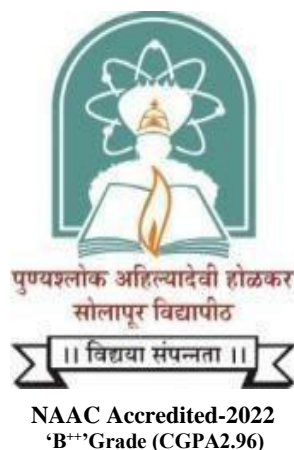


Punyashhlok Ahilyadevi Holkar Solapur University, Solapur



Name of the Faculty: Science & Technology

(As per New Education Policy 2020)

Syllabus: Botany

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

(Syllabus to be implemented from June 2024)



Punyashlok Ahilyadevi Holkar Solapur University, Solapur
Faculty of Science & Technology
Nep 2020 Compliant Curriculum

M. Sc. (Botany) Program Preamble

Revised Syllabus for the Master of Science in Botany, Punyashlok Ahilyadevi Holkar Solapur University, Solapur

(National Education Policy 2020)

Applicable from academic year 2023 – 2024 (June 2023) for M.Sc. Part I and Part II (Botany) as per Resolution No. dated of Board of Studies in Botany and Resolution No. dated of Academic Council of Punyashlok Ahilyadevi Holkar Solapur University, Solapur.

1. Title: M. Sc. Botany, Punyashlok Ahilyadevi Holkar Solapur University, Solapur Revised Syllabus as per NEP 2020

2. Faculty: Faculty of Science and Technology.

3. Year of implementation: For M. Sc. I (Semester I and Semester II): From June 2023 and for M. Sc. II (Semester III and Semester IV): From June 2024.

4. Preamble: Education is fundamental for achieving full human potential, developing an equitable and just society and promoting national development. Providing universal access to quality education is the key to India's continued ascent and leadership on the global stage in terms of economic growth, social justice and equality, scientific advancement, national integration and cultural preservation. Universal high-quality education is the best way forward for developing and maximizing our country's rich talents and resources for the good of the individual, the society, the country and the world. India will have the highest population of young people in the world over the next decade and our ability to provide high-quality educational opportunities to them will determine the future of our country. Higher education plays an extremely important role in promoting human as well as societal well-being and in developing India as envisioned in its Constitution—a democratic, just socially-conscious, cultured and human nation upholding liberty, equality, fraternity and justice for all. Higher education significantly contributes towards sustainable livelihood and economic development of the nation. As India moves towards becoming a knowledge economy and society, more and more young Indians are likely to aspire for higher education. India has tremendous biodiversity, genetic as well as of species and ecosystems which is a biological capital of our country. It contains over 7 percent of the world's biodiversity on 2.5 per cent of the Earth's surface. This diversity can be attributed to the vast variety of landforms and climates resulting in habitats ranging from tropical to temperate, and from alpine to desert. The number of plant species in

India is estimated to be over 45,523 representing about 11.8 per cent of the world's flora. It is estimated that 32% of Indian plants are endemic to the country and found nowhere else in the world. Among the plant species the flowering plants have a much higher degree of endemism, a third of these are not found elsewhere in the world. There are 17,527 species, 296 subspecies, 2215 varieties, 33 subvarieties and 70 forma, altogether 20,141 taxa of angiosperms under 2991 genera and 251 families in India, representing approximately 7% of the described species in the world. About 5725 species of flowering plants are broadly considered as endemics and represent 33.5% of the flora, of which, 3471 species are found in the Himalayas, 2051 in the Peninsular India and 239 in Andaman & Nicobar Islands. Gymnosperms are woody perennials, either shrubs or trees. There are 58 taxa growing in wild under 15 genera and 8 families in India. Though they are lesser in number, provide timber, wood, resins, tars and turpentine. Estimated number of pteridophytes (fern and fern-allies) are about 1200 taxa under 204 genera are distributed in different biogeographic regions of India.

The Eastern Himalaya and the Northeast India with about 845 taxa in 179 genera, representing approximately 67% of the pteridophytes known from the country, followed by southern India, including Eastern and Western Ghats, with 345 taxa in 117 genera and Northern India, including Western Himalaya, with 340 taxa in 101 genera. Bryophytes less known group of plants, comprising about 2800 species, is the second largest group of green plants in India, next only to the angiosperms. About 16 genera and 678 species are endemic to India. Liverworts are represented by ca. 850 species under 140 genera and 52 families. Lichens are a symbiotic association of fungi and algae and constitute a dominant component of epiphytic and saxicolous vegetation. At present about 2021 species of lichens in 248 genera are known to occur in India. Fungi range from microscopic organisms to huge solid bodies. Approximately 14,500 species in 2300 genera are found in India of which ca. 3500 species are endemic. Algae represented by over 6500 species in ca.

666 genera, they are found growing in a variety of habitats ranging from fresh water, marine, terrestrial and to soil. Of which 1924 species are endemic to the country. The major portion of Indian algal flora accounting for ca. 390 genera and 4500 species followed by terrestrial algae (125 genera and 615 spp.); soil algae (80 genera and 1500 spp.); marine algae (169 genera and 680 spp.).

Eligibility for M.Sc. Botany

B.Sc. with Botany as a principle subject/Botany at subsidiary level/B.Sc. Agriculture/B.Sc. Biotechnology

Punyashlok Ahilyadevi Holkar Solapur University, Solapur
M. Sc. I Choice Based Credit System (CBCS)
 Course Structure (NEP 2020)
 M.Sc. I w.e.f. 2023-24

Sr. No	Paper Code	Course/Title	Nature	Credit	Marks	
Semester I						
1.	DSC (1) Theory 2314101	Major mandatory course I Biology & diversity of Algae, Bryophytes, Pteridophytes and fungi	Theory	4	40	60
2	DSC (2) Theory 2314102	Major mandatory course II Taxonomy of Angiosperms	Theory	4	40	60
3	DSC (1) Practical 2314104	Major mandatory course I	Practical	2	20	30
4	DSC (2) Practical 2314105	Major mandatory course II	Practical	2	20	30
5	DSE (1) Theory 1. 2314107 2. 2314108 3. 2314109	Major elective course I (Select One) 1) Plant Growth and development 2) Herbal & Drug Technology 3) Plant Biotechnology	Theory	4	40	60
6	DSE (1) Practical 2314106 2314106 2314106	Major elective course I	Practical	2	20	30
7	RM 2314103	Research Methodology	Theory	4	40	60
		Total credits with marks		22	110	440
Semester II						
1	DSC (3) Theory 2314201	Major mandatory course I Biology and Diversity of Gymnosperm and Paleobotany	Theory	4	40	60
2	DSC (4) Theory 2314202	Major mandatory course II Advances in Pathology	Theory	4	40	60
3	DSC (3) Practical 2314204	Major mandatory course I	Practical	2	20	30
4	DSC (4) Practical 2314205	Major mandatory course II	Practical	2	20	30

5	DSE (2) Theory 1. 2314207 2. 2314208 3. 2314209	Major elective course I (Select One) 1) Crop Physiology 2) Angiosperm Systematics 3) Plant Tissue Culture	Theory	4	40	60
6	DSE (2) Practical 2314206 2314206 2314206	Major elective course I	Practical	2	20	30
7	OJT/FP 2314203	OJT/In-house Project/ Internship/ Apprenticeship		4	40	60
		Total credits with marks		22	110	440

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Name of the Faculty – Science and Technology

Name of the Course – M.Sc (Botany)

Semester – I

Total no. of Marks- 550

Total no. of Credits - 22

Sr No.	Subject Name	No. of Credits	Max no. of Marks	No. of Clock Hours
1.	DSC – 1 Biology & Diversity of Algae, Fungi, Bryophytes & Pteridophyte	4	100 (60+40) Unit 1-20 Unit 2-20 Unit 3-20 Unit 04-20 Unit 05-20	60
2.	Practicals based on DSC-1	2	50 (30+20)	60
3.	DSC-2 Taxonomy of Angiosperms	4	100 (60+40) Unit 1-20 Unit 2-20 Unit 3-20 Unit 04-20 Unit 05-20	60
4.	Practicals based on DSC-2	2	50 (40+10)	60
5.	DSE -1 Plant Growth & Development	4	100 (60+40) Unit 1-15 Unit 2-15 Unit 3-20 Unit 04-25 Unit 05-25	60
6.	Practicals based on DSE-1	2	50 (40+10)	60
7.	RM – Research Methodology	4	100 (60+40) Unit 1-20 Unit 2-20 Unit 3-20 Unit 04-20 Unit 05-20	60

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Name of the Faculty – Science and Technology

Name of the Course – M.Sc. (Botany)

Semester – II

Total no. of Marks- 550

Total no. of Credits - 22

Sr No.	Subject Name	No. of Credits	Max no. of Marks	No. of Clock Hours
1.	DSC –3 Biology & Diversity of Gymnosperms and Paleobotany	4	100 (60+40) Unit 1-20 Unit 2-20 Unit 3-20 Unit 04-20 Unit 05-20	60
2.	Practicals based on DSC-3	2	50 (30+20)	60
3.	DSC-4 Advances in Plant Pathology	4	100 (60+40) Unit 1-20 Unit 2-20 Unit 3-20 Unit 04-20 Unit 05-20	60
4.	Practicals based on DSC-4	2	50 (30+20)	60
5.	DSE -2 Crop Physiology	4	100 (60+40) Unit 1-25 Unit 2-15 Unit 3-25 Unit 04-15 Unit 05-20	60
6.	Practicals based on DSE-2	2	50 (30+20)	60
7.	RP – Research Project	4	100 (60+40)	60

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Name of the Faculty – Science and Technology

Name of the Course – M.Sc (Botany)

Semester – III

Total no. of Marks- 550

Total no. of Credits - 22

Sr No.	Subject Name	No. of Credits	Max no. of Marks	No. of Clock Hours
8.	DSC – 5 Plant Embryology and Palynology	4	100 (60+40) Unit 1-25 Unit 2-25 Unit 3-15 Unit 04-15 Unit 05-10 Unit 06-10	60
9.	Practicals based on DSC -5	2	50 (20+30)	60
10	DSC-6 Cytogenetics & Crop Improvement	4	100 (60+40) Unit 1-20 Unit 2-20 Unit 3-20 Unit 04-20 Unit 05-20	60
11	Practicals based on DSC-6	2	50 (20+30)	60
12	DSE -3 Advances in Plant Metabolism & Biochemistry	4	100 (60+40) Unit 1-05 Unit 2-20 Unit 3-25 Unit 04-25 Unit 05-25	60
13	Practicals based on DSE-3	2	50 (20+30)	60
14	RP – Research Project	4	100 (60+40)	60

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Name of the Faculty – Science and Technology

Name of the Course – M.Sc (Botany)

