Rayat Shikshan Sanstha's

SADGURU GADAGE MAHARAJ COLLEGE, KARAD.

(An Autonomous College - Affiliated to Shivaji University, Kolhapur)

Accrediated By NAAC with A^+ Grade (CGPA 3.63)

National Education Policy (NEP-2020)

Syllabus for

B.Sc. Part -I

BOTANY

(Major)

Syllabus to be implemented from July 2023 onwards of

Academic Year 2023-24

Department of Botany

Syllabus for B.Sc.-I BOTANY (Major)

B. Sc. Part-I, Semester-I

Paper- I (MJ-BBT23-101): Diversity of Cryptogams (Credits: 02)

w.e.f. July-2023

Learning Objectives: Students will be able to-

1. State basic knowledge of different plant groups.
2. Generalize knowledge, importance and biodiversity of lower plant groups.
3. Illustrate the knowledge of economic importance of lower plant groups.
4. Apply the knowledge of opportunities for a career in the uses of lower plant groups.

Unit I : Introduction to Plant Kingdom and Bacteria **08**

Systems of classification (Two, Three and Five kingdom systems), General outline of plant kingdom.

Bacteria: Discovery, General characters, Cell structure and Types

Modes of reproduction – Vegetative, Asexual, Sexual –

Conjugation. Economic Importance.

Unit II : Algae **08**

General Characters of Algae.

Classification System of Algae (by G. M. Smith)

Economic Importance of Algae

Morphology and life cycles (excluding developmental stages) of *Nostoc* and *Spirogyra*

Unit III : Fungi **08**

General Characters of Fungi

Classification System of Fungi (by G. C. Ainsworth)

Economic Importance of Fungi

Morphology and life cycle (excluding developmental stages) of *Mucor* and *Penicillium*

Unit IV : Lichens **06**

General characters of Lichens

Types of Lichens based on thallus morphology

Methods of reproduction

Economic Importance of Lichens

Reference books-

1. Ainsworth GC and AS Sussman, The Fungi Vols. I, II, III, IV- A and IV-B (Unit III)
2. Alexopoulus CJ (1960) Introductory Mycology (Unit III)
3. Awasthi DD (2000) A handbook of Lichens (Unit IV)
4. Dube HC (1990) An Introduction to Fungi, Vikas Publishing House Pvt. Ltd., Delhi (Unit III, IV)
5. Kumar HD (1990) Introductory Phycology. East Western Press. New Delhi (Unit II)
6. Sharma OP(1992) Textbook of Thallophytes. McGraw Hill Pub. Co. (Unit II)
7. Sharma OO (1989)Textbook of Fungi (Unit III)
8. Gangulee HS and Kar AK (1992) College Botany Vol. II, New Central Book Agency (P) Ltd. (Unit I, III, IV)
9. Sharma PD (1991) The Fungi. Rastogi and Company, Meerut. (Unit III)
10. Vashistha BR and Sinha AK, Botany for degree students – fungi (Unit III)
11. Vashishtha BR (1976) Botany for Degree Students Part I Algae. S. Chand and Company, New Delhi. (Unit II)
12. Smith GM (1971) Cryptogamic Botany. Vol. I Algae and Fungi. Tata McGraw Hill Publishing Co. New Delhi. (Unit II)

Learning Outcomes:

After successful completion of the course, Student will be able to:

1. Apply the features and uses of lower cryptogams.
2. Implement the knowledge of lower cryptogams.
3. Give knowledge about the plant diversity of lower cryptogams.
4. Use to know the career opportunities in academics, research and entrepreneurship with respect to lower cryptogams.

Department of Botany

Syllabus for B.Sc.-I BOTANY (Major)

B. Sc. Part-I, Semester-I

Paper- II (MJ-BBT23-102): Plant Morphology (Credits: 02)

w.e.f. July-2023

Learning Objectives: Students will be able to-

1. Generalize the knowledge of diversity in vegetative and reproductive parts of plants.
2. Apply the basic knowledge of plant identification.
3. Interpret basic knowledge of plant morphology.
4. Explain the knowledge of morphology and reproductive plant parts.

Unit I : Morphology of Vegetative Parts **7**

Root Morphology: Types of root- Tap root and adventitious roots; modifications for storage.

Stem Morphology: Shape, surface and nature of branching (monopodial and sympodial), modification of stem (Runner, Rhizome, Tuber and Bulb).

Leaf: Typical leaf, Types (simple and compound), Types of phyllotaxy, venation and modification of leaf (Tendril and phyllode).

Unit II : Inflorescence **8**

Inflorescence: Definition.

Racemose -Raceme, Spike, Spadix, Corymb, Umbel, Catkin and Capitulum.

Cymose -Solitary, Monochasial- Helicoid and scorpiod; Dichasial and Polychasial.

Special types -Verticillaster, Cyathium and Hypanthodium. Significance of inflorescence.

Unit III : Flower **8**

Definition, Structure of typical flower, Types of Thalamus.

Calyx and corolla- types of corolla, cohesion and aestivation; Perianth.

Androecium: Structure of typical stamen, Variations- cohesion and adhesion.

Gynoecium: Structure of typical carpel, number, position, cohesion and adhesion; placentation- types and significance.

Unit IV : Fruits **7**

Introduction, Parts of fruit, Classification of fruits: a) Simple: Indehiscent, Dehiscent and Fleshy, b) Aggregate: Etaerio of Berries and Etaerio of Follicles. c) Multiple/ Composite fruits: Syconus and Sorosis.

Reference books-

1. Gurucharan Singh (2009) Plant systematics an integrated approach (Third edition), Science publisher.
2. Dutta A. C. (1964) Botany for degree students, Oxford University press, Bombay, Culcutta, Madras.
3. Gurucharan Singh: Plant Systematics (2004) An Integrated Approach, Science Publishers.
4. Annie Ragland, V. Kumaresan: Taxonomy of Angiosperms, Saras Publication (ISBN : 9789382459668)
5. George H. M. Lawrence (1955) An introduction to plant taxonomy, central book depot, Allhabad.
6. Pandey B.P. (2001) Taxonomy of Angiosperms, S. Chand Publishing,.
7. Kumar A.: Advanced Morphology of Angiosperm.
8. Vasistha P. C. Taxonomy of Angiosperms.
9. Sachdeva S.K. (1990) Angiosperms – Morphology, Anatomy, Taxonomy, Evolution, Kalyani Publication, Ludhiana.
10. Pandey S.N. Mishra S.P. (2009) Taxonomy of Angiosperms, Ane Books Pvt. Ltd., New Delhi.
11. Singh M.P. and Sharma A.K. (2002) Textbook of Botany, Anmol Publication, Pvt. Ltd., New Delhi.

Learning Outcomes:

After successful completion of the course, Student will be able to:

1. Apply the knowledge about vegetative and reproductive parts of plants.
2. Implement the knowledge of plant identification.
3. Execute the knowledge in finding range of variations found in different species of plants.
4. Distinguish structure of typical flower, inflorescence and fruits.

Department of Botany

Syllabus for B.Sc.-I BOTANY (Major)

B. Sc. Part-I, Semester-I,

Practical (MJ-BBP23-103)

Based on theory paper I (Diversity of Cryptogams) and II (Plant Morphology) (Credits: 02)

w.e.f. July-2023

Learning Objectives: Students will be able to-

1. Define the lower plant groups.
2. Distinguish modification of root and stem.
3. Differentiate the various types of leaf and inflorescence and also variation in thalamus.
4. Generalize structure of typical flower.
5. Identify different types of fruits.

1.	Study of forms of bacteria based on their shape (Permanent slide/ Photograph).
2 and 3.	Study of life cycle of *Nostoc* and *Spirogyra*.
4 and 5.	Study of life cycle of *Mucor* and *Penicillium*.
6.	Study of Types of lichens (Based on morphology).
7.	Study of different root modification.
8.	Study of nature of branching, modification of stem.
9 and 10.	Study of leaf: Types (simple and compound), phyllotaxy, venation and modification.
11 and 12.	Inflorescence: Racemose, Cymose and special type.
13.	Structure of typical flower and variation in Thalamus.
14 and 15.	Study of different types of fruit.

Learning Outcomes:

After successful completion of the course, Student will be able to:

1. Differentiate the lower and higher plant groups.
2. Identify the variation in plants.
3. Recognize the types of lichens.
4. Relate the modification of root and stem.
5. Compare types of leaf, inflorescence and fruits.

Department of Botany

Syllabus for B.Sc.-I BOTANY (Major)

B. Sc. Part-I, Semester-II

Paper- III (MJ-BBT23-201): Diversity of Archegoniate (Credits: 02)

w.e.f. July-2023

Learning Objectives: Students will be able to-

1. State basic knowledge of different plant groups.
2. Generalize knowledge, importance and biodiversity of vascular and non-vascular plant groups.
3. Illustrate the knowledge of economic importance of vascular and non-vascular plant groups.
4. Apply the knowledge of opportunities for a career in the uses of vascular and non-vascular plant groups.

Unit I : Bryophytes **7**

General characters, Alteration of Generation, Economic importance, Morphology, Anatomy and Life cycle (excluding developmental stages) of *Riccia* and *Funaria*.

Unit II : Pteridophytes **8**

General characters, Economic importance, Morphology, Anatomy and Life cycles (excluding developmental stages) of Lycopsida – *Selaginella*, Pteropsida – *Pteris*; Heterospory and seed habit.

Unit III : Gymnosperms **7**

General characters, Classification (up to order), Economic importance, Morphology, Anatomy (Leaf and Stem) and life cycle (excluding developmental stages) of Gnetopsida – *Gnetum*.

Unit IV : Introductory Taxonomy **8**

Introduction, Scope of Taxonomy, Functions of taxonomy: Classification, Identification, Nomenclature, Binomial Nomenclature; Ranks, Categories and taxonomic groups.

