresser. Soil treatment: Concept, objectives and importance, Traditional and modern methods soil treating equipments-soil injector, chemicals used in soil treatment Soil solarization: Eco-friendly technique of soil treatment, Concept, objectives and importance, Description of soil solarization technique | |

| | | |
|-------------------|--|-----------|
| | Pesticide Application Equipments | 11 |
| Unit II | <p>Working and uses of following equipment.</p> <ol style="list-style-type: none"> 1. Pneumatic air pump – e.g. Hand pump and Diaphragm Pump 2. Power operated – e.g. Mist blower 3. Hydraulic energy pump – e.g. Peddle pump. 4. Types of nozzles – Haudrallic energy, kinetic energy, gaseous energy and centrifugal energy. 5. Ultra low volume sprayer <p>Care and maintenance of plant protection equipment's and their importance</p> | |
| | Plant Clinic, Plant Protection Museum, IPM and IDM | 10 |
| Unit – III | <p>Plant Clinic: Concept, objectives, requirements and importance of plant clinics.</p> <p>Plant protection museum: Concept, collection and preservation of pathological and entomological specimens and their maintenance. Other exhibits to be displayed in museum like plant protection equipment's and various pesticides,</p> <p>Role of museum in spreading awareness among farmers.</p> <p>IPM: Concept need and introduction to Integrated Pest Management (IPM),.</p> | |
| | Breeding Technique for Disease Resistance | 11 |
| Unit – IV | <p>Plant Breeding: Definition, objectives and importance</p> <p>Plant introduction and acclimatization: Concept, definition and objectives, merits, demerits and achievements</p> <p>Selection: Concept, definition, types, merits and demerits. Hybridization: Concept, definition, types, procedure and achievements. Back cross method: Concept, definition, procedure, merits and demerits Mutation breeding: Concept, definition and achievements.</p> <p>Gamma garden: Role of Gamma garden in crop improvement.</p> | |

Learning outcomes: The students should be able to.....

1. Discuss various Plant Protection techniques w.r.t. Seed and Soil treatment and Instruments used.
2. Demonstrate and explain care and maintenance of Plant Protection equipments.
3. Learns about Plant clinic, Plant Protection Museum and IPM & IDM.

4. Apply plant breeding techniques to improve plant resistance.

References Book:

1. Experiments in Microbiology, Plant Pathology and Tissue Culture. Aneja K. R.: Wishwa publishers (1985).
2. Text book of Modern pathology. Bilgrami K. S. and Dube H. C. Vikas Publishing House Pvt. Ltd. New Delhi. (1990).
3. Biotechnology and Integrated Pest Management Persley, G.J. CAB International, UK. 1996.
4. Plant protection techniques. Chatterjee, P. B. Bharati Bhawan Publishers and Distributors Patna. (1997)
5. Principles and Procedures of Plant Protection. Chattopadhyaya, S. P. Oxford and IBH, New Delhi. (1987).
6. Biological substitutes for pesticides. Gerhardson, B *Trends in biotechnology* 20:338-343. ICAE, Publication.:Crop Diseases Calender. (2002).
7. Dictionary of Remote Sensing. Rashid S. N. and M. M. A. Khan: Manak Publication Pvt. Ltd., New Delhi.
8. Molecular biology. Sambamurty, A. V., Narosa S. S. Publishing House, New Delhi. ISBN 978-81-7319-837-3. (2008).
9. Experimental and conceptual plant pathology. Singh, R. S., U. S. Singh, W. M. Hess and D. J. Weber (1988). Oxford and IBH publishing Co. Pvt. Ltd. New Delhi. (Unit II)

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Bachelor of Science (B. Sc.) Part – III Plant Protection

Semester: VI

PLANT PROTECTION PAPER –VIII

Course - (BBPT 604) Laboratory Techniques in Plant Protection and Pathophysiology

Learning objectives: The Student will be able to.....