Semester – IV

Total no. of Marks- 550

Total no. of Credits - 22

Sr No.	Subject Name	No. of Credits	Max no. of Marks	No. of Clock Hours
1.	DSC –7 Plant Tissue Culture, Green house Technology & Hydroponics	4	100 (60+40) Unit 1-30 Unit 2-30 Unit 3-10 Unit 04-10 Unit 05-10	60
2.	Practicals based on DSC-7	2	50(20+30)	60
3.	DSC-8 Phytogeography & Plant Ecology	4	100 (60+40) Unit 1-25 Unit 2-25 Unit 3-20 Unit 04-15 Unit 05-15	60
4.	Practicals based on DSC -8	2	50(20+30)	60
5.	DSE -4 Environmental Plant Physiology	4	100 (60+40) Unit 1-05 Unit 2-30 Unit 3-30 Unit 04-30 Unit 05-05	60
6.	Practicals based on DSE -4	2	50(20+30)	60
7.	RP – Research Project	4	100 (60+40)	60



Punyashlok Ahilyadevi Holkar Solapur University, Solapur
Faculty of Science & Technology Nep
2020 Compliant Curriculum

M.Sc. (Botany) Program Outcomes (PO)

Program outcomes for an M.Sc. in Botany typically include:

1. **Advanced Knowledge in Botany:** Graduates will possess a deep understanding of plant biology, including plant physiology, taxonomy, genetics, ecology, and evolution.
2. **Research Skills:** Students will be trained in modern research methodologies, including experimental design, data collection, and analysis, preparing them for careers in scientific research or further studies.
3. **Technical Proficiency:** Graduates will be proficient in using advanced laboratory techniques and tools related to botany, such as microscopy, molecular biology techniques, and bioinformatics.
4. **Environmental Awareness:** Students will develop a strong understanding of plant-environment interactions, including the role of plants in ecosystems and their responses to environmental stressors, contributing to sustainable environmental management.
5. **Critical Thinking and Problem-Solving:** The program emphasizes the development of critical thinking and analytical skills, enabling graduates to identify and solve complex biological problems.
6. **Communication Skills:** Graduates will be able to effectively communicate scientific knowledge and research findings to both scientific and non-scientific audiences through written, oral, and digital formats.
7. **Interdisciplinary Approach:** The program encourages an interdisciplinary approach, integrating knowledge from related fields such as biochemistry, molecular biology, and environmental science.
8. **Ethical and Professional Conduct:** Students will learn to conduct research and professional activities with integrity, following ethical guidelines in scientific practices.
9. **Career Readiness:** The program prepares students for diverse career opportunities in academia, research institutions, environmental consultancy, agriculture, biotechnology, and other related fields.
10. **Lifelong Learning:** Graduates will be encouraged to engage in continuous learning and professional development to keep pace with advancements in the field of botany and related disciplines.



Punyashlok Ahilyadevi Holkar Solapur University, Solapur
Faculty of Science & Technology
NEP 2020 Compliant Curriculum
M.Sc. (Botany) Program Specific Outcomes (PSOs)

The program-specific outcomes (PSOs) of an M.Sc. in Botany typically describe the skills, knowledge, and abilities that students are expected to acquire by the end of the program. These outcomes may vary slightly depending on the institution, but here are some common PSOs for an M.Sc. in Botany:

1. **Advanced Knowledge in Plant Sciences:** Students will gain in-depth knowledge of various aspects of plant biology, including taxonomy, physiology, genetics, ecology, and biotechnology. This includes understanding plant evolution, structure, function, and the ecological roles plants play.
2. **Research Skills:** Students will develop the ability to design, conduct, and analyze scientific research in botany. This includes formulating hypotheses, using advanced techniques for data collection and analysis, and interpreting results in the context of current scientific literature.
3. **Practical Skills in Plant Science:** Students will acquire hands-on experience with various laboratory and field techniques used in botanical research. This may include microscopy, plant tissue culture, molecular biology techniques, and ecological survey methods.
4. **Critical Thinking and Problem-Solving:** Graduates will be able to apply critical thinking to solve complex problems related to plant science, including issues in agriculture, environmental conservation, and biotechnology.
5. **Communication and Presentation:** Students will be trained to effectively communicate scientific information, both orally and in writing, to a variety of audiences, including peers, professionals, and the general public.
6. **Ethical and Environmental Awareness:** The program will instill an understanding of the ethical considerations in botanical research and the importance of biodiversity conservation and sustainable practices in managing plant resources.
7. **Preparation for Advanced Studies or Careers:** Graduates will be prepared for further research (e.g., Ph.D. programs) or professional careers in botany, environmental science, agriculture, forestry, biotechnology, and related fields.
8. **Interdisciplinary Approach:** The program will encourage the integration of knowledge from related disciplines (e.g., genetics, chemistry, environmental science) to solve complex botanical problems.

These outcomes ensure that students completing an M.Sc. in Botany are well-equipped for both academic and professional careers in plant sciences and related fields.

Other Features:

- i) Intake capacity/ Number of students at M. Sc. I will be 20 per year.
- ii) The student may take exit after successful completion of M. Sc. I (Semester I & II) and acquire a certificate of 'PG Diploma in Botany'. Such student may join M. Sc. part II within next five years after exit.

General guidelines:

- 1) There shall be at least a short tour (up to 3 days) and a long tour (not exceeding 10 days) per year for all M. Sc. I and M. Sc. II students. The long tour may be arranged to a region out of the state covering various Botanical Regions/ Research Institutes/ Centers and Universities. Tours are the part of curriculum and are obligatory to each student, failing which they will not be considered eligible to appear for the practical examination. Under unavoidable circumstances, if the student fails to attend the tour, he/ she has to produce justifiable evidence for not attending the tour. However, in lieu of tour the candidate will have to complete the work assigned by the Department.
- 2) If there are female students in a batch of sixteen, one additional lady teacher is permissible for excursion. T.A. and D.A. for teachers and non-teaching staff participating in the excursions should be paid as per the rules.
- 3) Following documents will have to be produced by each student at the time of practical examination (at the end of each Semester):
 - a. Submission of a laboratory journal of practical records.
 - b. Submission of a tour report (in his/ her own handwriting) duly signed by the concerned teacher is mandatory.

Important instructions:

- a. On Job Training /Field Project:** Every student shall go for on job training or field project in semester II. The same work will be evaluated in the department at the end of semester.
- b. Research Project:** Every student will have to work for research project in semester III and IV. The same work will be evaluated in the department at the end of semester III as well as semester IV. Project report shall be submitted in hard bound form and there will be presentation at the time of evaluation.



पुण्यश्लोक अहिल्यादेवी होळकर
सोलापूर विद्यापीठ

॥ विद्यया संपन्नता ॥

NAAC Accredited-2022
'B++' Grade (CGPA-2.96)

Punyashlok Ahilyadevi Holkar Solapur University, Solapur
First Year M.Sc (Botany) Semester-I

Vertical : DSC

Course Code: 2314101

Course Name: Biology & diversity of Algae, Bryophytes, Pteridophytes and fungi

***Teaching Scheme**

Lectures: 04 Hours/week, 04 Credits

Practical: 02 Hours/week, 01 Credit

***Examination Scheme**

UA: 60 Marks

CA: 40 Marks

Course Preamble: This course was designated to get knowledge about lower cryptogamic plants their identification skills, isolation techniques, their economic importance & role in Pollution control. This course include general characters, affinities in genera, their identification tricks, role in industries.

Course objective: During this course, the student is expected to:


1. Get idea about Algae, Fungi, Bryophytes & Pteridophytes
2. Get knowledge about characters, of cryptogamic plant
3. Get knowledge about internal structure, methods of identification, classification, practical skills of isolation, purification & mass production of lower cryptogamic plants which are useful in industry & economic point of view.
4. Get knowledge about Current trends of research in lower plants with their

Course Outcomes: At the end of this course students will be able to:

1. Understand difference between lower cryptogamic plants.
2. Understand characters of algae, fungi, bryophytes , Pteridophytes etc.
3. Gain knowledge to identify lower plants, their isolation & purification procedures.
4. Apply their knowledge to use cryptogamic plants in industrial sectors.

M.Sc. (Botany) Part- I SEMESTER – I
Major Mandatory I (Theory 4 credits, Practical 2 credits)
DSC (1): Biology & diversity of Algae, Bryophytes, Pteridophytes and fungi
(L-60)

Unit – I	Phycology: Algae in diversified habitats (terrestrial, fresh water, marine), thallus organization, cell ultrastructure, reproduction (vegetative, asexual and sexual), modern trends in classification of algae – criteria – pigments, reserve food, flagella etc. and System Salient features, inter-relationship and phylogeny of the following classes – Cyanophyceae, Chlorophyceae, Xanthophyceae, Bacillariophyceae, Phaeophyceae, Rhodophyceae Isolation, culture, cultivation and preservation of algae. Use of algae as a biofuel, Biomass production, phytoplankton. Recent trends in Phycology.	12 L
Unit – II	Bryology: Diversity in Bryophytes with respect to thallus structure, reproduction, life cycle, modern classification. Salient features, phylogeny and inter-relationship of the following orders– Marchantiales, Jungermanniales, Anthocerotales, Sphagnales, Buxbaumiales, Funariales and Polytrichales. Economic importance of Bryophytes.	12L
Unit – III	Pteridology: Salient features, phylogeny and inter-relationship of the following classes – Psilopsida, Lycopsida, Sphenopsida Pteropsida. Diversity in Pteridophytes with respect to morphology, anatomy, reproduction in <i>Psilotum</i> , <i>Mesopteris</i> , <i>Lycopodium</i> , <i>Selaginella</i> , <i>Isoetes</i> , <i>Equisetum</i> , <i>Ophioglossum</i> , <i>Angiopteris</i> , <i>Gleichenia</i> , <i>Pteris</i> , <i>Salvinia</i> , <i>Azolla</i> , Telome concept and stelar evolution. Current trends of Research in Pteridophytes.	12L
Unit- IV	Fungi: General characters and recent trends in classification, Cell ultrastructure and Cell wall composition, nutrition (saprobic, biotrophic, symbiotic), reproduction (vegetative, asexual and sexual), fructification and Spore forming structures, heterothallism, heterokaryosis parasexuality, life cycle patterns, growth, reproduction and phylogeny	12L
Unit -V:	Phylogeny with respects to following major classes up to the level of order (As per Ainsworth`s 1973 system) A) Myxomycota: Mastigomycotina B) Eumycota: 1) Zygomycotina 2) Ascomycotina 3) Basidiomycotina 4) Deuteromycotina. Life cycle patterns, growth, reproduction of: Stemonitales, Plasmodiophoromycetales, Chytridiales, Perenosporales, Mucorales, Taphrinales Eurotiales Melioles, Xylariales, Claricepitales, Pezizales, Dothideales, Uridinales, Ustilaginales, Polyporales Agaricales Lycoperlales Nidullariales, Hypomycetales Tuberculariales, Sphaeropsidales, Melanconiales	12L