Reference books-

1. Parihar N. S. (1962) Bryophyta. Central Book Depot, Allahabad (Unit I)
2. Kashyap S. R. (1929) Liverworts of Western Himalayas and the Punjab Plains Part Iand II (Unit I)
3. Jermy A. G. (1973) The Phylogeny and Classification of ferns. (Unit II)
   Parihar N. S. (1959) An Introduction to Pteridophyta (Unit II)
4. Bierhorst D. W. (1971) Morphology of Vascular plants (Unit II, III)
5. Chamberlein C. J. (1966) Gymnosperms, Structure and Evolution (Unit III)

6. Coulter and Chamberle in J. M., Morphology of Gymnosperms (Unit III)
7. Bhatnagar S. P. and Moitra A (1996) The Gymnosperms. (Unit III)
8. Foster A. S. and Gifford E. M. (1959) Comparative morphology of vascular plants (Unit III)
9. Rashid A (1978) An introduction to Peridophytes (Unit II)
10. Ramanujan CGK (1979) Indian Gymnosperms in Time and Space (Unit III)
11. Smith GM(1971) Cryptogamic Botany. Vol. II Tata McGraw Hill Publishing Co. New Delhi. (Unit I)
13. Spome KR (1966) Morphology of Pteridophytes (Unit II)
14. Sporne KR (1967) Morphology of Gymnosperms (Unit III)
15. Surange KR (1968) Indian Fossil Pteridophyles (Unit IV)
16. Trivedi AN (2002) Advances in Pteridology (Unit II)
17. Vashishta BR (1996) Botany for degree students – Pteridophytes (Unit II)
18. Vashistha PC (1976) The Gymnosperms (Unit III)
19. Watson EV (1971) The structure and life of Bryophytes. Hutchinson and Co., London (Unit I)

Learning Outcomes:

After successful completion of the course, Student will be able to:

1. Apply the knowledge of features and uses of vascular and non-vascular plants.
2. Describe the concepts regarding vascular plants and non-vascular plants.
3. Interpret knowledge about plant diversity of vascular and non-vascular plants.
4. Express terminologies about taxonomy.

Department of Botany

Syllabus for B.Sc.-I BOTANY (Major)

B. Sc. Part-I, Semester-II

Paper- IV (MJ-BBT23-202): Plant Resources and Pharmaceutical Industry (Credits: 02)

w.e.f. July-2023

Learning Objectives: Students will be able to:

1. Impart the knowledge plant role in human welfare.
2. Make aware of the industrial applications of plant resources.
3. Update about plant dependent industries.
4. Encourage and think about entrepreneurship and start-ups.

Unit I : Plant Resources **08**

Introduction, concept, natural resources, biological resources, plants as natural resources, underutilized plants from Western Ghats

Utilization - Bioenergy, food, fodder, fibre, medicine and essences.

Plant Resources Processed – Jam, jelly, squash, ketchup, raisin, pickle and rubber Unprocessed – Honey, timber, wood, and tannins

Unit II : Flower arrangement **07**

Introduction, principles and basic elements of art in flower arrangement

Flowers and foliages suitable for flower arrangement

Types – social, formal and non-formal, materials used flower arrangement as a business

Unit III : Plant resources used in cosmetics, aromatics and pharmaceuticals **07**

Introduction, Scope of Herbal preparations.

Methods of extraction – Maceration, digestion, decoction, aromatic waste, extracts and tinctures i) *Aloe* ii) Henna iii) Lemon grass iv) Rose v) Jasmine vi) Turmeric vii) Ginger viii) Neem ix) Holy basil x) Kuda xi) Amala with reference to part used, products and uses

Unit IV : Plant Pharmaceutical Industry **08**

Concept and advantages

Types of pharmaceutical products: Churna, Asava, and Arishta, Drug plants with reference to the botanical source, active principles and medicinal uses of *Adathoda zeylanica*, *Tinospora cordifolia*, and *Asparagus racemosus.*

Manufacture of Churna (Triphalachurna), Arishta (Ashokarishta), and Asava (Kumariasava).

Concept of nutraceuticals and cosmeceuticals

Commercial significance of Amla and *Aloe*

Reference books-

1. A Textbook of Economic Botany. Sambamurthy, A.V.S.S., Subramanyam, N.S., Wiley Eastern Ltd., New Delhi. (1989)
2. Ayurvedic Useful Plants in India. Drury, C. H. Asiatic Publishing House, New Delhi. (2006).
3. Economic Botany - Plants in Our World. Simpson, B.B., Conner-Ogorzaly, M., McGraw Hill, New York. (1986)
4. Economic Botany in Tropics. Kocchar, S.L., 4th Edition. Macmillan India Ltd., New Delhi. (2011)
5. Indian MateriaMedica Vol. I and II. Nadkarni, K. M. Popular Prakashan, Mumbai. (2002)
6. Banker G S and Rhode C T Modem Pharmaceutics, Marcel Dekker Inc., NY.
7. Bean H S, Beckett A H, and Carless A H Advances in Pharmaceutical Sciences, Vol 1-4 Academic Press, London.
8. Cartstensen J T, Drug Stability, Marcel Dekker Inc NY.
9. Thakur, R.S., Puri, H.S. and Husain, A. (1969). Major medicinal plants of India, Central Institute of medicinal and aromatic plants, Lucknow.
10. Sharma, O.P. (1996). Hills Economic Botany, Tata McGraw Hill co., Ltd., New Delhi
11. Kocchar, S.L. (1998). Economic Botany of the tropics, II Edn. MacMillan India Ltd.

Learning Outcomes:

After successful completion of the course, Student will be able to:

1. Analyze the role of plants in human welfare.
2. Know the industrial applications of plant resources.
3. Recognize the plant dependent industries.
4. Discuss ideas related to plantbased entrepreneurship and start-ups.

Department of Botany

Syllabus for B.Sc.-I BOTANY (Major)

B. Sc. Part-I, Semester-I,
Practical (MJ-BBP23-203)
Based on theory paper III (Diversity of Archegoniate) and IV (Plant Resources and Pharmaceutical Industry) (Credits: 02)
w.e.f. July-2023

Learning Objectives: Students will be able to-

1. Define practical knowledge about archegoniate plant.
2. Participate in experiential learning with these practical.
3. Categorize underutilized plants of Western Ghats.
4. Generalize the plant resources and utilization of plants.
5. Understand the preparation of medicinal, aromatic and cosmetic remedies.

1.	Study of life cycle of *Riccia* and *Funaria.*
2.	Study of life cycle of *Selaginella* and *Pteris*.
3.	Study of life cycle of *Gnetum*.
4.	Underutilized plants from Western Ghats (Checklist)
5 and 6.	Preparation of Jam, squash, ketchup
7.	Plant resources-timber, wood and tannins yielding plant
8 and 9.	Flower arrangement
10 and 11.	Maceration, digestion and decoction techniques in pharmaceuticals.
12.	Medicinal plants: *Adathoda zeylanica, Tinospora cordifolia,* and *Asparagus racemosus*
13.	Preparation of Triphalachurna
14.	Preparation of Ashokarishta
15.	Preparation of Kumariasava

Learning Outcomes:

After successful completion of the course, Student will be able to:

1. Identify the variation in plants.
2. apply the practical knowledge regarding timber, wood and tannins yielding plant, as well as maceration, digestion and decoction techniques in pharmaceuticals
3. Prepare Jam Jelly and Ketchup.
4. Formulate the Ayurvedic preparations.
5. Self-entrepreneur

Department of Botany
Nature of SEE Question Papers
(w.e.f.July2023)

Que. 1. Select correct alternative. 08

1. .....

a) ..... **b)** .....

c) ..... **d)** .....

2. .....

a) ..... **b)** .....

c) ..... **d)** .....

3. .....

a) ..... **a)** .....

c) ..... **c)** .....

4. .....

a) ..... **a)** .....

c) ..... **c)** .....

5. .....

a) ..... **a)** .....

c) ..... **c)** .....

6. .....

a) ..... **b)** .....

c) ..... **d)** .....

7. .....

a) ..... **b)** .....

c) ..... **d)** .....

8. .....

a) ..... **b)** .....

c) ..... **d)** .....

Que. 2. Attempt any two. 16

A) .....

B) .....

C) .....

Que. 3. Attempt any four. 16

a) .....

b) .....

c) .....

d) .....

e) .....

f) .....

Department of Botany
For academic year: 2023-24

List of Paper setters

Sr. No.	Name of Paper setter	College
1	Dr. V. K. Nikam	S.G.M. College, Karad
2	Dr. (Mrs.) M. S. Patil	S.G.M. College, Karad
3	Dr. K. H. Patil	S.G.M. College, Karad
4	Dr. V. B. Chopade	S.G.M. College, Karad
5	Dr. A. V. Waghmode	S.G.M. College, Karad
6	Prof. Dr. D. D. Namdas	YCIS Satara
7	Dr. J. J. Chavan	YCIS Satara
8	Dr. S. D. Shaikh	RCSC Kolhapur
9	Dr. Mrs. R. A. Shinde	YCIS Satara
10	Dr. N. M. Pise	K. B. P. College, Pandharpur

Department of Botany
For academic year: 2023-24

List of Examiners

Sr. No.	Name of Examiners	College
1	Prof. Dr. D. D. Namdas	YCIS Satara
2	Dr. J. J. Chavan	YCIS Satara
3	Dr. S. D. Shaikh	RCSC Kolhapur
4	Dr. Mrs. R. A. Shinde	YCIS Satara
5	Dr. N. M. Pise	K. B. P. College, Pandharpur
6	Dr. H. S. Patil	Arts, Science and Commerce College, Baramati
7	Dr. S. R. Valvi	NowrosjeeWadia College, Pune
8	Dr. U. R. Pawar	ShriPanchamKhemrajMahavidyalalaya, Sawantwadi
9	Dr. U. H. Patil	BhogavatiMahavidylaya, Kurukali
10	Dr. S. K. Mengane	M. H. ShindeMahavidyalaya, Tisangi

Department of Botany
For academic year: 2023-24

List of Moderators

Sr. No.	Name of Moderators	College
1	Prof. Dr. D. D. Namdas	YCIS Satara
2	Dr. J. J. Chavan	YCIS Satara
3	Dr. S. D. Shaikh	RCSC Kolhapur
4	Dr. N. M. Pise	K. B. P. College, Pandharpur
5	Dr. H. S. Patil	Arts, Science and Commerce College, Baramati

Rayat Shikshan Sanstha's

SADGURU GADAGE MAHARAJ COLLEGE, KARAD.