1. Impart the knowledge of techniques in soil microbiology and soil pathology.
2. Impart the knowledge of seed and market pathology and nursery diseases.
3. Imbibe the knowledge about techniques in pathophysiology, culture and staining of pathogens.
4. Impart the knowledge about recent techniques in plant protection.

| Unit | SEMESTER – VI (BBPT 604) Laboratory Techniques in Plant Protection and Pathophysiology | No. of hours per unit/ Credits 45 |
|---------------|---|--|
| Unit-I | Soil Microbiology & Pathology | |
| | <p>Soil Microbiology Introduction to soil microbiology, soil microorganisms common examples and their role in maintaining soil health.</p> <p>Methods of studying soil microorganisms: Culture method, Burried slide method and Respirometer,.</p> <p>Soil pathology Introduction to soil pathology, soil sickness- Concept, causes and remedial measures Role of soil pathogens in plant pathology.</p> | |
| | Seed and Market Pathology | 11 |

| | | |
|--------------------------|--|------------------|
| <p>Unit-II</p> | <p>Seed Pathology</p> <p>Concept, objectives and importance of seed pathology Examples of seed borne pathogens and methods to study them. Seed health management</p> <p>Nursery diseases and their management</p> <p>Market pathology:-</p> <p>Concept, need and significance.</p> | |
| <p>Unit – III</p> | <p>Pathophysiology, Culture and Staining Techniques Pathophysiology</p> <p>Concept and importance, Factors get affected due to pathogen infection.</p> <p>Paper Chromatographic technique in studying pathophysiology: pigments, amino acids, organic acids, sugars and polyphenols.</p> <p>Culture techniques</p> <p>Brief introduction to technique, Different types of culture media</p> <p>Staining techniques</p> <p>Common stains used in plant pathology, their preparation &significance Fungi: Cotton blue</p> <p>Bacteria: Gram’s stain Mycoplasma: Dien’s stain.</p> | <p>11</p> |
| <p>Unit – IV</p> | <p>Techniques in Plant Protection</p> <p>Recent techniques in Plant Protection</p> <ol style="list-style-type: none"> a. GMO’s (Genetically Modified Organisms) b. B.T. Cotton c. Pheromones d. Microbial pesticides e. Remote sensing f. Disease forecasting with computer g. E. M. Solution (Effective Microbial Solution)/Eco friendly botanical pesticides. | <p>12</p> |

Learning outcomes: The students should be able to.....

1. Learns about laboratory techniques in soil microbiology and soil pathology.
2. Know the laboratory techniques in seed and market pathology and nursery diseases.

3. Understand laboratory techniques in pathophysiology, culture and staining of pathogens.
4. Learns about use of recent techniques in plant protection.

References Book:

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2. Introduction to the Bacteria. Clifton, A. McGraw Hill Co., New York. 1958
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Bachelor of Science (B. Sc.) Part – III Plant Protection

Semester: VI

Practical BBPP 606 (Based on BBPT 603 and BBPT 604)

Learning objectives: Student will be able to.....

1. Give the practical knowledge about laboratory techniques in market pathology.
2. Give the practical knowledge about laboratory techniques in pathophysiology (Paper chromatography technique and estimation of pigments by colorimeter).
3. Give the practical knowledge about survey and collection of local diseases and pests.

| Section | SEMESTER - VI Practical BBPP 606 (Based on BBPT 603 and BBPT 604) | No. of hours per unit/ Credits 45 |
|------------------|--|--|
| Section-I | Practicals based on BBPT 603 | |
| | <ol style="list-style-type: none"> 1. Study of soil microbes, e.g. bacteria, algae and fungi (with permanent slides or live specimens, min 5 examples from each group) 2. Study of fungal soil pathogens (Min. 6- Max. 10 examples with permanent slides or live specimens) 3. Study of fungal seed borne pathogens on different types of crop seeds and grains (min. 6- max. 10 examples). 4. Study of Nursery Diseases of vegetable plots by visiting different nurseries. 5. Study of locally available market diseases (only fungal) of fruits and vegetables (min6- max. 10 examples). 6. Pathophysiological study w.r.t. moisture content and RWC in leaves of crop plants (2-3 examples of different diseases). | |