	<p align="center">Punyashlok Ahilyadevi Holkar Solapur University, Solapur First Year M. Sc. (Botany) Semester-I</p> <p>Vertical : DSC Course Code: 2314104 Course Name: Biology & diversity of Algae, Bryophytes, Pteridophytes and fungi</p>
<p>*Teaching Scheme</p> <p>Practical:04Hours/week, 02Credit</p>	<p>*Examination Scheme</p> <p>UA:30 Marks CA: 20 Marks</p>

Practicals

DSC (1): Biology & diversity of Algae, Bryophytes, Pteridophytes and fungi

- 1-3. Study of algal types as per theory per Chlorophyceae, Xanthophyceae, Bacillariophyceae, Phaeophyceae and Rhodophyceae with the help of specimens and slides (at least available specimens)
- 4-6. Morphological, anatomical and reproductive studies of the following members by using specimens and slides: *Marchantia*, *Targionia*, *Cythodium*, *Fossombronia*, *Notothyllus*, *Pogonatum*, *Polytrichum* and *Sphagnum*. (Available specimens)
- 7-9. Study of Pteridophytes mentioned against each class as per theory paper (specimens / Slides)
 Submission of (at least 10) dry and wet specimens/ slides / photographs from each group.
- 10-12. Study of types of fungi according to order in your syllabus

Reference Books:

- Text book of Algae by Kumar H. D. and H. N. Singh (1971)
 Text book of Algae by Sharma O.P. (1986)
 Text book of Botany - Algae by Pandey B.P. (1994)
 Botany for degree students - Algae by Vashishta B.R. (1995)
 College Botany Vol. II by Gangulee H. C. and A.K. Kar (1992)
 Taxonomy and Biology of blue green algae by Desikachary T.V. (1972)
 The structure & reproduction of algae by Fritsch F. E. (1965)
 The algae by Chapman V.J. & Chapman D.J. (1973)
 Algae form and function by Venkataraman et . al. (1974)
- Journals**
- 1) Phykos
 - 2) Phycologia
 - 3) Seaweed Research
 - 4) Mahasagar
 - 3) Indian Journal of Marine Biology.

Bryophytes:


- 1) Bryophyta by Parihar N. S. (1991)
- 2) Watson E.V. [1964] The structure and life of Bryophytes.
- 3) Bryophytes Atma Ram and Sons, Delhi by Puri . P. (1980)
- 4) Inter relationship of Bryophytes by Cavers F. [1964]
- 5) Liverworts of Western Himalayas & The Punjab plains Part I and II. by Kashyap S.R. [1929]
- 6) Bryology in India by RamU-dar [1976]

Pteridophytes:

- 1) Biology and Morphology of Pteridophytes by Parihar N. S. (1996)
- 2) Bierhorst D.W. [1971] Morphology of vascular plants.
- 3) Jermy A.G. [1973] The Phylogeny and Classification of ferns.
- 4) Rashid A. [1978] An Introduction to Pteridophytes.
- 5) Sporne K. R. [1966] Morphology of Pteridophytes

Fungi

- 1) Introductory Mycology John Wiley and Sons Inc. by Alexopoulos C.J., Mims C.W. and Blackwel . M. (1996)
- 2) Introduction to Bacteria McGraw Hill book Co., New York by Clifton .A.(1958)
- 3) Introductory Phycology Affiliated East – West Press Ltd., New Delhi by Kumar H.D.(1988)
- 4) Introduction to Plant Viruses Chand and Co. Ltd., Delhi by Mandahar .C.L.(1978)
- 5) An Introduction to Mycology New Age Intermediate Press by Mehrotra R.S. and Aneja R. S. (1998)
- 6) Diseases of crop plants in India Prentice Hall of India Pvt.Ltd. New Delhi by Rangaswamy G. and Mahadevan A.
- 7) Biology of Lichens by Hale M., Tos . E. Jr. (1967)
- 8) The Fungi Vol. – I, II, III, IV A, IV B by Ainsworth G. E. and A.S. Sussman
- 9) Introduction to Fungi Cambridge University Press, Cambridg by Webster . J. (1985)
- 10) Textbook of fungi by Sharma O.P. (1989)
- 11) Morphology and Taxonomy of fungi by Bessey . E.A.
- 12) College Botany Vol. I by Gangulee H.S. and A.K. Kar (1992)
- 13) The Myxomycetes of India by Thind. K. S. (1977)
- 14) Taxonomy of fungi imperfecti Hypomycetes by Kendrick W.B. (1979)
- 15) Hypomycetes by Subramanian C.V. (1971)
- 16) Illustrated Genera of Rust Fungi by Cummins G.B. (1959)
- 17) The Rust fungi of Cereales, Grasses and Bamboo by
- 18) 17Cummins G.B. (1971 18) The Rusts of Leguminaceae & 18Compositae by Cummins G.B. (1984)
- 19) Ustilaginales of India by Mundkur B.B. & M.J. Tirumalachar (1952)
- 20) Aquatic Phycomycetes by Sparrow F.K. (1960)
- 21) Aquatic fungi of India by Dayal (1995)
- 22) New concepts of kingdoms of Organisms [Science 163: 150-160] by Whittaker R.H. (1969)
- 23) A Text book of Botany: Fungi S. Chand & Co. Ltd. Ramnagar, New Delhi, pp- 416 by Pandey B.P. (1994)
- 24) Biology of the Fungi (first ed.) Satyajeet Prakashan, Pune, pp.67 by Vaidhya J.G. (1995)
- 25) The Fungi Hafner Publ. Co. Ltd. N.Y. by Gaumann G.A. (1952)
- 26) The Fungi Oxford & IBH by Mehrotra B.S. (1976)
- 27) The Fungi [Vol. I & Vol. II] John Wiley and Sons, Inc, New York by Wolf F.A. and Wolf F. T.
- 28) Modern topics in Fungi. Ed.D. S. Mukadam. Saraswati press, Aurangabad,
- 29) Microbiology and plant pathology by P.D. Sharma, Rastogi

	<p>Punyashlok Ahilyadevi Holkar Solapur University, Solapur First Year M.Sc (Botany) Semester-I Vertical : DSC Course Code: 2314102 Course Name: Taxonomy of Angiosperms</p>
<p>*Teaching Scheme Lectures:04 Hours/week, 04 Credits</p>	<p>*Examination Scheme UA:60 Marks CA: 40 Marks</p>

Course Preamble: This course was designated to understand the concepts, terminologies of Taxonomy, methods , branches of taxonomy, identification methods, skills to classify the plants, understand the importance of herbaria, botanical gardens, nomenclature skills, authentication methods, citations etc, so that they will work at reputed herbarium centers, herbal drug industries, this syllabus will be helpful to crack various forest exam.

Course objective: During this course, the student is expected to:

1. To understand terminology & concepts in Taxonomy of angiosperms.
2. To understand plant identification tricks, their classification skills.
3. To understand importance of herbaria & botanical gardens,
4. Gain knowledge about rare, endangered & threatened plant species & their conservation statuaries.


Course Outcomes: At the end of this course students will be able to:

1. Gain knowledge about specific terminologies used in identification of plants.
2. Understand different criteria used for identification & classification of plants.
3. Understand Criteria to build botanical gardens, herbaria
4. Gain skills to identify the plants, it is useful in herbal drug industries & various taxonomic centers & industries.

Major Mandatory II (Theory 4 credits, Practical 2 credits)

DSC (2): Taxonomy of Angiosperms (L-60)

Unit – I	Taxonomy: Introduction, aims, principles and importance of taxonomy in charting, documentation, Bioprospecting, CBD implementation, conservation and sustainable use of plants. Taxonomic Tools: Herbarium, Botanical Gardens and their role in teaching, research and conservation; important herbaria and botanical gardens of the world and India, Important Websites for taxonomic literature. alpha Taxonomy, omega taxonomy, chemotaxonomy, numerical taxonomy and serotaxonomy.	12L
Unit – II	General evolutionary trends and Species Concept: General evolutionary trends: Habitat and habit, vegetative and reproductive structures of flowering plants. Species concept: Classical, modern, typological, non-dimensional, multidimensional.	12L
Unit – III	Nomenclature: ICN, principles, rules, recommendations, articles, typification, principle of priority, effective and valid publications, citation of authority, transference, rejection of names, synonyms and homonyms. Systems of classifications- Principles, outlines, merits and demerits of Bessey’s and Cronquist’s systems, Angiosperm Phylogeny group, APG IV (2016)	12L
Unit – IV	Biodiversity: Characterization, generation, maintenance, loss, magnitude and distribution, economic value, conservation strategies, floristic diversity of India, hotspots, endemic and genetic diversity of plants, floristic works in Maharashtra	12L
Unit – V	Salient features, morphological diversity and economic importance of plant families Dicotyledonae: Annonaceae, Fabaceae, Meliaceae, Myrtaceae, Polygonaceae Bignoniaceae, Verbenaceae, Lamiaceae, Sapotaceae Casuarinaceae, Amaranthaceae, Euphorbiaceae, Urticaceae Monocotyledonae: Areaceae, Amaryllidaceae, Commelinaceae, Orchidaceae, Liliaceae, Poaceae	12L

	<p align="center">Punyashlok Ahilyadevi Holkar Solapur University, Solapur First Year M.Sc (Botany) Semester-I</p> <p>Vertical : DSC Course Code: 2314105 Course Name: Taxonomy of Angiosperms</p>
<p>*Teaching Scheme</p> <p>Practical: 04 Hours/week, 02 Credit</p>	<p>*Examination Scheme</p> <p>UA: 30 Marks CA: 20 Marks</p>

Practicals

DSC (2): Taxonomy of Angiosperms

1. Preparation of bracketed / indented dichotomous keys for identification of taxa.
2. Preparation of botanical description of a plant species.
- 3-11. Study of families as per theory syllabus (available plant families and Bentham and Hooker's system to be followed)
12. Knowledge of identification of common local flowering plants with the help of flora.

Submission- Herbarium sheets preferably of weeds (at least 10)

Excursion report

Reference Books:

- Ahmedullar, M. and M.P. Nayar 1987. Endemic plants of the Indian region, Vol. I
 Benson, L. 1957. Plant classification
 Benson, I. 1962. Plant Taxonomy
 Cronquist, A. 1968 Evolution and Classification of flowering plants.
 Cronquist, A. 1981. An integrated system of classification of flowering plants.
 Davis, P.H. and V.M. Heywood 1963. principles of Angiosperm taxonomy.
 Dahlgren, P.M.T. 1980. A revised system of classification of the Angiosperms Bot. J. Linn. soc. 80;91-124.
 Dahlgren, R.M.T.: 1981 Angiosperm classification and phylogeny-A rectifying comment, bot.J.1961.
 Hajra, P.K.et.al. 1996. flora of India. Introductory volume (part-I)
 Kubitzki, K. 1977. Plant systematics and evolution.
 Lawrence, G.H.M. 1951. Taxonomy of vascular plants.
 Naik, V.N. 1984. Taxonomy of Angiosperms.
 Nayar, M.P. 1996. Hot spot of endemic plants of India, Nepal and Bhutan.
 Quicke, Donald I.J. 1993 Principles and Techniques of contemporary taxonomy.