(An Autonomous College - Affiliated to Shivaji University, Kolhapur)

Accrediated By NAAC with A^+ Grade (CGPA 3.63)

National Education Policy (NEP-2020)

Syllabus for

B.Sc. Part -I

BOTANY

(Minor)

Syllabus to be implemented from July 2023 onwards of

Academic Year 2023-24

Department of Botany

Syllabus for B.Sc.-I BOTANY (Minor)

B. Sc. Part-I, Semester-I

Paper- I (MN-BBT23-101): Diversity of Cryptogams (Credits: 02)

w.e.f. July-2023

Learning Objectives: Students will be able to-

1. State basic knowledge of different plant groups.
2. Generalize knowledge, importance and biodiversity of lower plant groups.
3. Illustrate the knowledge of economic importance of lower plant groups.
4. Apply the knowledge of opportunities for a career in the uses of lower plant groups.

Unit I : Introduction to Plant Kingdom and Bacteria **08**

Systems of classification (Two, Three and Five kingdom systems), General outline of plant kingdom.

Bacteria: Discovery, General characters, Cell structure and Types

Modes of reproduction – Vegetative, Asexual, Sexual –

Conjugation. Economic Importance.

Unit II : Algae **08**

General Characters of Algae.

Classification System of Algae (by G. M. Smith)

Economic Importance of Algae

Morphology and life cycles (excluding developmental stages) of *Nostoc* and *Spirogyra*

Unit III : Fungi **08**

General Characters of Fungi

Classification System of Fungi (by G. C. Ainsworth)

Economic Importance of Fungi

Morphology and life cycle (excluding developmental stages) of *Mucor* and *Penicillium*

Unit IV : Lichens **06**

General characters of Lichens

Types of Lichens based on thallus morphology

Methods of reproduction

Economic Importance of Lichens

Reference books-

1. Ainsworth GC and AS Sussman, The Fungi Vols. I, II, III, IV- A and IV-B (Unit III)
2. Alexopoulus CJ (1960) Introductory Mycology (Unit III)
3. Awasthi DD (2000) A handbook of Lichens (Unit IV)
4. Dube HC (1990) An Introduction to Fungi, Vikas Publishing House Pvt. Ltd., Delhi (Unit III, IV)
5. Kumar HD (1990) Introductory Phycology. East Western Press. New Delhi (Unit II)
6. Sharma OP(1992) Textbook of Thallophytes. McGraw Hill Pub. Co. (Unit II)
7. Sharma OO (1989)Textbook of Fungi (Unit III)
8. Gangulee HS and Kar AK (1992) College Botany Vol. II, New Central Book Agency (P) Ltd. (Unit I, III, IV)
9. Sharma PD (1991) The Fungi. Rastogi and Company, Meerut. (Unit III)
10. VashisthaBR and Sinha AK, Botany for degree students – fungi (Unit III)
11. Vashishtha BR (1976) Botany for Degree Students Part I Algae. S. Chand and Company, New Delhi. (Unit II)
12. Smith GM (1971) Cryptogamic Botany. Vol. I Algae and Fungi. Tata McGraw Hill Publishing Co. New Delhi. (Unit II)

Learning Outcomes:

After successful completion of the course, Student will be able to:

1. Apply the features and uses of lower cryptogams.
2. Implement the knowledge of lower cryptogams.
3. Give knowledge about the plant diversity of lower cryptogams.
4. Use to know the career opportunities in academics, research and entrepreneurship with respect to lower cryptogams.

Department of Botany

Syllabus for B.Sc.-I BOTANY (Minor)

B. Sc. Part-I, Semester-I

Paper- II (MN-BBT23-102): Plant Morphology (Credits: 02)

w.e.f. July-2023

Learning Objectives: Students will be able to-

1. Generalize the knowledge of diversityin vegetative and reproductive parts of plants.
2. Applythe basic knowledge of plant identification.
3. Interpretbasic knowledge of plant morphology.
4. Explain the knowledge of morphology and reproductive plant parts.

Unit I : Morphology of Vegetative Parts **7**

Root Morphology: Types of root- Tap root and adventitious roots; modifications for storage.

Stem Morphology: Shape, surface and nature of branching (monopodial and sympodial), modification of stem (Runner, Rhizome, Tuber and Bulb).

Leaf: Typical leaf, Types (simple and compound), Types of phyllotaxy, venation and modification of leaf (Tendril and phyllode).

Unit II : Inflorescence **8**

Inflorescence: Definition.

Racemose -Raceme, Spike, Spadix, Corymb, Umbel, Catkin and Capitulum.

Cymose -Solitary, Monochasial- Helicoid and scorpiod; Dichasial and Polychasial.

Special types -Verticillaster, Cyathium and Hypanthodium. Significance of inflorescence.

Unit III : Flower **8**

Definition, Structure of typical flower, Types of Thalamus.

Calyx and corolla- types of corolla, cohesion and aestivation; Perianth.

Androecium: Structure of typical stamen, Variations- cohesion and adhesion.

Gynoecium: Structure of typical carpel, number, position, cohesion and adhesion; placentation- types and significance.

Unit IV : Fruits **7**

Introduction, Parts of fruit, Classification of fruits: a) Simple: Indehiscent, Dehiscent and Fleshy, b) Aggregate: Etaerio of Berries and Etaerio of Follicles. c) Multiple/ Composite fruits: Syconus and Sorosis.

Reference books-

1. Gurucharan Singh (2009) Plant systematics an integrated approach (Third edition), Science publisher.
2. Dutta A. C. (1964) Botany for degree students, Oxford University press, Bombay, Culcutta, Madras.
3. Gurucharan Singh: Plant Systematics (2004) An Integrated Approach, Science Publishers.
4. Annie Ragland, V. Kumaresan: Taxonomy of Angiosperms, Saras Publication (ISBN : 9789382459668)
5. George H. M. Lawrence (1955) An introduction to plant taxonomy, central book depot, Allhabad.
6. Pandey B.P. (2001) Taxonomy of Angiosperms, S. Chand Publishing,.
7. Kumar A.: Advanced Morphology of Angiosperm.
8. Vasistha P. C. Taxonomy of Angiosperms.
9. Sachdeva S.K. (1990) Angiosperms – Morphology, Anatomy, Taxonomy, Evolution, Kalyani Publication, Ludhiana.
10. Pandey S.N. Mishra S.P. (2009) Taxonomy of Angiosperms, Ane Books Pvt. Ltd., New Delhi.
11. Singh M.P. and Sharma A.K. (2002) Textbook of Botany, Anmol Publication, Pvt. Ltd., New Delhi.

Learning Outcomes:

After successful completion of the course, Student will be able to:

1. Apply the knowledge about vegetative and reproductive parts of plants.
2. Implement the knowledge of plant identification.
3. Execute the knowledge in finding range of variations found in different species of plants.
4. Distinguish structure of typical flower, inflorescence and fruits.

Department of Botany

Syllabus for B.Sc.-I BOTANY (Minor)

B. Sc. Part-I, Semester-I,

Practical (MN-BBP23-103)

Based on theory paper I (Diversity of Cryptogams) and II (Plant Morphology) (Credits: 02)

w.e.f. July-2023

Learning Objectives: Students will be able to-

1. Define the lower plant groups.
2. Distinguish modification of root and stem.
3. Differentiate the various types of leaf and inflorescence and also variation in thalamus.
4. Generalize structure of typical flower.
5. Identify different types of fruits.

1.	Study of forms of bacteria based on their shape (Permanent slide/ Photograph).
2 and 3.	Study of life cycle of *Nostoc* and *Spirogyra*.
4 and 5.	Study of life cycle of *Mucor* and *Penicillium*.
6.	Study of Types of lichens (Based on morphology).
7.	Study of different root modification.
8.	Study of nature of branching, modification of stem.
9 and 10.	Study of leaf: Types (simple and compound), phyllotaxy, venation and modification.
11 and 12.	Inflorescence: Racemose, Cymose and special type.
13.	Structure of typical flower and variation in Thalamus.
14 and 15.	Study of different types of fruit.

Learning Outcomes:

After successful completion of the course, Student will be able to:

1. Differentiate the lower and higher plant groups.
2. Identify the variation in plants.
3. Recognize the types of lichens.
4. Relate the modification of root and stem.
5. Compare types of leaf, inflorescence and fruits.

Department of Botany

Syllabus for B.Sc.-I BOTANY (Minor)

B. Sc. Part-I, Semester-II

Paper- III (MN-BBT23-201): Diversity of Archegoniate (Credits: 02)

w.e.f. July-2023

Learning Objectives: Students will be able to-

1. State basic knowledge of different plant groups.
2. Generalize knowledge, importance and biodiversity of vascular and non-vascular plant groups.
3. Illustrate the knowledge of economic importance of vascular and non-vascular plant groups.
4. Apply the knowledge of opportunities for a career in the uses of vascular and non-vascular plant groups.