| | | |
|-------------------|---|--|
| | <ol style="list-style-type: none"> 7. Estimation of pigment composition in healthy and diseased leaves of crop plants (2-3 different diseases). 8. Estimation of sugar composition of healthy and diseased leaves of crop plants (2-3 different diseases). 9. Estimation of polyphenols composition of healthy and diseased leaves of crop plants (2-3 different diseases). 10. Study of GMOs (suitable 3-5 examples). 11. Study of microbial pesticides (1 or 2 examples from each group- virus, bacteria and fungi) 12. Preparation of microbial pesticide from fungal pathogen and its application on weeds. | |
| Section-II | Practicals based on BBPT 604 | |
| | <ol style="list-style-type: none"> 1. Study of soil microbes, e.g. bacteria, algae and fungi (with permanent slides or live specimens, min 5 examples from each group) 2. Study of fungal soil pathogens (Min. 6- Max. 10 examples with permanent slides or live specimens) 3. Study of fungal seed borne pathogens on different types of crop seeds and grains (min. 6- max. 10 examples). 4. Study of Nursery Diseases of vegetable plots by visiting different nurseries. 5. Study of locally available market diseases (only fungal) of fruits and vegetables (min6- max. 10 examples). 6. Study of causes of post-harvest damage and spoilage of fruits and vegetables. 7. Study of techniques of prolonging life of fruits and vegetables. 8. Study of preservation techniques of locally available fruits. 9. Study of types of green houses 10. Study of basic techniques of cultivation in green houses. 11. Visit to a greenhouse and submission of its report | |

Learning outcomes: The students should be able to.....

1. Learns about laboratory techniques in market pathology.
2. Apply laboratory techniques in pathophysiology (Paper chromatography technique and estimation of pigments by colorimeter).
3. Discuss survey and collection of local diseases and pests.
4. Know the post harvest management and green house technology.
5. Learns about the basics of agricultural journalism and marketing.

References for Practical

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Bachelor of Science (B. Sc.) Part – III: Plant Protection

Semester VI

Learning Objectives: Student will be able to.....

1. Identification of opportunities for development
2. Learn the mechanism of finance and fund raising
3. Understand the importance of marketing for better business opportunities
4. Study the plant based industrial sector in India and abroad.

| Unit | SEMESTER - VI (SECCT 607) Entrepreneurship Development | No. of hours per unit/ Credits 45 |
|-------------------|---|---|
| Unit-I | Entrepreneurship Development | 5 |
| | Introduction to entrepreneurship, Identification of opportunities for entrepreneurship, Concept of different occupations: - business, employment and profession. Functions of an entrepreneur. Business idea and plan, Types of businesses / ownerships – Sole Proprietorship, Partnership, Private limited company, Public limited company, Joint stock Company, Co-operative society. | |
| Unit-II | Business Finance & Accounts | 05 |
| | Preparation of project report for business, Sources of finance – government and nongovernment agencies, Working capital, Cash flow, Fund flow, Preparation of basics of financial statements, costing and pricing, Policies and incentives. | |
| Unit – III | Enterprise Management and Modern Trends | 05 |
| | Small business management and entrepreneurship, Woman entrepreneurship, Features of small business firms, Process of management in small business, Concept of data | |

| | | |
|------------------|---|-----------|
| | and information, Information as a commodity, Study of marketing strategy and marketing mix, Decision-making models, Types of decisions, Decision Support Systems, Introduction to e-commerce, types – B2B, B2C, C2B, C2C. | |
| Unit – IV | Entrepreneurship opportunities in Plant Sciences | 05 |
| | Plant based industries in India and abroad both in food and non- food sectors, Import and export regulations of plant based products, Case study on successful as well as unsuccessful small scale plant based industries in India. | |

Learning Outcomes: The students should be able to.....

1. Get the idea about IP rights
2. Avail the financial and marketing skill
3. Prepare the proposal for small scale industry.
4. Identify opportunities in the plant based industrial sector.

Recommended Books:

1. Entrepreneurship. Alpana Trehan Wiley India
2. A complete guide to successful Entrepreneurship, G. N. Pandey Vikas Publishers India

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Bachelor of Science (B. Sc.) Part - III: Plant Protection

Semester VI

Practical Paper SECCBP 610 (based on SECCBT 607)

Learning objectives: Student will be able to.....

1. Give the practical Exposure to a work environment, common practices, employment opportunities and work ethics in their relevant field.

| | | |
|----------------|---|--|
| Section | SEMESTER - VI SECCBP 610 (based on SECCBT 607) | No. of hours per unit/ Credits 45 |
| Section | Course Work: Industrial training (25) | |
| | 15 Days internship program and report writing | |

Learning Outcomes: The students should be able to.....

1. Participate in the projects in industries during his or her industrial training.
2. Describe use of advanced tools and techniques encountered during industrial training and visit.
3. Interact with industrial personnel and follow engineering practices and discipline prescribed in industry.
4. Develop awareness about general workplace behavior and build interpersonal and team skills.
5. Prepare professional work reports and presentations.