Rao.R.R. 1994. Biodiversity of India (FloristicAspects).
Rendle, A.B. 1925. The classification of flowering plants.
Stace, C.A. 1980. plant taxonomy and biosystematics.
Takhtajan, A.L.1969 Flowering plants: origin and dispersal.
The new global Taxonomy initiatives BOTANY 2000-ASIA Newsletter 5(4) 1996.
Systematics agenda 2000 charting the biosphere: a global initiative to discover, describe, and classify the world's species. Technical report. Published by SA200, New York Botanical Gardens.



Punyashlok Ahilyadevi Holkar Solapur University, Solapur
First Year M.Sc (Botany) Semester-I

Vertical : DSC

Course Code: 2314107

Course Name: Plant Growth and development

***Teaching Scheme**

Lectures:04 Hours/week, 04 Credits

***Examination Scheme**

UA:60 Marks

CA: 40 Marks

Course Preamble: This course was designated to gain knowledge about concepts, techniques in plant physiology. Various growth hormones introduction, their roles in plant growth & development, to understand various physiological processes in plants, types of enzymes their roles in physiology along with techniques to understand physiological role of various enzymes & hormones.

Course objective: During this course, the student is expected to:


1. Get knowledge about concepts in plant growth & development.
2. Get knowledge about Role of enzymes in plant development
3. Get knowledge about centers working on production of different plant varieties.
4. Get knowledge about application of various plant physiology techniques in research centres & industries.

Course Outcomes: At the end of this course students will be able to:

1. Clearly understand concepts & techniques in plant growth & development
2. Understand use of enzymes & hormones for natural growth & development of plants.
3. Understand role of plant physiologist in different physiology research institutes & centers.
4. This knowledge help them to produce new crop varieties.

Major elective course I
(Theory:4 credits + Practical: 2 credits)
Plant Growth and development (60 L)

Unit 1:	Growth and Photomorphogenesis Phytochrome & cryptochrome- discovery, properties, role and mechanism of action.	10L
Unit 2:	Senescence: Senescence of leaves and petals, Mechanism, biochemical changes and Programmed cell death.	10L
Unit 3:	Physiology of seed development & seed germination A brief outline of physiology of seed development & seed germination. Post harvest physiology- ripening of fruits and its regulation, metabolism of stored seeds and leafy vegetables	10L
Unit 4:	Plant growth regulators: Plant growth regulators-signaling mechanism of auxin, cytokinin, gibberellin, ABA, ethylene. a brief idea about discovery and possible mechanism of action of triacontanol, Brassinosteroids, salicylic acid, jasmonates, polyamines & morphactins. A brief idea about role of growth retardants- CCC, Paclobutrazol, Maleic hydrazide and TIBA	15L
Unit 5:	Secondary messengers and signaling in plants cells A brief idea about role of mutants in physiological studies with references to <i>Arabidopsis thaliana</i>	15L

	<p align="center">Punyashlok Ahilyadevi Holkar Solapur University, Solapur First Year M.Sc (Botany) Semester-I Vertical : DSC(1) Course Code: 2314106 Course Name: Plant Growth and development Practical</p>
<p>*TeachingScheme</p> <p>Practical:04Hours/week, 02Credit</p>	<p>*Examination Scheme</p> <p>UA:30 Marks CA: 20 Marks</p>

Practical

DSE (1): Plant Growth and development

1. Comparative growth study of etiolated and light grown seedlings and analysis of Photosynthetic pigments
2. Study of change in nitrate reductase activity during leaf senescence.
- 3 & 4. Hormonal and chemical regulation of leaf and Petal senescence. (Kinetin / ethephon / SA / KCl / CaCl₂)
5. Pigment changes during ripening of fruits.
6. Study of enzyme acid phosphatase during ripening of fruits.
7. Study of changes in respiration rate during ripening of fruits
8. Effect of different chemical compounds on pollen germination.
9. Effect of various PGRS on seedling growth.
10. Effect of growth retardants on plants.
11. Study of changes in starch & sugars during fruit ripening of Banana / Guava.
12. Study of changes in acidity and TSS (total soluble solids) during grape ripening.

References

- Bidwell R.C.S. 1979. Plant physiology.
- Boner J. and Varner J. E. 1976. Plant Biochemistry.
- Edwards G. Walker D.W. 1983. C3-c4 mechanism and cellular environmental regulation of photo synthesis. Govindjee 1982. Photosynthesis vol I & II. Hopkins W.C. 1995. Introduction to plant physiology.
- Krishnmoorthy H.N. 1992. Physiology of plant growth and development.
- Marschner, H.W. 1986. Mineral nutrition of higher plants.
- Miller P. 1973. Phytochemistry vol I, II & III. Moore T.C. 1974. Research experiences in plant physiology, a laboratory manual.
- Mukherjee, S.P. and Ghosh A.N. 1996. Plant physiology
- Noggle G.R. & G.J. Fritz. 1990. Introductory plant physiology II Ed.
- Randhir Singh & Sawhney S.K. 1988. Advances in frontier areas of Plant Biochemistry.
- Sadasivan and Manikkam 1996. Plant biochemical methods.
- Salisbury F.B. & Ross C.W. 1992. Plant physiology IV Ed.
- Sinha S.K. Sane P.V. Bhargava S.C. And Agraval P.K 1990. Preceding Of International congressof plant physiology vol I& II.
- Smith H. 1975. Phytochrome and Photomorphogenesis.
- Steward F.C. 1976. Growth and Organization in Plants.
- Stumpf P.K. & Conn.E. 1980. The Biochemistry of Plants: A Comprehensive Treaties.
- Taiz L. And Zieger, F. 1998. Plant Physiology.
- Wilkins M.B. 1976. Physiology of Plant Growth and Development. Annual Reviews of Plant Physiology and Molecular Biology. Indian Journal of Plant Physiology. Journal of Experimental Botany



Punyashlok Ahilyadevi Holkar Solapur University, Solapur
First Year M.Sc (Botany) Semester-I

Vertical : DSE (1):

Course Code: 2314108

Course Name: Herbal & Drug Technology

***Teaching Scheme**

Lectures:04 Hours/week, 04 Credits

***Examination Scheme UA:60 Marks**

CA: 40 Marks

Course Preamble: This course was designated to get knowledge about herbal medicinally important plant species. Photochemical present in plants, role of each phyto constituents, isolation techniques, drug purification, manufacturing, detection of adulterations in herbal drugs. This course will be helpful to students to work in herbal drug industries & research institutions.

Course objective: During this course, the student is expected to:

1. Understand raw material as source of herbal drugs from cultivation to herbal drug product
2. Know the WHO and ICH guidelines for evaluation of herbal drugs
3. Know the herbal cosmetics, natural sweeteners, nutraceuticals
4. Appreciate patenting of herbal drugs, GMP


Course Outcomes: At the end of this course students will be able to:

1. Understand basic techniques, concepts in herbal technology.
2. Understand the standardization & compositions of herbal cosmetics, natural sweeteners, nutraceuticals.
3. Understand medicinal plant identification skills & drug production techniques.
4. By applying this practical knowledge they will develop their carrier in Herbal drug technology research centers & institutes.

Major Elective course
(Theory:4 credits + Practical: 2 credits)
DSE (1): Herbal & Drug Technology (60L)

Unit I	<p>Herbs as raw materials Definition of herb, herbal medicine, herbal medicinal product, herbal drug preparation Source of Herbs Selection, identification and authentication of herbal materials, Processing of herbal raw material</p> <p>Biodynamic Agriculture Good agricultural practices in cultivation of medicinal plants including Organic farming. Pest and Pest management in medicinal plants: Biopesticides/Bioinsecticides.</p> <p>Indian Systems of Medicine 1. Basic principles involved in Ayurveda, Siddha, Unani and Homeopathy 2. Preparation and standardization of Ayurvedic formulations viz Aristas and Asawas, Gutika, Churna and Bhasma.</p>	(12L)
Unit II	<p>Nutraceuticals General aspects, Market, growth, scope and types of products available in the market. Health benefits and role of Nutraceuticals in ailments like Diabetes, Cardiovascular System (CVS) diseases, Cancer, Irritable bowel syndrome (IBS) and various Gastrointestinal disorders.</p> <p>Study of following as health food: Alfa-alfa, Chicory, Ginger, Fenugreek, Garlic, Honey, Amla, Ashwagandha, Spirulina</p> <p>Herbal-Drug and Herb-Food Interactions: General introduction to interaction and classification. Study of following drugs and their possible side effects and interactions: Hypericum, kava-kava, Ginkgo biloba, Ginseng, Pepper & Ephedra.</p>	(12L)
Unit III	<p>Herbal Cosmetics Sources and description of raw materials of herbal origin used via fixed oils, waxes, gums colours, perfumes, protective agents, bleaching agents, antioxidants in products such as skin care, hair care and oral hygiene products.</p> <p>Herbal excipients: Herbal Excipients – Significance of substances of natural origin as excipients – colorants, sweeteners, binders, diluents, viscosity builders, disintegrants, flavors & perfumes.</p> <p>Herbal formulations: Conventional herbal formulations like syrups, mixtures and tablets and Novel dosage forms like phytosomes</p>	(12L)

Unit IV	<p>General Introduction to Herbal Industry</p> <p>Herbal drugs industry: Present scope and future prospects. A brief account of plant-based industries and institutions involved in work on medicinal and aromatic plants in India.</p> <p>Schedule T – Good Manufacturing Practice of Indian systems of medicine</p> <p>Components of GMP (Schedule -T) and its objectives Infrastructural requirements, working space, stor- age area, machinery and equipments, standard operating procedures, health and hygiene, documentation and records</p>	(12L)
Unit V	<p>Patenting and Regulatory requirements of natural products: Evaluation of Drugs WHO & ICH guidelines for the assessment of herbal drugs</p> <p>Stability testing of herbal drugs.</p> <p>Definition of the terms: Patent, IPR, Farmers right, Breeder’s right, Bioprospecting and Biopiracy</p> <p>Patenting aspects of Traditional Knowledge and Natural Products. Case study of Curcuma & Neem. Regulatory Issues – Regulations in India (ASU DTAB, ASU DCC), Regulation of manufacture of ASU drugs – Schedule Z of Drugs & Cosmetics Act for ASU drugs.</p>	(12L)

 <p>पुण्यश्लोक अहिल्यादेवी होळकर सोलापूर विद्यापीठ ॥ विद्यया संपन्नता ॥ NAAC Accredited-2022 'B++' Grade (CGPA-2.96)</p>	<p>Punyashlok Ahilyadevi Holkar Solapur University, Solapur First Year M.Sc (Botany) Semester-I Vertical : DSC Course Code: 2314106 Course Name: Herbal & Drug Technology</p>
<p>**Teaching Scheme</p> <p>Practical: 04 Hours/week, 02 Credit</p>	<p>*Examination Scheme</p> <p>UA: 30 Marks CA: 20 Marks</p>