Unit I	**:**	**Bryophytes** General characters, Alteration of Generation, Economic importance, Morphology, Anatomy and Life cycle (excluding developmental stages) of *Riccia* and *Funaria*.	**7**
Unit II	**:**	**Pteridophytes** General characters, Economic importance, Morphology, Anatomy and Life cycles (excluding developmental stages) of Lycopsida – *Selaginella*, Pteropsida – *Pteris*; Heterospory and seed habit.	**8**
Unit III	**:**	**Gymnosperms** General characters, Classification (up to order), Economic importance, Morphology, Anatomy (Leaf and Stem) and life cycle (excluding developmental stages) of Gnetopsida – *Gnetum*.	**7**
Unit IV	**:**	**Introductory Taxonomy** Introduction, Scope of Taxonomy, Functions of taxonomy: Classification, Identification, Nomenclature, Binomial Nomenclature; Ranks, Categories and taxonomic groups.	**8**

Reference books-

1. Parihar N. S. (1962) Bryophyta. Central Book Depot, Allahabad (Unit I)
2. Kashyap S. R. (1929) Liverworts of Western Himalayas and the Punjab Plains Part Iand II (Unit I)
3. Jermy A. G. (1973) The Phylogeny and Classification of ferns. (Unit II)
   Parihar N. S. (1959) An Introduction to Pteridophyta (Unit II)
4. Bierhorst D. W. (1971) Morphology of Vascular plants (Unit II, III)

5. Chamberlein C. J. (1966) Gymnosperms, Structure and Evolution (Unit III)
6. Coulter and Chamberlein J. M., Morphology of Gymnosperms (Unit III)
7. Bhatnagar S. P. and Moitra A (1996) The Gymnosperms. (Unit III)
8. Foster A. S. and Gifford E. M. (1959) Comparative morphology of vascular plants (Unit III)
9. Rashid A (1978) An introduction to Peridophytes (Unit II)
10. Ramanujan CGK (1979) Indian Gymnosperms in Time and Space (Unit III)
11. Smith GM (1971) Cryptogamic Botany. Vol. II Tata McGraw Hill Publishing Co. New Delhi. (Unit I)
13. Spome KR (1966) Morphology of Pteridophytes (Unit II)
14. Sporne KR (1967) Morphology of Gymnosperms (Unit III)
15. Surange KR (1968) Indian Fossil Pteridophyles (Unit IV)
16. Trivedi AN (2002) Advances in Pteridology (Unit II)
17. Vashishta BR (1996) Botany for degree students – Pteridophytes (Unit II)
18. Vashistha PC (1976) The Gymnosperms (Unit III)
19. Watson EV (1971) The structure and life of Bryophytes. Hutchinson and Co., London (Unit I)

Learning Outcomes:

After successful completion of the course, Student will be able to:

1. Apply the knowledge of features and uses of vascular and non-vascular plants.
2. Describe the concepts regarding vascular plants and non-vascular plants.
3. Interpret knowledge about plant diversity of vascular and non-vascular plants.
4. Express terminologies about taxonomy.

Department of Botany

Syllabus for B.Sc.-I BOTANY (Minor)

B. Sc. Part-I, Semester-II

Paper- IV (MN-BBT23-202): Plant Resources and Pharmaceutical Industry (Credits: 02)

w.e.f. July-2023

Learning Objectives: Students will be able to:

1. Impart the knowledge plant role in human welfare.
2. Make aware of the industrial applications of plant resources.
3. Update about plant dependent industries.
4. Encourage and think about entrepreneurship and start-ups.

Unit I : Plant Resources **08**

Introduction, concept, natural resources, biological resources, plants as natural resources, underutilized plants from Western Ghats

Utilization - Bioenergy, food, fodder, fibre, medicine and essences.

Plant Resources Processed – Jam, jelly, squash, ketchup, raisin, pickle and rubber Unprocessed – Honey, timber, wood, and tannins

Unit II : Flower arrangement **07**

Introduction, principles and basic elements of art in flower arrangement

Flowers and foliages suitable for flower arrangement

Types – social, formal and non-formal, materials used flower arrangement as a business

Unit III : Plant resources used in cosmetics, aromatics and pharmaceuticals **07**

Introduction, Scope of Herbal preparations.

Methods of extraction – Maceration, digestion, decoction, aromatic waste, extracts and tinctures i) *Aloe* ii) Henna iii) Lemon grass iv) Rose v) Jasmine vi) Turmeric vii) Ginger viii) Neem ix) Holy basil x) Kuda xi) Amala with reference to part used, products and uses

Unit IV : Plant Pharmaceutical Industry **08**

Concept and advantages

Types of pharmaceutical products: Churna, Asava, and Arishta, Drug plants with reference to the botanical source, active principles and medicinal uses of *Adathoda zeylanica*, *Tinospora cordifolia*, and *Asparagus racemosus.*

Manufacture of Churna (Triphalachurna), Arishta (Ashokarishta), and Asava (Kumariasava).

Concept of nutraceuticals and cosmeceuticals

Commercial significance of Amla and *Aloe*

Reference books-

1. A Textbook of Economic Botany. Sambamurthy, A.V.S.S., Subramanyam, N.S., Wiley Eastern Ltd., New Delhi. (1989)
2. Ayurvedic Useful Plants in India. Drury, C. H. Asiatic Publishing House, New Delhi. (2006).
3. Economic Botany - Plants in Our World. Simpson, B.B., Conner-Ogorzaly, M., McGraw Hill, New York. (1986)
4. Economic Botany in Tropics. Kocchar, S.L., 4th Edition. Macmillan India Ltd., New Delhi. (2011)
5. Indian MateriaMedica Vol. I and II. Nadkarni, K. M. Popular Prakashan, Mumbai. (2002)
6. Banker G S and Rhode C T Modem Pharmaceutics, Marcel Dekker Inc., NY.
7. Bean H S, Beckett A H, and Carless A H Advances in Pharmaceutical Sciences, Vol 1-4 Academic Press, London.
8. Cartstensen J T, Drug Stability, Marcel Dekker Inc NY.
9. Thakur, R.S., Puri, H.S. and Husain, A. (1969). Major medicinal plants of India, Central Institute of medicinal and aromatic plants, Lucknow.
10. Sharma, O.P. (1996). Hills Economic Botany, Tata McGraw Hill co., Ltd., New Delhi
11. Kocchar, S.L. (1998). Economic Botany of the tropics, II Edn. MacMillan India Ltd.

Learning Outcomes:

After successful completion of the course, Student will be able to:

1. Analyze the role of plants in human welfare.
2. Know the industrial applications of plant resources.
3. Recognize the plant dependent industries.
4. Discuss ideas related to plant based entrepreneurship and start-ups.

Department of Botany

Syllabus for B.Sc.-I BOTANY (Minor)

B. Sc. Part-I, Semester-I,
Practical (MN-BBP23-203)
Based on theory paper III (Diversity of Archegoniate) and IV (Plant Resources and Pharmaceutical Industry) (Credits: 02)
w.e.f. July-2023

Learning Objectives: Students will be able to-

1. Define practical knowledge about archegoniate plant.
2. Participate in experiential learning with these practical.
3. Categorize underutilized plants of Western Ghats.
4. Generalize the plant resources and utilization of plants.
5. Understand the preparation of medicinal, aromatic and cosmetic remedies.

1.	Study of life cycle of *Riccia* and *Funaria.*
2.	Study of life cycle of *Selaginella* and *Pteris*.
3.	Study of life cycle of *Gnetum*.
4.	Underutilized plants from Western Ghats (Checklist)
5 and 6.	Preparation of Jam, squash, ketchup
7.	Plant resources-timber, wood and tannins yielding plant
8 and 9.	Flower arrangement
10 and 11.	Maceration, digestion and decoction techniques in pharmaceuticals.
12.	Medicinal plants: *Adathoda zeylanica, Tinospora cordifolia,* and *Asparagus racemosus*
13.	Preparation of Triphalachurna
14.	Preparation of Ashokarishta
15.	Preparation of Kumariasava

Learning Outcomes:

After successful completion of the course, Student will be able to:

1. Identify the variation in plants.
2. apply the practical knowledge regarding timber, wood and tannins yielding plant, as well as maceration, digestion and decoction techniques in pharmaceuticals
3. Prepare Jam Jelly and Ketchup.
4. Formulate the Ayurvedic preparations.
5. Self-entrepreneur

Department of Botany
Nature of SEE Question Papers
(w.e.f.July2023)

Que. 1. Select correct alternative. 08

1. .....

a) ..... **b)** .....

c) ..... **d)** .....

2. .....

a) ..... **b)** .....

c) ..... **d)** .....

3. .....

a) ..... **a)** .....

c) ..... **c)** .....

4. .....

a) ..... **a)** .....

c) ..... **c)** .....

5. .....

a) ..... **a)** .....

c) ..... **c)** .....

6. .....

a) ..... **b)** .....

c) ..... **d)** .....

7. .....

a) ..... **b)** .....

c) ..... **d)** .....

8. .....

a) ..... **b)** .....

c) ..... **d)** .....

Que. 2. Attempt any two. 16

A) .....

B) .....

C) .....

Que. 3. Attempt any four. 16

a) .....

b) .....

c) .....

d) .....

e) .....

f) .....