Practicals:

1. Preliminary Phytochemical Screening of Aqueous Extract of Neem.
2. Determination of The Alcohol Content of Asava and Arista
3. Evaluation of Excipients of Natural Origin of Honey, Acacia and Starch
4. Preparation and Evaluation of Turmeric Cream
5. Preparation and Standardization of Herbal Lotion
6. Preparation and Standardization of Methi-Shikakai Shampoo
7. Preparation and Evaluation of Orange Syrup.
8. Preparation and Evaluation of Tablet and Churna Mixture
9. Monograph Analysis of Castor oil wt/ml of castor oil Acid value of castor oil saponification value of castor oil Refractive index of castor oil
10. Determination of Aldehyde content
11. Determination of phenol content
12. Determination of Total Alkaloids

References:

- Glossary of Indian medicinal plants, R. N. Chopra, S. L. Nayar and I. C. Chopra, 1956. C.S.I.R, New Delhi.
- The indigenous drugsof India, Kanny, Lall, Dey and Raj Bahadur, 1984. International Book-Distributors.
- Herbal plants and Drugs Agnes Arber, 1999. Mangal Deep Publications.
- Ayurvedic drugs and their plant source. V.V. Sivarajan and Balachandran Indra 1994. Oxford IBH-publishing Co.
- Ayurveda and Aromatherapy. Miller, Light and Miller, Bryan, 1998. Banarsidass, Delhi.
- Principles of Ayurveda, Anne Green, 2000. Thomsons, London.
- Pharmacognosy, Dr. C. K. Kokate et al. 1999. Nirali Prakashan



Punyashlok Ahilyadevi Holkar Solapur University, Solapur
First Year M.Sc (Botany) Semester-I Vertical :

DSC

Course Code: 2314109

2314103

Course Name: Plant Biotechnology

***Teaching Scheme**

Lectures: 04 Hours/week, 04 Credits

***Examination Scheme**

UA: 60 Marks

CA: 40 Marks

Course Preamble: This course was designated to gain knowledge about concept, theories in plant biotechnology, different sterilization techniques used, techniques to develop genetically modified plants. Preservation & propagation techniques used in plant biotechnology.

Course objective: During this course, the student is expected to:


1. Understand different hybridization techniques and basics of embryogenesis.
2. They will be able to learn about different gene delivery techniques.
3. Identify different biotechnological techniques used in plant research and breeding.
4. Critically assess the scientific validity and reliability of research studies in plant biotechnology

Course Outcomes: At the end of this course students will be able to:

1. Students learn techniques of hybridization, plant tissue culture techniques.
2. Learn various techniques of sterilization
3. Learn techniques of gene delivery, gene isolation, production of genetically modified plants.
4. Application of those techniques in plant tissue culture, plant biotechnology industries & research stations.

Major elective course I
(Theory:4 credits + Practical: 2 credits)
DSE (1): Plant Biotechnology 60L

UNIT-I	Plant Biotechnology, Plant Genomics and Genetic Engineering Definition, scope, and historical development of plant biotechnology. Overview of the plant biotechnology industry. Ethical considerations and public perception of plant biotechnology. Basics of plant molecular genetics. Techniques for gene isolation and characterization. Ti & Ri Plasmid and their uses, viral vectors & their applications. Methods of gene transfer into plants.	15L
UNIT-II	Micropropagation Organogenesis, Somatic Embryogenesis, Synthetic seeds. Shoot tip culture/Axillary bud culture. Rapid clonal propagation. Embryo Culture & Embryo Rescue. Acclimatization of Plants. Soma clonal Variations/In vitro mutagenesis Selected successful examples of Plants of Diverse Origin using Tissue Culture technology Rescue of endangered Plants.	15L
UNIT-III	Plant Tissue Culture and Transformation Principles and applications of plant tissue culture Callus induction and regeneration techniques Protoplast Isolation, Culture, Fusion, Selection of Hybrid Cells and Regeneration of Hybrid Plants, Symmetric and Asymmetric hybrids. Anther, Pollen and Ovary culture for production of Haploid Plants and Homozygous lines. Genetic transformation methods in plants Cryopreservation, Slow growth & DNA Banking for germplasm Conservation.	15L
UNIT-IV	Tools and Applications of plant biotechnology Polymerase chain reaction (PCR) and its applications DNA sequencing and gene expression analysis Functional genomics and transcriptomics Commercial micro propagation. Metabolic engineering & Industrial products, Plant secondary metabolites, Industrial enzymes, Biodegradable plastics, Therapeutic proteins: lysosomal enzymes, Antibodies and edible vaccines.	15L

	<p align="center">Punyashlok Ahilyadevi Holkar Solapur University, Solapur First Year M.Sc (Botany) Semester-I</p> <p>Vertical : DSC Course Code: 2314106 2314103 Course Name: Plant Biotechnology</p>
<p>*Teaching Scheme Lectures:04 Hours/week, 04 Credits</p>	<p>*Examination Scheme UA:30 Marks CA: 20 Marks</p>

Practical DSE (1): Plant Biotechnology

1. Aseptic technique for plant tissue culture
2. Preparation of culture media and sterilization techniques.
3. Callus induction and regeneration experiments using explants
4. Anther and ovule culture.
5. Embryo culture, Protoplast isolation and fusion technique.
6. Micropropagation of plants through shoot proliferation
7. In vitro rooting and acclimatization.
8. Protein extraction from plant tissues.
9. Sodium Dodecyl Sulfate-Polyacrylamide Gel Electrophoresis (SDS-PAGE) for protein separation.
10. Study of Gene Expression Analysis through PCR.
11. RNA/DNA extraction from plant tissues.
12. Designing and executing controlled experiments in plant biotechnology.

Submission

Project report based upon this paper.

Reference Books:

1. An introduction to Plant Tissue Culture 2nd edn. Razdan, M. K, Science Publishers,USA.
2. Textbook of plant biotechnology, Chawala P.K.2002, Oxford & IBH, New Delhi.
3. Bhojwani, S. S. and M. K. Razdan 1996.Plant Tissue Culture: Theory and Practice, Elsevier Pub.
4. Chrispeels, M. J. 2002. Plant Tissue Culture: Genetical Aspects. Jones and Bortlett Publishers, International.
5. Chopra V. L. et al 1999. Applied Plant biotechnology. Science Publishers Inc.
6. Verpoorte, R. and A.W. Alfermann (Eds) 2000.Metabolic Engineering of plant secondary metabolism, lower Academic Publisher.

7. Chawla HC (2004) – Introduction to plant biotechnology (Science Publ)
8. Davies K (Ed) (2004) – Plant pigments and their manipulation – Annual plant reviews, vol 14 (Blackwell Publ)
9. Altman A, Hasegawa PM (Ed) (2012) – Plant Biotechnology and agriculture. Prospects for the 21st century (Academic press).
10. Bhojwani SS. & Razdan MK (1996). - Plant Tissue Culture: Theory & Practice (Elsevier)



Punyashlok Ahilyadevi Holkar Solapur University, Solapur
First Year M.Sc (Botany) Semester-I

Vertical : DSC

Course Code: 2314103

Course Name: Research Methodology

***Teaching Scheme**

Lectures:04 Hours/week, 04 Credits

***Examination Scheme**

UA:60 Marks

CA: 40 Marks

Course Preamble: This course was designated to recall and identify key concepts and terminology related to research methodology. Biostatistical methods, design of experiments, literature survey, methods of data collection, use of formulas, with this applied knowledge they will be able to get knowledge in research field.

Course objective: During this course, the student is expected to:

1. Get knowledge about different research methodologies & their objectives.
2. Get knowledge about how to design research problem.
3. Get knowledge about techniques of data collection, data analysis methods.
4. Use of research techniques in research field .

Course Outcomes: At the end of this course students will be able to:


1. Analyze the strengths and weaknesses of different research methodologies in relation to specific research contexts or objectives.
2. Apply the principles of a specific research methodology to design a research study or experiment.
3. Critically evaluate the reliability and validity of data collection and analysis methods used in a study.
4. Design and propose modifications or adaptations to existing research methodologies to address specific research challenges or gaps.

Mandatory (Theory: 4 credits)
RM: Research Methodology (60L)

Unit-I:	Introduction to Research Importance and Meaning of Research, Objectives, Characteristics, Types of Research, Steps in Research; Identification, Selection and Formulation of Research Problem, Research Design, Formulation of Hypothesis.	(15L)
Unit-II:	Sampling Techniques & Parametric Tests Sampling theory, Types of Sampling, Steps in Sampling, Sample Size, Advantages and limitations. Collection of Data: Primary Data, Data Collection Methods, Secondary Data, Relevance, Limitations and Cautions, Testing of significance Mean, Proportion, Standard Deviation, Variance and Correlation, Testing for Significance of Difference between Means, Proportions, Variances and Correlation Coefficient. Chi-square tests, ANOVA.	(15L)
Unit-III:	Thesis and Manuscript writing: Preparation of Manuscript; Author instructions, Modes of paper communication, criteria for publication. Computer and internet application in Research (Search engines). Presentation of a scientific Paper, Preparation of Oral Presentation and Poster Presentation. Concept of plagiarism, citation index, h-index, i10-index, ISSN and ISBN.	(15L)
Unit-IV:	Introduction to IPR and Patents: Intellectual property, Protection of Intellectual property, Forms of protection- patent, copyright, trademark, geographical indications, trade secrets. Criteria and procedure of patenting, patenting biological material. Patent procedure in India, Types of patenting, Patenting of biological materials with examples and case studies.	(15L)

References:

- Gibaldi, Joseph (6th edn. 2003), *MLA Handbook for Writers of Research Papers*, New York: MLA Association. Adam Sirjohn (2004), *Research Methodology: Methods & Techniques*, Delhi: New Age International Ltd
- Bateson, F. W. (1972), *The Scholar Critic: An Introduction to Literary Research*, London: Routledge
- Brown, James Dean (2006), *Understanding Research in Second Language Learning*, New York: Cambridge University Press
- Kothari, C.R. (1985), *Research Methodology: Methods & Techniques*, Delhi : New Age International Ltd
- Seliger (2001), *Second Language Research Methods*, Oxford University b. Additional Reading
- Caivary, R. & Nayak V. K. (2005), *Research Methodology*,
- S. Chand Chindhade, S. and A. Thorat (2009), *An Introduction to Research*, Mumbai: CUP
- Deshpande, H. V. *Research Literature and Language: Philosophy, Areas and Methodology*. Kolhapur: Sukhada Saorabh Prakashan, 2007
- Lenburg, Jeff (2007), *Guide to Research*, Viva Books
- Rajannan, B. (1968), *Fundamentals of Research*, ASRC Hyderabad c. References
- Abdul Rahim, F. (2005), *Thesis Writing: A Manual for Researchers* (New Delhi: New Age International)
- Eliot, Simon and W. R. Owens (4th edn. 1998), *A Handbook to Literary Research*, London: Routledge & Open University
- Gupta, R. K. (1971), *American Literature Fundamentals of Research*, ASRC Hyderabad
- Harner, James L. (2002), *Literary Research Guide: An Annotated Listing of Reference Sources in English Literary Studies*, New York: MLA of America
- Hunt, Andy (2005), *Your Research Project*, New Delhi: Foundation Books
- Litosseliti, Lia (2000), *Using Focus Groups in Research*, British Library Cataloguing
- Miller, R. H. (1995), *Handbook of Literary Research*, Methuen
- Mishra, D. S. (1989), *A Grammar of Literary Research*, New Delhi: Harman Publishing House
- Oakman, Robert L. (1984), *Computer Methods for Literary Research*, Athens: University of Georgia Press
- 23. Rahim, F. Abdul (1996), *Thesis Writing-A Manual for Researchers*, New Delhi: New Age International Ltd