Department of Botany
For academic year: 2023-24

List of Paper setters

Sr. No.	Name of Paper setter	College
1	Dr. V. K. Nikam	S.G.M. College, Karad
2	Dr. (Mrs.) M. S. Patil	S.G.M. College, Karad
3	Dr. K. H. Patil	S.G.M. College, Karad
4	Dr. V. B. Chopade	S.G.M. College, Karad
5	Dr. A. V. Waghmode	S.G.M. College, Karad
6	Prof. Dr. D. D. Namdas	YCIS Satara
7	Dr. J. J. Chavan	YCIS Satara
8	Dr. S. D. Shaikh	RCSC Kolhapur
9	Dr. Mrs. R. A. Shinde	YCIS Satara
10	Dr. N. M. Pise	K. B. P. College, Pandharpur

Department of Botany
For academic year: 2023-24

List of Examiners

Sr. No.	Name of Examiners	College
1	Prof. Dr. D. D. Namdas	YCIS Satara
2	Dr. J. J. Chavan	YCIS Satara
3	Dr. S. D. Shaikh	RCSC Kolhapur
4	Dr. Mrs. R. A. Shinde	YCIS Satara
5	Dr. N. M. Pise	K. B. P. College, Pandharpur
6	Dr. H. S. Patil	Arts, Science and Commerce College, Baramati
7	Dr. S. R. Valvi	NowrosjeeWadia College, Pune
8	Dr. U. R. Pawar	ShriPanchamKhemrajMahavidyalalaya, Sawantwadi
9	Dr. U. H. Patil	BhogavatiMahavidylaya, Kurukali
10	Dr. S. K. Mengane	M. H. ShindeMahavidyalaya, Tisangi

Department of Botany
For academic year: 2023-24

List of Moderators

Sr. No.	Name of Moderators	College
1	Prof. Dr. D. D. Namdas	YCIS Satara
2	Dr. J. J. Chavan	YCIS Satara
3	Dr. S. D. Shaikh	RCSC Kolhapur
4	Dr. N. M. Pise	K. B. P. College, Pandharpur
5	Dr. H. S. Patil	Arts, Science and Commerce College, Baramati

Rayat Shikshan Sanstha's

SADGURU GADAGE MAHARAJ COLLEGE, KARAD.

(An Autonomous College - Affiliated to Shivaji University, Kolhapur)

Accredited By NAAC with A^+ Grade (CGPA 3.63)

National Education Policy (NEP-2020)

Syllabus for

B.Sc. Part -I

BOTANY
(Indian Knowledge System)

Vedic Agriculture

Syllabus to be implemented from July 2023 onwards of Academic Year 2023-24

Department of Botany
Syllabus for B.Sc.-I BOTANY (IKS)
B. Sc. Part-I, Semester-I
Paper (IKSB23-101): Vedic Agriculture (Credits: 02)
w.e.f. July-2023

Learning Objectives: Students will be able to-

1. Understand the basics of Vedic agriculture
2. Learn the ancient agriculture methods for sustainable agriculture.
3. Become skilled in preparation and production of various biopesticides and biofertilizers.
4. Acquire basic knowledge of traditional agricultural practices.

Unit I **Organic farming** **08**

Organic farming: Definition, scope and principles, relevance to modern agriculture.

Different eco-friendly farming systems: biological farming, natural farming.

Future prospects, advantages and barriers.

Unit II **Government policies and Biofertilizers** **08**

Initiatives taken by the central and state governments, NGOs and other Organizations for promotion of organic agriculture in India.

Manures: Types of organic manure and botanicals.

Unit III **Organic farming** **08**

Inorganic farming: limitations and disadvantages. Fertilizers used in inorganic farming, nutrient management in inorganic farming. Impact of inorganic farming relevance to human health and environment.

Unit IV **Management and Marketing** **06**

Fundamentals of insect, disease and weed management under organic mode of production, cultural, biological methods nonchemical pest disease management.

Botanicals- pyrethrum, neem seed kernel extract, neem seed powder, soluble neem formulations, neem oil.

Operational structure of NPOP: other agencies for organic production.

Inspection, certification, labeling and accreditation procedures for organic products.

Marketing and export potential of organic products.

Reference books:

1. Arun K. Sharma. 2002. A Hand book of organic farming. Agrobios, India. 627p.
2. Palaniappan, S. P. and Annadurai, K.1999. Organic farming –Theory and Practice. Scientific publishers, Jodhpur, India. 257p
3. Mukund Joshi and Prabhakarasetty, T. K. 2006. Sustainability through organic farming. Kalyani publishers, NewDelhi. 349p.
4. Balasubramanian, R., Balakishnan, K. and Siva Subramanian, K. 2013. Principles and practices of organic farming. Satish Serial PublishingHouse. 453p.
5. Tarafdar, J. C., Tripathi, K. P and Mahesh Kumar, 2009. Organic agriculture. Scientific Publishers, India. 369p.
6. Tiwari, V. N., Gupta, D. K., Maloo, S. R and Somani, L. L. 2010. Natural, organic, biological, ecological and biodynamic farming. Agrotech Publishing Academy, Udaipur. 420p.
7. Dushyent Gehlot. 2005. Organic farming-standards, accreditation, certification and inspection. Agrobios, India.357p

Learning Outcomes:

After successful completion of the course, Student will be able to:

1. Understand the process and steps involved in biofertilizers and biopesticide production, various methods of organic compost preparation.
2. Evaluate the importance of vedic agriculture knowledge for sustainable agriculture practices.
3. Analyze the economics of preparation of biofertilizers and biopesticides.
4. Apply the knowledge of production of biofertilizers and biopesticides and initiate a startup.

Rayat Shikshan Sanstha's

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National Education Policy (NEP-2020)

Syllabus for

B.Sc. Part -I

BOTANY

(Skill Enhancement Course)

Syllabus to be implemented from July 2023 onwards of

Academic Year 2023-24

Department of Botany

Syllabus for B.Sc.-I BOTANY (SEC)

B. Sc. Part-I, Semester-II

Paper (SECB23-201): Mushroom Cultivation (Credits: 02)

w.e.f. July-2023

Learning Objectives: Students will be able to-

1. Understand the basics of Mushroom production technology.
2. Learn the structural layout of mushroom cultivation.
3. Skilled in cultivation of various commercially used mushrooms.
4. Acquire basic knowledge of sterilization techniques, spawn development and compost preparation.

Unit I	**Introduction to mushrooms**	**07**
	Introduction, history, and importance of mushrooms, mushroom morphology Mushroom Types: Edible and poisonous mushrooms Nutrient profile of mushrooms Health benefits of mushrooms Present scenario and prospects for mushroom cultivation	
Unit II	**Common edible mushrooms**	**08**
	General morphology, distinguishing characteristics, spore germination and life cycle of button mushroom, straw mushroom, and oyster mushroom. Other economically important and medicinal mushrooms Shiitake Mushroom (*Lentinula edodes*), Kabul Dhingri (King Oyster) Mushroom.	
Unit III	**Commercial cultivation of mushrooms**	**08**
	Cultivation technology: Infrastructure and requirement. Preparation of spawn substrate, preparation of pure culture and culture maintenance, storage of spawn. Cultivation of commercially important mushrooms – Paddy straw mushroom, Wheat Straw Mushroom (Oyster Mushroom), Button Mushroom.	

Unit IV	**Harvesting, Pest management, and post-harvest processing of mushrooms** Harvesting: Sanitation during harvesting, the process of harvesting, post-harvest processing. Storage: Long term and short-term storage of mushroom. Diseases and pests: Dry bubble and wet bubble- Major diseases of cultivated mushrooms, Major insect pests, Mushroom flies / nematodes/mites Post-harvest processing: Value-added products/recipes, Quality assurance, packaging, Market opportunities.	**07**

Reference books-

1. Subrata Biswas, M. Datta, S. V. Ngachan. (2012) Mushrooms: A Manual for Cultivation. PHI Learning Pvt Ltd.
2. R. Gogoi, Y. Rathaiah, T.R. Borah. (2006). Mushroom cultivation technology. Scientific
   Publishers, Jodhpur, India.
3. M. H. Pinkerton. (2013). Commercial Mushroom Growing. British Library Cataloguing-inPublication data.
4. O.P. Ahlawat, R.P. Tewari (2007).Cultivation technology of Paddy straw Mushroom. National Research Centre for Mushroom (ICAR), Chambaghat, Solan, India.
5. Board NIIR. Handbook on Mushroom Cultivation and Processing. Centre for Information
   Technology.
6. Tripathi, D.P. (2005). Mushroom Cultivation. Oxford and IBH Publishing Co. Pvt .Ltd, New Delhi.
7. Pathak Yadav Gour. (2010). Mushroom Production and Processing Technology. Published byAgrobios (India).

Learning Outcomes:

After successful completion of the course, Student will be able to:

1. Understand the process and steps involved in Mushroom production, various methods of culture media, spawn and compost preparation.
2. Evaluate the importance of different types of Mushrooms and their cultivation.
3. Analyze the economics of Mushroom Cultivation.
4. Apply the knowledge of Mushroom Cultivation and initiate a startup.

Rayat Shikshan Sanstha's

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National Education Policy (NEP-2020)

Syllabus for

B.Sc. Part -I

BOTANY
(Generic Elective)

Syllabus to be implemented from July 2023 onwards of Academic Year 2023-24

Rayat Shikshan Sanstha's

Sadguru Gadage Maharaj College, Karad.

Syllabus introduced from July 2023

Bachelor of Science (B. Sc.) Part - I: Botany (Generic Elective)

Semester I

Theory Paper I (Paper Code: GE-BBT23-101) Basics in Plant Nursery (Credits 02)

Learning objectives: The students should be able to….

1. Discuss the concept and importance of plant nurseries.
2. Explain the basic material, tools, and techniques required to establish a plant nursery.
3. Apply the various practices followed in plant nurseries.
4. Demonstrate knowledge and skills required for plant nurseries

Unit I	**Introduction to the plant nursery**	07
	Introduction to the nursery industry, nursery techniques, Importance, Irrigation and Drainage management. Types of nurseries Nursery standards Establishment of Nursery: Selection of site and location,Design.	
Unit II	**Requirements of plant nursery**	08
	Nursery beds: types and precautions taken during bedpreparations Nursery tools, implements and containers for seedlings Seeds and other vegetative material required Watering, weeding, and nutrients Seasonal activities and routine operations in plant nursery	
Unit III	**Soil and media for nursery plants**	08
	Soil and soil factors (pH, Nutrition) Growth media and potting mixers Transplanting, Potting, pruning, and in ground production	
Unit IV	**Nursery Registration and Entrepreneurship Development**	07
	Registration of Nursery Accreditation of Nursery Certification of Nursery Government Policies for Nursery Development	

Learning Outcomes:

After successful completion of the course the students will be able to……

1. Describe the concept and importance of plant nurseries
2. Design plant nursery
3. Demonstrate different techniques required in plant nursery
4. Apply various practices to maintain plant nursery

References Books:

1. Plant nursery management: principles and practices. Krishnan, P. R., Kalia, R. K., Tewari, J. C., Roy, M. M. Central Arid Zone Research Institute, Jodhpur. (2014).
2. Plant Nursery Management: How to Start and Operate a Plant Nursery. Ray, P.K. Scientific Publishers, Jodhpur. (2012).
3. Plant Propagation: Principles and practices (8^{th} Edition). Hartmann, H.T., Kester D. E., Davis, F. T., Geneve, R. L. Pearson Education Limited, England. (2010).
4. Nursery management. Mason, J. Landlinks Press, Australia. (2004).

Rayat Shikshan Sanstha's

Sadguru Gadage Maharaj College, Karad.

Syllabus introduced from July 2023

Bachelor of Science (B. Sc.) Part - I: Botany (Generic Elective)

Semester I

Theory Paper II (Paper Code: GE-BBT23-102) Plant Nursery Management (Credits 02)

Learning objectives: The students should be able to……..

1. Describe the different diseases and pests of nursery plants.
2. Distinguish the methods of vegetative propagation.
3. Demonstrate various practices followed in plant nurseries.
4. Differentiate the plant growth regulators by specialized structures.

Unit I	**Disease and pest management**	07
	Different diseases of nursery plants	
	Different pest infections faced by nursery plants	
	Factors affecting nursery establishment	
Unit II	**Vegetative propagation**	08
	Vegetative Propagation through cutting	
	Vegetative Propagation through budding	
	Vegetative Propagation through grafting	
	Vegetative Propagation through layering	
Unit III	**Vegetative propagation by specialized structures**	08
	Propagation by bulb	
	Propagation by corm	
	Propagation by rhizome	
	Propagation by tuber	
	Propagation by off-set	
Unit IV	**Plant growth regulators**	07
	Definition of growth regulators	
	Types of growth regulators	
	Use of growth regulators in plant nurseries	

Learning Outcomes: The students will be able to……

1. Identify different diseases and pests in plant nurseries
2. Perform nursery plants propagation by vegetative methods
3. Use different specialized structures for vegetative propagation of nursery plants
4. Apply various plant regulators in nurseries

References Books:

1. Introduction to Horticulture. Kumar, N. Rajalakshmi Publications, Nagercoil. (1997).
2. Plant nursery management: Principles and practices. Ratha Krishnan, M., et.al. Central Arid Zone Research Institute (ICAR), Jodhpur. (2014).
3. Plant Propagation. Mishra, K., Mishra, N. K., Chand, S. John Wiley & Sons, New Jersey. (1994).

Rayat Shikshan Sanstha's

Sadguru Gadage Maharaj College, Karad.

Syllabus introduced from July 2023

Bachelor of Science (B. Sc.) Part - I: Botany (Generic Elective)

Semester I

Practical Paper I (Paper Code: GE-BBP23-103) Practicals based on Paper I and II

(Credits 02)

Learning objectives: The students should be able to……..

1. Demonstrate nursery bed preparation and media preparation.
2. Explain the basic material, tools, and techniques required to establish a plant nursery.
3. Apply various methods of vegetative propagation.
4. Understand use of potting and repotting.
5. Categories the various plant growth regulators.
6. Describe the growth media and potting mixtures.

1. Demonstration of nursery bed preparation.
2. Demonstration of nursery media preparation.
3. Study of nursery tools.
4. Study of cutting
5. Study of budding
6. Study of grafting
7. Study of layering
8. Study of propagation of succulents.
9. Study of potting technique.
10. Study of soil pH of different soil types used in nursery.
11. Study of water holding capacity of different soil typesused in nursery.
12. Study of application of different nutrients used in nursery.
13. Study of growth regulators in plant nurseries, seed dormancy.
14. Study of Growth media and potting mixers, potting and repotting.
15. Library of Nursery.
16. Visit to any local plant nursery and report submission.

Learning outcomes: The students will be able to……

1. Demonstrate different techniques required in plant nursery.
2. Categories different material tools and techniques for plant nursery.
3. Use different methods of vegetative propagation.
4. Employ various plant regulators in nurseries
5. Demonstrate the technique of potting and repotting.
6. Generalize the growth media and potting mixtures.

References Books:

1. Introduction to Horticulture. Kumar, N. Rajalakshmi Publications, Nagercoil. (1997).
2. Nursery management. Mason, J. Landlinks Press, Australia. (2004).
3. Plant Nursery Management: How to Start and Operate a Plant Nursery. Ray, P.K. Scientific Publishers, Jodhpur. (2012).
4. Plant Propagation. Mishra, K., Mishra, N. K., Chand, S. John Wiley & Sons, New Jersey. (1994).

Rayat Shikshan Sanstha's

Sadguru Gadage Maharaj College, Karad.

Syllabus introduced from July 2023

Bachelor of Science (B. Sc.) Part - I: Botany (Generic Elective)

Semester II

Theory Paper III (Paper Code: GE-BBT23-201) Scope of Plant Nursery (Credits 02)

Learning objectives: The students should be able to…….

1. Define objective and importance of olericulture and cultivation of various vegetables.
2. Pomiculture
3. Categories the types of gardens.
4. Apply the knowledge of medicinal plants.

Unit I	**Olericulture**	**07**
	Definition, objectives, and Importance of Olericulture. Cultivation and management of onion, garlic, brinjal, tomato, okra, capsicum, chilly, and cauliflower (any four). Processing of olericulture produce, Transportation, and marketing of olericulture produce.	
Unit II	**Pomiculture**	**08**
	Definition, objectives, and importance of pomiculture, National and International Status of pomiculture. Principles of pomiculture, basic requirements for practicing pomiculture (land, equipment, seeds, post-harvest storage) Cultivation and management of banana, grapes, pomegranate, dragon fruit, raspberry, custard apple, amla, chickoo, mango, strawberry (any four)	
Unit III	**Types of Gardens**	**08**
	Concept of special types of gardens vertical garden, roof garden, rock garden, clock garden. Garden plant components, arboretum, shrubbery, fernery, palmatum, arches and pergolas, edges and hedges, succulents, flower borders and beds. Lawns: Establishment, and Maintenance.	

Unit IV **Medicinal Plants** **07**

Definition, history, present and future needs.

Introduction to medicinally important secondary metabolites ofplants.

Importance of medicinal plants- Amla (*Phyllanthus emblica*), Ginger (*Zingiber officinalis*), Aloe (*Aloe vera*), Turmeric (*Curcuma longa*), Narkya (*Nothopodytes nimmoniana*)

Learning Outcomes: The students will be able to……..

1. Know and analyze the role of nursery.
2. Describe the olericulture and pomoculture.
3. Identify the types of gardens.
4. Apply the knowledge of medicinal plants and secondary metabolites.

References Book:

1. An Introduction to Medicinal Plants. Dutt, A. 1st Edition. Adhyayan Publishers and Distributors, New Delhi. (2009).
2. Herbal Drug Industry: A Practical Approach to Industrial Pharmacognosy. Chaudhry, R. D., Eastern Publishers, India. (1996).
3. Introductory Ornamental Horticulture. Arora, J. Kalyani Publishers, New Delhi. (2014).
4. Natural Products: A Lab Guide, Raphael, I. 2nd Edition. Academic Press, USA. (1991).

Rayat Shikshan Sanstha's

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Syllabus introduced from July 2023

Bachelor of Science (B. Sc.) Part - I: Botany (Generic Elective)

Semester II

Theory Paper IV (Paper Code: GE-BBT23-202) Advances in Nursery Techniques (Credits 02)

Learning objectives: The students should be able to……..

1. Introduce the students to the advanced methods of nursery techniques.
2. Explain the techniques required to establish a plant tissue culture laboratory.
3. Demonstrate somatic embryogenesis and micropropagation.
4. Comprehend knowledge and skills required for aquaponics techniques.

Unit I	**Plant Tissue Culture Introduction**	**07**
	Introduction, the importance of Plant Tissue Culture. Explants selection, sterilization, and inoculation. Equipment's Principle and working - pH meter, Hot air oven,Autoclave, LAF, Rotary Shaker.	
Unit II	**Micropropagation**	**08**
	Introduction, stages of Micropropagation, factors affecting micropropagation, advantages and applications. Organogenesis - formation of shoots and roots, production ofvirus-free plants by meristem and shoot-tip culture. Advantages and Limitations of Micropropagation, Importance of Micropropagation in Crop Improvement, Hardening.	
Unit III	**Somatic Embryogenesis**	**08**
	Concept Somatic Embryogenesis. Process of Somatic Embryogenesis Factors affecting embryogenesis Production of artificial seeds; Cryopreservation.	
Unit IV	**Aquaponics**	**07**
	Concept, Advantages of Aquaponics Principle, Types, Components of Aquaponics system Technical Challenges: pH, Nutrients and Pest and disease management	

Learning Outcomes: The students will be able to…….

1. Demonstrate the advance method of nursery techniques.
2. Perform plant tissue culture techniques.
3. Perform steps in somatic embryogenesis and micropropagation of plants.
4. Establish a unit of aquaponics and use different media for hydroponics.

References Books:

1. Plant Tissue Culture: Techniques and Experiments. Smith, R. H. 2nd Edition, Academic Press,USA. (2000).
2. Plant Tissue Culture: Theory and Practice. Bhojwani, S. S., Razdan, M. K., Elsevier, NewDelhi. (2005).

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Syllabus introduced from July 2023

Bachelor of Science (B. Sc.) Part - I: Botany (Generic Elective)

Semester II

Practical Paper II (Paper Code: GE-BBP23-203) Practicals based on Paper III and IV

(Credits 02)

Learning objectives: The students should be able to…..