	<p align="center">Punyashlok Ahilyadevi Holkar Solapur University, Solapur First Year M.Sc (Botany) Semester-II</p> <p>Vertical : DSC Course Code: 2314201 Course Name: Biology and diversity of Gymnosperms and Paleobotany</p>
<p>*Teaching Scheme Lectures:04 Hours/week, 04 Credits</p>	<p>*Examination Scheme UA:60 Marks CA: 40 Marks</p>

SEMESTER II

Course preamble: This course was designated to get knowledge about gymnosperms, characteristics features of gymnosperms, classification, different orders of gymnosperms. their identification tricks, economic & medicinal importance, and use of Paleobotany in research

Course objective: During this course, the student is expected to:


1. Learn different gymnosperms their characters
2. Learn different orders of gymnosperms with their characters, medicinal & economic importance
3. Learn identification tricks of gymnosperms with their fossil members
4. Learn paleobotanical concepts & their applications

Course Outcomes: At the end of this course students will be able to:

1. Get knowledge about gymnosperm classification, characters.
2. Get knowledge about importance of gymnosperms.
3. Get knowledge about fossils & their characters.
4. Get knowledge about industrial applications of gymnosperms.

**Major mandatory course I (Theory: 4 credits+ Practical: 2 credits)
DSC (3): Biology and diversity of Gymnosperms and Paleobotany 60L**

Unit- I	Introduction to Gymnosperm: Diversity of Gymnosperms with respect to morphology, anatomy, reproduction, phylogeny and modern trends in classification	12L
Unit –II	Introduction to Paleobotany: Salient features, phylogeny, affinities and inter- relationships of the following orders – Cycadales, Coniferales, Ginkgales, Taxales, Ephedrales and Welwitschiales, Economic importance of Gymnosperms	12L
Unit III	Fossils: Process of fossilization, types of fossils, techniques used in fossil studies.	12L
Unit IV	Studies on morphology and evolutionary trends in plants: Psilophytales, Filicales, Pteridospermales, Bennettitales, Cycadales, Cordaitales, Coniferales and Angiosperms. Indian fossil flora.	12L
Unit – V	Studies of morphology and anatomy of following fossils genera Psilophytales- Rhynia, Astroxylon, Psilophyton Lepidodendrales- Lepidodendron, Stigmaria, Lepidocarpus. Calamitales- Arthropitys, calamostachys, Annularia. Coenopteridales- Staraurrpteris, Botryopteris, Etaupteris. Filicales- Rodeites, Gleichemites Pteridospermales- Lygenopteris, Medullosa, Pachytosta Coniferales- Elatocladus, Brachyphyllum Cycadales- Ptilophyllum Dictyozamites Angiosperms- Palmoxylon, Enigmocarpon, Sahnianthus	12L

	<p align="center">Punyashlok Ahilyadevi Holkar Solapur University, Solapur First Year M.Sc (Botany) Semester-II</p> <p>Vertical : DSC Course Code: 2314102 2314103 Course Name: Biology and diversity of Gymnosperms and Paleobotany</p>
<p>**TeachingScheme</p> <p>Practical:04Hours/week, 02Credit</p>	<p>*Examination Scheme</p> <p>UA:30 Marks CA: 20 Marks</p>

Practicals (2 credits):

DSC (3): Biology and diversity of Gymnosperms and Paleobotany

1-5. Habit, morphology of vegetative parts, external morphology of reproductive parts and anatomy of available [specimens/slides] types for Following---

- Cycadales- *Zamia*
- Coniferales- *Araucaria, Podocarpus, Cupressus*.
- Ginkgoales- *Ginkgo*
- Taxales - *Taxus*
- Ephedrales - *Ephedra*.

6-12. Practical on Palaeobotany –

Types of fossils- Impression, compression, petrification, coal ball

Study of following fossil genera-

- **Psilophytales-** *Rhynia, Astroxylon, Psilophyton*
- **Lepidodendrales-** *Lepidodendron, Stigmaria, Lepidocarpus*.
- **Calamitales-** *Arthropitys, calamostachys, Annularia*.
- **Coenopteridales-** *Staraurrpteris, Botryopteris, Eopteris*.
- **Filicales-** *Rodeites, Gleichenites*
- **Pteridosperales-** *Lygenopteris, Medullosa, Pachytesta*
- **Cycadales-** *Ptilophyllum Dictyozamites*
- **Angiosperms-** *Palmoxylon, Enigmocarpon, Sahnianthus*
- **Coniferales-** *Elatocladus, Brachyphyllum*

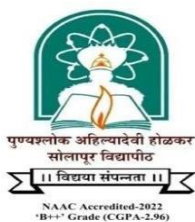
Submission of at least 5 slides from gymnosperms

Reference Books:

1. Bierhorst D.W. [1971] Morphology of Vascular plants Macmillan and co. New York
2. Chamberlein C.J. [1966] Gymnosperms. Structures and evolution.
3. Coulter & Chamberlein J.M. [1978] Morphology of Gymnosperms Central Book Depot. Allahabad.
4. Foster A. S. & Gifford E. M. [1959] Comparative Morphology of Vascular Plants
Vakil, Feffer & Simons Ltd.
5. Ramanujan c. G. K. [1979] Indian Gymnosperms in Time and space. Today & Tommorows Publisher.
6. Sporne K. R. [1967] Morphology of Gymnosperms-Hutchinson vaiv. Lib. London
7. Vashistha, p.C. Gymnosperms [1976]

Paleobotany

1. Arnold C.A. [1972] An Introduction to Paleobotany
2. Andrews H.N. Studies in Paleobotany [1961]
3. Darroh, W.C. [1960] Principles of Paleobotany
4. Surange K.R. Indian Fossil Pteridophytes
5. Shukla A. C. and Mishra S.D. [1975] Essentials of Paleobotany



Punyashlok Ahilyadevi Holkar Solapur University, Solapur
First Year M.Sc (Botany) Semester-II

Vertical : DSC (4)

Course Code: 2314202

Course Name: Advances in Plant Pathology

***Teaching Scheme**

Lectures: 04 Hours/week, 04 Credits

***Examination Scheme**

UA: 60 Marks

CA: 40 Marks

Course Preamble: This course was designated to gain knowledge about different concepts in plant pathology, different plant diseases, causal organisms, preventive measures. Techniques to prevent the disease.

Course objective: During this course, the student is expected to:


1. Get knowledge about different concepts in plant pathology.
2. Get knowledge about different disease causing agents.
3. Get knowledge about life cycle of plant & pathogen.
4. Get knowledge about techniques to prevent disease .

Course Outcomes: At the end of this course students will be able to:

1. Understand different concepts in plant pathology
2. Understand types, patterns, season of disease causing agents.
3. Understand life cycle of plant & pathogen.
4. Understand techniques to prevent disease spread & maximum production.

**Major mandatory course I (Theory: 4 credits+ Practical: 2 credits)
DSC (4): Advances in Plant Pathology (60L)**

Unit – I	Introduction plant diseases: Concept and classification of plant diseases, plant pathogens-concept and classification. Importance of plant diseases. Methods of diagnosis of plant diseases. Mechanism of infection – Pre penetration, penetration, post penetration and colonization	12L
Unit – II	MLO: Classification, morphology and characteristics of MLO, Identification Techniques of MLOs.	12L
Unit – III	Defense mechanism and Epidemiology: Defense mechanism against pathogen- structural, physiological, genetical and chemical, systematic acquired resistance Role of environmental factors on disease development, Epidemiology- slow and rapid epiphytotics, Disease forecasting, assessment of disease incidence and crop loss.	12L
Unit – IV	Principles of plant disease control: Prophylaxis - Exclusion, Eradication, Protection, Immunization- Chemical control, genetic resistance. Plant diseases and disorders- a brief idea of following important diseases.	12L
Unit – V	Diseases: (Pathogen, Symptoms and disease management) 1. Viral diseases: TMV, BMV 2. Phytoplasma diseases: little leaf of brinjal, Grassy Shoot disease of sugarcane 3. Bacterial diseases- Canker, Blight, Leafspot. 4. Fungal diseases- club root, white rust, Downy mildew, powdery mildew Rusts, smuts Ergot, Leaf spot, fruit rot, study of seed borne pathogens. 5. Algal diseases- Red rust. Phanerogamic diseases- Total and partial stem and root parasites 6. Nematodes- Root knot of vegetables.	12L

 <p>पुण्यश्लोक अहिल्यादेवी होळकर सोलापूर विद्यापीठ ॥ विद्यया संपन्नता ॥ NAAC Accredited-2022 *B++* Grade (CGPA-2.96)</p>	<p>Punyashlok Ahilyadevi Holkar Solapur University, Solapur First Year M.Sc (Botany) Semester-II Vertical : DSC (4) Course Code: 2314205 Course Name: Advances in Plant Pathology</p>
<p>**Teaching Scheme</p> <p>Practical:04Hours/week, 02Credit</p>	<p>*Examination Scheme</p> <p>UA:30 Marks CA: 20 Marks</p>

Practical (2 credits)

DSC (4): Advances in Plant Pathology

1. Study of Fungal diseases (as per theory)
2. Study of bacterial diseases (as per theory)
3. Study of viral diseases (as per theory)
4. Study of Phytoplasma diseases (as per theory)
5. Study of diseases caused by Nematodes
6. Study of phanerogamic total and partial stem and root parasites
7. Estimation of chlorophylls, from healthy and infected plant parts.
8. Estimation of sugars from healthy and infected plant parts.
9. Estimation of polyphenols from healthy and infected plant parts.
10. Study of some fungicides, biopesticides (Demonstration)
11. Isolation of Soil fungi
12. Demonstration of antibiotics using a bacterial culture and known antibiotics

Reference Books:

1. Mehrotra. R.S. (1980)- plant pathology. Agrios, G.N. (1978)-plant pathology.
2. Ny vail, R. F. (1979) – Field Crop Diseases Handbook. Singh, R.S. (1963) – Plant diseases
3. Padoley, S.K. and P.B. Mistry – A manual of plant pathology.
4. Gangopadhyay, S. (1984)- Clinical plant pathology. Rangaswami, G.(1979) Diseases of crop plants in India.
5. Mahadevan A. and R.Sridhar (1982)- Methods in physiological plant pathology. Aneja, K. R. (1993) – Experiments in Microbiology plant Pathology and Tissue culture. Gangulee, H.C.&A.K. kar (1992) – College Botany Vol. II.
6. Cooke, A.A. (1981) – Diseases of Tropical and subtropical field, Fiber and Oil Plants. Paul Khurana, S.M. (1998) – Pathological problems of Economic Crop plants and their management.
7. Kuljit, J.(1969)- The Biology of parasitic flowering plants. Univ. of California Press, U.S.A. Plank, J.E. Van der (1963)- Plant diseases, Epidemics and Control.
8. Plank, J.E. Van der (1968)- Diseases Resistance in Plants. A.P. London and New York. Chaube and Pundhir (2005)- Crop diseases and their management
9. Microbiology and plant pathology by P.D. Sharma. Rastogi publication Shivaji Road, Meerut.