1. Explain the economically important nursery plants.
2. Comprehend the knowledge of medicinal plants.
3. Demonstrate the technique of aquaponics.
4. Describe the types of gardens.
5. Generalized the equipment's required for plant tissue culture and media.

1. Identification of locally available common medicinal plants.
2. Study of agronomy of any four vegetable plants Onion, Brinjal, Tomato, Capsicum.
3. Study of agronomy of any four fruits plants Banana, Grapes, Pomegranate, Custard apple.
4. Study of agronomy of Ginger, Turmeric.
5. Study of agronomy of Awala, Aloe and Narkya.
6. Sterilization Techniques - Autoclave and Hot Air Oven.
7. Preparation of M. S. media.
8. Selection, sterilization and inoculation techniques of plant.
9. Plant tissue Culture.
10. Establishment of callus culture.
11. Organogenesis in callus cultures.
12. Hardening techniques.
13. Study of Aquaponics.
14. Study of types of gardens.
15. Visit to garden/ nursery and preparation of land scaping/ garden model/landscape sketch and submit the report.

Learning outcomes: The students will be able to….

1. Establish nursery for economically important plants.
2. Develop various plant-based products based on medicinal value.
3. Set-up a hydroponic unit and performs aquaponics techniques.
4. Classify the types of gardens.
5. Perform steps involved in plant tissue culture.

References Books:

1. A Handbook for Skill Development Nursery Management of Horticultural Crops. Deepa, H., Bharti, N. Satish Serial Publishing House, New Delhi. (2019).
2. Horticultural Nursery Management under National Agricultural Innovation Project- ICARNew Delhi. Bhujbal, B. Yashwantrao Chavan Maharashtra Open University, Nashik. (2017).
3. Plant Tissue Culture: Theory and Practice. Bhojwani, S. S., Razdan, M. K., Elsevier, New Delhi. (2005).

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Syllabus to be introduced from June 2023

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

Semester: I

Theory Paper I (GE-BPPT23-101):Fundamentals of Plant Pathology (Credits 02)

Course Objectives:

1. To understand the basic knowledge about plant diseases.
2. To imbibe the knowledge of effect of fungicides.
3. To gain the knowledge about principles of plant disease management.
4. To impart the knowledge about management of crop diseases by IDM.

Unit I **Concept of Plant Diseases** **08**

Introduction to the Science of plant pathology: Its Importance, Scope and Causes of Plant Diseases

Terminologies in Plant Pathology, Disease triangle Concept.

Symptoms and signs of plant diseases.

Dissemination of plant pathogens.

Survival of plant pathogens.

Flowering Parasitic Plants.

Unit II **Plant Diseases** **07**

Study of plant diseases with respect to symptoms, causal organism, disease cycle and their management.

Cereals a) Wheat – i) Black stem rust.

b) Jowar – i) Grain smut.

Pulses a) Bean -i)Anthracnose

Vegetables a) Tomato - i) Late blight of Tomato/Early blight of

b) Amaranthus - i) White rust.

Oil seed crop a) Groundnut - i) Tikka disease.

b) Sunflower - i) Rust/ any other available disease.

Unit III **General methods of plant protection.** **07**

Cultural methods – Tillage, crop rotation, trap crops, fertilizer applications

Mechanical methods – Field sanitation, Hand picking, destruction of egg masses, light traps, use of sticky bands, bagging for the pests.

Physical methods – Heat and soil solarisation

Unit IV **Integrated Disease Management** **08**

Definition of IDM, concept and definition of IDM

Main components of integrated disease management (IDM).

Host resistance

Induced systemic resistance

Genetically improved plants

Physical methods ,Biological methods, Cultural methods

Plant nutrition

Use of pesticides of plant origin

Judicious use of chemicals

Course Outcomes:

1. Student's explain effect of environmental factors on disease development.
2. Student's get the knowledge about fungicides.
3. Student's apply the methods used for plant disease management.
4. Student's gain the knowledge about integrated disease management.

Reference Books:

1. Jain V., 2009 Laboratory Manual of Plant Pathology. Oxford Book, Calcutta.
2. Agrios G. 2005 Plant Pathology. (5^{th}Edn.), Academic Press, San Diego.
3. Aneja K., 2005. Experiments in Microbiology Plant Pathology and Tissue Culture. New Age International (P) Ltd. Publishers, New Delhi.
4. Bilgrami K. 1990. Textbook of Modern Plant Pathology. New edition, New Delhi.
5. Chattopadhyay S., 1987 Principles and procedures of plant protection. Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi.
6. Baruah H., 1984 Text Book of Plant Pathology. Oxford and IBH Publ. Co., New Delhi.
7. Mehrotra R., and Aggarwal A., 1980 Fundamentals of Plant Pathology. McGraw-Hill Education Pvt. Ltd., New Delhi.
8. Butler & Edwin. 1949. Plant Pathology. Macmillan & Co.

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Sadguru Gadage Maharaj College, Karad.

Syllabus to be introduced from June 2023

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

Semester: I

Theory Course II (GE-BPPT23-102): Entomology (Credits 02)

Course Objectives:

1. To know the basic knowledge about insects and their body parts.
2. To update the knowledge of Entomology.
3. To understand the knowledge about formulation and uses of insecticides.
4. To discuss about biocontrol agents and apply this knowledge for pest control.

Unit I **Introduction to Entomology** 08

Introduction and history of entomology in India including contribution of scientists in brief.

Definitions: Insect, Entomology and agro-entomology

Economic importance of insects: Harmful, beneficial and productive insects.

Body segmentation: Structure of head, thorax and abdomen.

Unit II **Plant Insect Pests** 07

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

Cereals a) Paddy - Leaf hopper.

Pulses a) Green Peas - Pod borer.

Vegetables a) Bhendi - Fruit borer.

Fruits a) Custard apple - Mealy bugs.

Ornamentals a) Rose - Aphids

Polyphagus insect pests – i) White Grub

ii) Whitefly.

Unit III **Importance of toxicological study** 07

Toxicity : Definition, types: - acute & chronic
L.D.-50
Color code
Antidotes

General precautions regarding to uses of pesticides

Limitations of Chemical control.

Biological control of insect pests:

Unit IV **Insecticides** 08

Definition, classification ,characters of an ideal insecticide.

Study of major insecticides with respect to properties,

formulations, methods of application, mode of action and uses.

Plant origin insecticides- a) Azadirachtin

Chlorinated hydrocarbons –a) Endosulfan.

Organophosphate – a) Malathion.

Carbamate – a) Carbaryl.

Synthetic Pyrethroids. a) Cypermethrin

Nematicides : a) Nemagon

Rodenticides : a) Zinc Phosphoide

Course Outcomes:

1. Student's explain importance of beneficial insects.
2. Student's apply the management practices for different field pests.
3. Student's understand formulation and uses of insecticides.
4. Student's update the knowledge and concept of Entomology.

Reference Books:

1. Dhaliwal G.S., 2015. Element of Agricultural Entomology. Published by Kalyani Publishers, New Delhi (ISBN: 978-93-272-5134-0).
2. Conrad Ross, 2013. Natural beekeeping: organic approaches to modern apiculture. Chelsea Green Publishing.
3. Butt, Tariq M., Chris Jackson, and Naresh Magan, 2001. Fungi as biocontrol agents: progress, problems and potential. CABI publishing.
4. Srivastava K. P. and Dhaliwal G. S. A text book of Applied Entomology, Vol. II, Kalyani Publisher.
5. David B. V., and Rammurthy V. V., Elements of Economic Entomology Namrutha Publications (7th Edition).
6. Ragumoorthy K. N., Srinivasan M. R., Balasubramani V., and Natarajan N. A. E. Principles of Applied Entomology. Publication, Coimbatore.
7. Tembhare D. B., Modern Entomology. Himalaya Publishing House (ISBN : 978-93-5051-828-1).
8. Dhaliwal G. S., Ram Singh and Chillar B. S. Essentials of Agricultural Entomology. Kalyani Publisher.

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Syllabus to be introduced from June 2023

Bachelor of Science (B. Sc.) Part - I Plant Protection (GE)

Practical Course -I (GE-BPPP23-103) (Credits 02)

(Practicals based on Theory Courses I and II)

Course Objectives:

1) To familiarize the students with general plant pathological equipment's and pathological procedures.

2) To learn the plant diseases with respect to symptoms, causal organisms, disease cycle and management.

3) To learn the insect pests with respect to marks of identification nature of damage and management.

4) To impart the knowledge about integrated disease management.

Sr. No.	Name of Practical's
1	Study of general plant pathological equipment's like compound microscope, autoclave, laminar air flow, incubators and hot air oven
2 & 3	Study of plant diseases of Cereals a) Black stem rust of wheat. b) Grain smut of Jowar
4	Study of plant diseases of Pulses a) Anthracnose of Bean
5 & 6	Study of plant diseases of Vegetables a) Late/Early blight of Tomato b) White rust of *Amaranthus*
7 & 8	Study of plant diseases of Oil seed crop a) Tikka disease of groundnut b) Rust/ any other available disease of Sunflower
9	Determination of sucrose % by hand refractometer.
10	Study of Methods of collection and preservation of insects including immature stages
11 - 14	Study of major pests with reference to scientific name, marks of identification, host range, life cycle, nature of damage and management A. Cereals a) Paddy - Leaf hopper. B. Pulses a) Green Peas - Pod borer.

C. Vegetables a) Bhendi - Fruit borer.

D. Fruits a) Custard apple - Mealy bugs.

E. Ornamentals a) Rose - Aphids

F. Polyphagus insect pests –i) White Grub

ii) Whitefly.

15 Study of Insecticides (As per theory).

16 Collection of Insect pests and plant diseases.

Course Outcomes:

1) Student's learn and use all plant pathological procedures
2) Student's demonstrate the methods used for estimation of sucrose % in plants.
3) Student's apply the different methods for disease management.
4) Student's identify different types of insects and their proper management.

Reference Books:

1. Jain V., 2009. Laboratory Manual of Plant Pathology. Oxford Book, Calcutta.
2. Havlin J., Beaton J., Tisdale S., & Nelson W., 2006. Soil Fertility and fertilizers. 7th Ed. Prentice Hall.
3. Agrios G., 2005. Plant Pathology. (5thEdn.), Academic Press, San Diego.
4. Aneja K., 2005. Experiments in Microbiology Plant Pathology and Tissue Culture. New Age International (P) Ltd. Publishers, New Delhi.
5. Brady N., & Weil R., 2002. The Nature and Properties of Soils. 13th Ed. Pearson Edu.
6. Yawalkar K., Agrawal J., & Bokde S., 2000. Manures and Fertilizers. Agri-Horti Publ.
7. Prasad R., & Power J., 1997. Soil Fertility Management for Sustainable Agriculture. CRC Press.
8. Mehrotra R., and Aggarwal A., 1980. Fundamentals of Plant Pathology. McGraw-Hill Education Pvt. Ltd., New Delhi.

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Syllabus to be introduced from June 2023

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

Semester: II

Theory Course III (GE-BPPT23-201): Weed Biology (Credits-02)

Course Objectives:

1. To understand the basic knowledge of ecology of weeds.
2. To apply the methods for integrated weed management.
3. To update the knowledge about the certification of organic farm products.
4. To impart the knowledge about weed biology.

Unit I	**Weed Biology and Ecology Weeds**	07
	Weed - Introduction, types of weed, harmful and beneficial effects,	
	Critical periods of crop weed competition and allelopathy.	
	Propagation, dissemination and weed seed dormancy	
	Weed biology and ecology	
Unit II	**Traditional methods of weed management**	08
	Weed management principles and methods/options – preventive, physical, cultural, biological.	
	IWM (Integrated Weed Management)	
Unit III	**III Organic Methods of Weed Management**	07
	Thermal Weed Control.	
	Soil Solarization and mulching.	
	Mechanical Weed Management	
	Stale Seed bed.	
	Crop Rotation.	
Unit IV	**Certification of organic farming Products**	08
	Organic certification Standards and regulations	
	Operational Structure of NPOP – other agencies for organic production	
	Inspection, Certification, Labeling and accreditations procedures for organic products	

Course Outcomes:

1. Student's recognize the knowledge about weeds and its potential negative impact in a farm.
2. Student's learn about traditional weed management practices.
3. Student's update the knowledge about the importance of certification of organic farming products.
4. Student's design farm friendly methods of weed management.

Reference Books:

Agrawal 2018. Edition, reprint, revised; Publisher, Oxford and IBH Publishing Company Pvt. Limited; ISBN, 8120409949.

Joshi A.K., and Singh B.D. 2017. Seed Science and Technology; Edition. Revised; Publisher. Kalyani Publishers.

Basra A. S., ed. 2007. Handbook of seed science and technology. Scientific Publishers.

Hutchins J.D., and Reeves J.E. (Eds.). 1997. Seed Health Testing: Progress Towards the 21st Century. CABI, Wallington.

Agarwal V.K., and Sinclair J.B., 1993. Principles of Seed Pathology. Vols. I and II, CBS Publ., New Delhi.

Paul N. 1988. Seed Pathology. MacMillan, London.

Agarwal R.N., 1982. Seed Technology; Author, R. L. Agrawal; Publisher, Oxford, and IBH Publishing.

Suryanarayana D., 1978. Seed Pathology. Vikash Publ., New Delhi.

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Syllabus to be introduced from June 2023

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

Semester: II

Theory Course IV (GE-BPPT23-202): Biofertilizers and Biopesticides (Credits 02)

Course objectives:

1. To explain the basic knowledge about importance of biofertilizers.
2. To understand the knowledge culture of bacteria and fungi.
3. To acquire the knowledge about botanical and bacterial biopesticides.
4. To apply the knowledge about preparation vermicomposting in field.

Unit I	**Basics of Biofertilizers**	07
	Biofertilizers– definition, importance and advantages. Sources of Biofertilizers- Bacteria, Cyanobacteria, Mycorrhiza and Phosphate Solubilizing Microorganisms (PSM). Outlines of production technology of biofertilizers- isolation, selection of strain, preparation of mother culture, starter culture, mass culturing.	
Unit II	**Culture of Bacterial and fungal Biofertilizers**	08
	Rhizobium –Mass multiplication, starter culture, mass cultivation, inoculant formulations and application method. **Azatobacter-** Mass multiplication, maintenance of culture, application and crop response. ***Anabaena***- Characteristics, *Azolla Anabaena* association, *Azolla* production and application. **VAM**-mass production-substrate, substrate free, in-vitro methods and crop response l	
Unit III	**Botanical and fungal Biopesticides**	07
	Biological control agents and their characteristics. Types of biopesticides: Bacterial, fungal and viral; advantages and disadvantages. Properties of botanical biopesticides: Pesticide products *Azadirachta*, *Pongamia* and *Annona*. Characteristics of biological fungicides: *Trichoderma*, *Pseudomonas* and *Fusarium* species; production and processing of biological fungicides.	
Unit IV	**Biofertilizers**	08

Introduction, types, importance, history of biofertilizers production, advantages of biofertilizers

Sources of biofertilizers –Bacteria, Cyanobacteria, Mycorrhiza

Manures – Compost, methods of composting

Vermicomposting, green manuring; types, advantages and disadvantages and nutrient availability.

Preparation of FYM, composts, different methods of composting, decomposition process

Course Outcomes:

1. Student's discuss about the need and importance of biofertilizers
2. Student's explain importance of VAM
3. Student's realize the importance of botanical biopesticides
4. Student's demonstrate the preparation method of vermicomposting and FYM.

Reference Books:

- Ortiz A., and Estibaliz S., 2022. The role of beneficial microorganisms in soil quality and plant health. *Sustainability* 14, no. 9 : 5358.
- Abbey L., Joel A., Adedayo L.A., Ekene Mark- A.I., and Mercy I., 2019. Biopesticides and biofertilizers: types, production, benefits, and utilization. Byproducts from Agriculture and Fisheries*:* Adding Value for Food, Feed, Pharma, and Fuels: 479-500.
- Kumar V.V., 2018. Biofertilizers and biopesticides in sustainable agriculture. Role of Rhizospheric Microbes in Soil: Volume 1: Stress Management and Agricultural Sustainability : 377-398.
- Saleem F. and Shakoori A.R., 2012. Development of Bio insecticide, Lambert Academic Publishing, Latvia, European Union.
- Mahendra K. R., 2005. Hand book of Microbial biofertilizers. The Haworth Press,Inc. New York.
- Kannaiyan S., 2003. Biotechnology of Biofertilizers. CHIPS, Texas.
- Reddy S.M., 2002. Bioinoculants for sustainable agriculture and forestry. Scientific Publishers, Jodhpur.
- Subba Rao N.S., 1995. Soil microorganisms and plant growth Oxford and IBHpublishing co. Pvt. Ltd. New Delhi.

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Syllabus to be introduced from June 2023

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

Practical Course II (GE-BPPT23-203) (Credits 02)

Practical's based on Theory Course III and IV

Course Objectives:

1. To imparts knowledge about Weeds and their management.
2. To learn about preparation methods for vermicomposting, vermiwash, and Biofertilizers.
3. To apply the knowledge about cultivation and use of green manures in field.
4. To understand the knowledge about mass multiplication of *Azolla*.

Sr. No.	Name of Practical's
1 - 4	Study of common weeds of field crops **Dicot Weeds**: *Argemone mexicana,Parthenium hysterophorus, Amaranthus spinosus, Alternanthera sessilis, Euphorbia* sp., *Celosia argentea* **Monocot Weeds**: *Cyperus rotundus, Cynodon dactylon*
5	Study of mechanism of dispersal of weed seed.
6 & 7	Study of Cultivation of Sun hemp and Daincha helps to control the nut grass (*Cyperus*) Weed
8	Study of different types of mulches
9	Study of different types of biofertilizers as per theory syllabus
10	Study of preparation methods for vermicomposting and vermiwash
11 &12	Study of preparation methods for enriched compost
13 & 14	Study of Bio -fertilizers and Bio-inoculants as per syllabus
15	Cultivation of *Azolla* biofertilizer

Course Outcomes:

1. Student's identified and classifies the weeds.
2. Student's update the knowledge preparation methods for vermicomposting, vermi -wash, and Biofertilizers.
3. Student's apply the methods used for mass multiplication of *Azolla* biofertilizer.
4. Student's know the procedure for certification of organic farming product.

Reference Books:

1. Awan D.A., Mushtaq A.S., Muhammad S.N, and Shakoori A.R., 2012. Toxicological and biochemical studies on spinosad and synergism with piperonyl butoxide in susceptible and resistant strains of Tribolium castaneum. Pak. J. Zool 44: 649-662.
2. Rai M., ed. 2006. Handbook of microbial biofertilizers. CRC Press.
3. Rai MK., 2006 Microbial biofertilizers. Haworth press, Inc 10: 13904-1580.
4. Banerjee M.R., Laila Y., Joseph K.V., and M. Rai M., 2006. Plant-growth-promoting rhizobacteria as biofertilizers and biopesticides. Handbook of microbial biofertilizers. Food Products Press, New York: 137-181.
5. Board N.I.I.R. 2004. The complete technology book on bio-fertilizer and organic farming. National Institute of Industrial Re.
6. Kannaiyan S., 2002. Biotechnology of biofertilizers. Springer Science & Business Media.
7. Reddy S.M., 2002 Bioinoculants for sustainable agriculture and forestry. Scientific Publishers, Jodhpur.
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