Punyashlok Ahilyadevi Holkar Solapur University, Solapur

First Year M.Sc (Botany) Semester-II

Vertical : DSE-2

Course Code: 2314102

2314103

Course Name: Crop Physiology

***Teaching Scheme**

Lectures:04 Hours/week, 04 Credits

***Examination Scheme**

UA:60 Marks

CA: 40 Marks

Course preamble: This course was designated to understand different process, techniques in crop physiology. Role of various growth regulators, enzymes in plant physiology & metabolism. Different institutes working in area of crop physiology for improvement & better yield in plants, this course will be useful to work & produce high yielding, disease resistant crop varieties in crop research stations.

Course objective: During this course, the student is expected to:


1. Get knowledge about methods like Photoperiodism & vernalization.
2. Get knowledge about enzymes involved in crop growth, crop weed interactions.
3. Get knowledge about various plants & their nutritive importance.
4. Get knowledge about different research stations & their working strategies.

Course Outcomes: At the end of this course students will be able to:

1. Understand technique of Photoperiodism & vernalization & its role in plant growth.
2. Understand different enzymes involved in crop growth.
3. Understand various plants & their nutritive importance.
4. Understand about different research stations & their working strategies.

Major elective course II
(Theory:4 credits + Practical: 2 credits)
DSE (2): Crop Physiology 60L

Unit I	Crop growth: Crop growth analysis and its applications, crop productivity, harvest Index, water use efficiency and N- use efficiency, plant growth regulators in agriculture and anti transpirants Reproductive development- Photoperiodism and vernalization Fertilizers- Types, application through soil, foliar application, organic farming and its importance.	15L
Unit II	Crop weed interactions: Common weedicides and their mode of action. Source sink relationship Phloem transport, vegetative and reproductive phase and factors affecting source sink relationship, Agronomy	10L
UNIT III	A brief idea of physiological basis of yield in sugar cane, Jowar, cotton, groundnut & wheat	10L
UNIT IV	Physiology of crops with reference to following aspects- i) Mineral nutrition of groundnut. ii) Nitrogen fixation in chickpea. Fruit physiology of Ber, Pomegranate, Mango, lemon and grape. [any 2] Post harvest technology of grapes/ Ber/ and pomegranate w.r.t. market strategy	15L
Unit V	A brief idea of crop physiological 5 stations in India ICRISAT, IARIT, CIMAP Luck now, central soil salinity research lab Karnal, CAZRI Jodhpur, BARC, UAS, Bangalore.	10L

	<p align="center">Punyashlok Ahilyadevi Holkar Solapur University, Solapur First Year M.Sc (Botany) Semester-II Vertical : DSE-2 Course Code: 2314206 Course Name: Crop Physiology Practical</p>
<p>**Teaching Scheme</p> <p>Practical:04Hours/week, 02Credit</p>	<p>*Examination Scheme</p> <p>UA:30 Marks CA: 20 Marks</p>

Practical DSE (2): Crop Physiology

1. Growth analysis of any two crop plants (RGR, NAR, LAR, LAI etc).
2. Study of the effect of anti transpirants on stomatal behavior.
3. Study of the effect of source manipulation on sink capacity in any crop plant.
4. Estimation of acid invertase during ripening of sugarcane stalk.
5. Study of allelopathic effect of weed extract on germination of crop seeds.
6. Estimation of total lipids in oilseeds.
7. Study of effect of weedicide on some aspects of weed metabolism.
8. Study of Crop varieties
9. Visit to ware houses to study proper storage conditions for grains, seed and fruits.
10. Study of root nodules in leguminous crops.
11. Study of fertilizers (Chemical and Biofertilizers)
12. Effect of biofertilizers on growth and development of plant.

Reference Books:

1. Cherry J.H. 1989. Environmental Stress in Plants. Biochemical & Physiological Mechanisms.
2. Fageria N.K. 1992. Maximizing Crop Yield.
3. Gupta U.S. 1975. Physiological Aspects of Dry land Farming.
4. Kozlowski T.T. 1984. Flooding and Plant Growth.
5. Rice E.L. 1982. Allelopathy (Physiological Ecology)
6. Sharma S.K. & Gupta I.S. 1986. Physiological Aspects of Dryland Farming.
7. Turner N.C. & Kramer P.J. 1980. Adaptations of Plants to Water and High Temperature Stress.
8. Yawalkar & Agrawal, Manures and Fertilizers.
10. Evans L.T. 1972. Crop Physiology.
11. Levitt J. 1980. Responses of Plants to Environmental Stresses. Vol. 1 And 2. 12.

Indian Journal of Plant Physiology. New Delhi.

12. Agros Annual Review of Plant Physiology. Jodhpur.

13. 14 Environmental Plant Physiology. 15 Journal of Experimental Botany. 16
Environmental Plant Physiology.



Punyashlok Ahilyadevi Holkar Solapur University, Solapur

First Year M.Sc (Botany) Semester-II

Vertical : DSC(2)

Course Code: 2314208

Course Name: Angiosperm Systematics

***Teaching Scheme**

Lectures:04 Hours/week, 04 Credits

***Examination Scheme**

UA:60 Marks

CA: 40 Marks

Course preamble: This course was designated to get knowledge about concepts in taxonomy, biosystematics & evolutionary concepts, various tools used in taxonomy for identification of plants, classification methods, vegetative & reproductive characters of some families.

Course objective: During this course, the student is expected to:

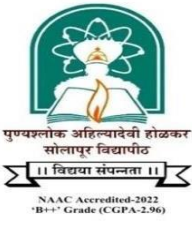
1. Get knowledge of concepts in taxonomy.
2. Get knowledge about tools used for identification.
3. Get knowledge about biosystematics & evolutionary concepts.
4. Get knowledge about characters of families.

Course Outcomes: At the end of this course students will be able to:

1. Understand nomenclature principles and rules all plants are named.
2. Understand its great value in Forestry because all forest trees have been named and classified.
3. Understand wide importance in Agriculture, Horticulture, etc
4. Understand plant ecology, the knowledge of taxonomy became essential, plant ecologist must be aware of the names of plants and their relationship to habitat and environment

Major elective course II
(Theory:4 credits + Practical: 2 credits)
DSE (2): Angiosperm Systematics (60L)

Unit I	Plants, Taxonomy and Systematics Two kingdom system, empires of three kingdom system, five kingdom system, the plant kingdom, basic components of systematics, advancement levels in systematics.	10L
Unit II	Biosystematics and Evolutionary Concepts: Biosystematics: Steps in biosystematics, Biosystematics categories, Importance of Biosystematics studies, Evolutionary concepts: Origin of intra-population variation, population and environment General biological Principle, Transference of Function, Adaptive radiations	10L
Unit III	Tools of Taxonomy and Floristics Tools of Taxonomy: Floras, monographs, revisions, websites, Computer, GPS, GIS, Herbarium, flora, Botanical Garden. Floristics: Need and significance. History of botanical exploration in India and recent works with special emphasis on Maharashtra.	10L
Unit IV	Identification and Classification of Plants Identification: Collection, specimen preparation, herbarium methods, Identification methods Classification: based on morphology, sexual system, natural system, phylogenetic system. Phenetic and cladistic method of classification.	10L
Unit V	Taxonomic evidences Based on morphology, anatomy, embryology, palynology, cytology, metabolites and molecular level	10L
Unit VI	Studies on the following as per Bentham and Hooker's system of classification. Dicot: Malvales, Celastrales, Rosales, Rubiales, Ebenales, Lamiales Series: curvembrae Monocot: Microspermae and Glumaceae	10L

 <p>पुण्यश्लोक अहिल्यादेवी होळकर सोलापूर विद्यापीठ ॥ विद्यया संपन्ता ॥ NAAC Accredited-2022 "B++" Grade (CGPA-2.96)</p>	<p>Punyashlok Ahilyadevi Holkar Solapur University, Solapur First Year M.Sc (Botany) Semester-I Vertical : DSC Course Code: 23141206 2314103 Course Name: Taxonomy of Angiosperms Practical</p>
<p>***Teaching Scheme</p> <p>Practical: 04 Hours/week, 02 Credit</p>	<p>*Examination Scheme</p> <p>UA: 30 Marks CA: 20 Marks</p>

Practicals

DSE (2): Angiosperm Systematics

1-9. Citation, Taxonomical description illustration and economic importance of family (as per theory syllabus). Note: Select available material belongs to order mentioned in theory.

14. Preparation of key for genus and species

11 & 12. Studies on variation between genus of same family

13 & 14. Studies on variation between species of same genus

15. Studies on taxonomic evidences in angiospermic plants (any two)

References

1. Briggs, David. 2009. Plant microevolution and Conservation in Human-influenced Ecosystems. Cambridge University Press.
2. Cooke, T. 1903-1908. The Flora of Presidency of Bombay, Vol. I-III.
3. Cronquist, A. 1981. An Integrated System of Classification of Flowering Plants. Columbia University Press, New York.
4. Cronquist, A. 1988. The Evolution and Classification of Flowering Plants (2nd ed.) Allen Press, U.S.A. Hickey, M. and King, C. 2000. The Cambridge Illustrated Glossary of Botanical Terms. Cambridge University Press, UK.
5. Hutchinson, J. 1959. Families of Flowering plants. Clarendon Press, Oxford.
6. Jain S.K. and Rao R.R. 1976. Handbook of Field and Herbarium Methods, Today and Tomorrow Publishers, New Delhi.
7. Jones, S. B. and Luchinger A.E. 1986. Plant Systematics 2nd edn, McGraw Hill Book Co.
8. Judd Walter S., Campbell, C. S., Kellogg, E. A., Stevens, P.F. and M. J. Donoghue. 2008. Plant Systematics- A Phylogenetic Approach. Sinauer Associates, INC, Publishers. Sunderland, Massachusetts, USA. i. Kubitzki, K. 1977. Flowering Plants Evolution and Classification of Higher Categories. Plant Systematics Evolution Supplement I.
9. Kuijt J. 1969. The biology of parasitic flowering plants. California University Press.
10. Lawrence, G. H. M. 1951. Taxonomy of Vascular Plants. Oxford and IBH Publ. Co. Pvt. Ltd. New Delhi. Mabberly, T. J. 2009. The Plant Book 2nd edn Cambridge University Press, Cambridge.
11. Manilal, K. S. and M. S. Muktesh Kumar [ed.] 1998. A Handbook of Taxonomic Training. DST, New Delhi.
12. Gurcharan Singh (2010). Plant Systematics, Science Publishers, USA.



Punyashlok Ahilyadevi Holkar Solapur University, Solapur
First Year M.Sc (Botany) Semester-II

Vertical : DSE

Course Code: 2314209

Course Name: Plant Tissue Culture

***Teaching Scheme**

Lectures: 04 Hours/week, 04 Credits

***Examination**

Scheme UA: 60

Marks

CA: 40 Marks

Course preamble: This course was designated to get knowledge about plant tissue culture, concepts, methods, sterilization principles, anther, embryo, endosperm culture, production of large number of plants in small area under aseptic conditions, production of genetically modified plant with the application of plant tissue culture.

Course objective: During this course, the student is expected to:


1. Learn concepts in plant tissue culture, sterilization principles & different techniques.
2. Learn media preparation & methods of plant regeneration & propagation.
3. Learn organ culture & synthetic seed production.
4. Learn cell line cultures & cryopreservation techniques.

Course Outcomes: At the end of this course students will be able to:

1. Understand & apply techniques in plant tissue culture, sterilization principles & different techniques
2. Understand & apply knowledge of media preparation & methods of plant regeneration & propagation.
3. Understand & apply knowledge of organ culture & synthetic seed production.
4. Understand & apply knowledge of cell line cultures & cryopreservation techniques

Major elective course II
(Theory:4 credits + Practical: 2
credits)
Plant Tissue Culture (60L)

Unit I	<p>Plant tissue culture Objectives and goals of plant tissue culture, laboratory design and development, Operation and management. Tissue nutrition-Basic principles of in vitro culture, factors influencing morphogenesis and Physiological significance of tissue nutrition Media preparation: Media preparation and handling: Sterilization methods, equipment and apparatus, procedures of media preparation and stock solutions.</p>	15L
Unit II	<p>Plant regeneration and plant propagation Types of Cultures: Explant culture, Callus formation and culture, Callus desiccation. Organogenesis, Meristem culture- Axillary Bud culture, protocols and schedules of observation. Callus culture- Somatic Embryogeny Cell suspension culture, Cell line and bioreactors</p>	15L
Unit III	<p>Organ culture Anther culture, ovary culture, Isolation of haploids & its significance. Embryo culture, embryo rescue. Hardening of tissue cultured plants Synthetic seed- Concept, method and applications.</p>	15L
Unit IV	<p>Cell and Protoplast Culture Cell suspension culture: Types and Application. Cell line isolation, Cell immobilization and synseed production Somaclonal variation: Nomenclature; schemes for obtaining somaclonal variations- without invitro selection and with invitro selection; factors influencing somaclonal variation; Applications and Limitations; Gametoclonal variations. Protoplast isolation, culture and somatic hybridization, Cryopreservation: Introduction, principle, procedure, importance and future prospects</p>	15L

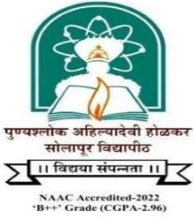
	<p align="center">Punyashlok Ahilyadevi Holkar Solapur University, Solapur First Year M.Sc (Botany) Semester-II Vertical : DSE 2 Course Code: 2314206 Course Name: Plant Tissue Culture</p>
<p>Teaching Scheme</p> <p>Practical:04Hours/week, 02Credit</p>	<p>*Examination Scheme</p> <p>UA:30 Marks CA: 20 Marks</p>

DSE (2): Plant Tissue Culture

1. Designing of plant tissue culture laboratory.
2. Preparation of culture media.
3. Sterilization techniques.
4. Callus culture, organogenesis, Meristem culture.
5. Anther culture,
6. Somatic embryogenesis.
7. Cell suspension culture.
8. Techniques of hardening.
9. Encapsulation of embryos.
10. Synthetic seed preparation.
11. Visit to commercial greenhouse/ Tissue culture laboratory.
12. Project Report Submission

References:

- Dodds J. H. & Roberts L.W. (1985): Experiments in Plant Tissue Culture.
- Camborg O.L. And Philips G.C. (1996): Plant, Tissue and Organ Culture Fundamental Methods.
- Dixon, R.A. (1985): Plant Cell Culture. A Practical Approach.
- Narayanaswamy S. (1997): Plant Cell and Tissue Culture.
- Evans et. al. (1983): Hand Book of Plant Cell Culture Vol. I, II, III.
- VASIL T.K. (1984): Cell Culture and Somatic Cell Genetics of Plant Vol. I. Laboratory Procedures and Their Applications
- Bhojwani S.S. And Razdan N.K.(1983): Plant Tissue Culture, Theory And Practice:ElsevierPublic Street H.E. (1974): Tissue Culture.
- Reinert J. And Bajaj Y.P.S. (1976): Plant Cell, Tissue and Organ Culture Thorpe T.A. (1981):Plant Tissue Culture.
- Nelson P.V. (1973) Greenhouse, Operation and Management. Prasad Kumar-GreenhouseManagement for Horticultural Crops.

	<p align="center">Punyashlok Ahilyadevi Holkar Solapur University, Solapur First Year M.Sc (Botany) Semester-II</p> <p>Vertical : OJT Course Code: 2314203 Course Name: On job Training(OJT) / Field Projects</p>
<p>*TeachingScheme Lectures:04 Hours/week, 04 Credits</p>	<p>*Examination Scheme UA:60 Marks CA: 40 Marks</p>

On Job Training/ Field projects Guidelines for ON JOB Training / Field Projects

INTRODUCTION

India is going to have the largest working-age population in the world by 2030, but gainful employment for general-stream students is a major challenge. Improving the employability of these students requires a new vision with curricular support for employment. A course requiring student's to participate in a professional activity or work experience, with an entity external to the educational institution. Internships involve working with local industry, government or private organizations, etc. to provide opportunities for students to actively engage in onsite experiential learning. Apprenticeship/Internship has a prominent role to play in linking higher education with the requirements of the industry and the world of work. This is considered to be one of the most effective ways to develop skilled manpower for the country. OJT / Field Project program aims to promote comprehensive employment and training program that utilizes various training activities and field-based activities to systematically develop the employability of eligible youth. It provides for industry-led, practice-oriented and outcome-based learning. This will focus on outcome-based learning in the degree programme and will enable students to demonstrate workforce professional abilities for potential employment. The major advantages of On-the-Job Training include the following:

1. It is relevant to the subject and the competencies to be acquired by the trainees, as it is directly in the context of a job.
2. It is most effective because it is learning by experience.
3. Trainees are more likely to retain the knowledge and skills, as they learn through hands-on training.
4. Trainees are highly motivated and develop self-confidence.
5. It helps trainees to understand and learn about the new tasks and skills that will help them to adapt to the new project more effectively.
6. It is useful in reducing the cost of training.

7. Trainees can also get an opportunity to earn while they learn.

On-the-Job Training (OJT) OJT is a strategic training service that supports and encourages students in their hiring process by adding staff capacity. OJT benefits the students in a hands-on environment, acquire job and career advancement skills, and provides an opportunity for long-term employment.

Objectives:

1. To improve the employability of students pursuing postgraduate level.
2. To focus on outcome-based learning in degree programmes.
3. To promote active linkage between the higher education system and industry, non-commercial and commercial enterprises/organizations.
4. The HEIs should have a prior Memorandum of Understanding (MoU) with discipline-specific commercial and non-commercial organizations or enterprises, offices, industry etc. for providing apprenticeship/internship, before introducing the apprenticeship/internship embedded degree programme.
5. The HEIs may plan the number of seats for apprenticeship/internship training as per the facility and infrastructure available.

Duration of OJT: The period of apprenticeship/internship training shall be a total of 60 Contact hours or 2hrs / day for 30 days along with regular lectures and practical sessions as mentioned in the curriculum.

Selection of Institute for On-Job Training: The following may serve as the important qualification descriptors for a UG/UG Honors/PG degree in Botany:

1. Knowledge of the diverse places where Botanical fields involved.
2. Understanding of basic concepts in plant sciences.
3. Basic skills such as identification of lower, higher cryptogamic & non cryptogamic plants, methods in plant biotechnology, seed science, crop improvement, cytogenetics, Plant breeding, Plant physiology etc.
4. Moderately advanced skills in Plant tissue culture, biotechnology, genetics etc.
5. Ability to participate in teamwork through small botanical field projects.
6. Ability to present and articulate their knowledge of Botany.
7. Knowledge of recent developments in the area of Botany.
8. Analysis of data collected through study and small projects.
9. Ability to innovate to generate new knowledge.
10. Awareness of how some Botanist leads may be developed into the enterprise.

11. Awareness of requirements for the fruition of a Botany related enterprise. The Institute offers OJT should have all the Supportive services and facilities required to fulfill its aims and objectives. • Tools, equipment and uniforms must be necessary to complete the training objectives; • The tools and equipment remain the property of the OJT Service Provider while the worker is in training; The OJT institute requires to maintain daily attendance records for each Trainee employed under an OJT Agreement. These records may be kept in any of several ways including sign-in/out sheets, time clocks, or other time cards that record hours worked. The Employer must submit documentation that supports the number of hours worked each day by the Trainee at the time of examination.

Training

1. The OJT Contract must be completed and signed before the OJT Trainee starts the OJT Training.

2. The OJT Employer shall develop a training plan for the OJT Trainee that includes competencies needed to be satisfactorily skilled in the OJT position. These competencies will be listed on the Training Plan/Evaluation Form.

3. The OJT Employer will provide an orientation to the OJT Trainee that covers, at a minimum, the OJT Employer's rules, expectations, safety information,

4. No fees shall be charged to any OJT Trainee or OJT Employer for referral or placement services relative to this OJT contract.

5. This contract may be amended by the mutual written agreement of the parties. All amendments shall be signed by both parties before the start date of the amendment and must be attached to the contract.

6. Credits for the apprenticeship/internship programme shall be included in the total credits of the entire programme.

7. The students must pass the apprenticeship/internship course. Reappearance for failed/uncompleted apprenticeship/internship training is mandatory.

8. The marks secured by the student in the apprenticeship/internship course will be reflected in the semester and final grade sheet.

Evaluation of OJT: Based on attendance, report submission Presentation/ Viva- Voce The evaluation of OJT shall be of 100 marks of which 80 Marks for UA and 20 Marks for CA.

Field Project: Field Project is included in the programme where students work individually or

in groups to design experiments to solve/answer a problem suggested by the Mentor or identified by the students in consultation with the Mentor. The students are mentored regularly during the duration of the project in progress. Evaluation of Field Project: The evaluation of FP shall be of 100 marks of which 80 Marks for UA and 20 Marks for CA