

**PUNYASHLOK AHILYADEVII HOLKAR SOLAPUR  
UNIVERSITY, SOLAPUR**



**Name of the Faculty: Science & Technology**

**CHOICE BASED CREDIT SYSTEM**

**Syllabus: BOTANY**

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

**(Syllabus to be implemented from w.e.f. June 2020)**

## **P. A. H. Solapur University, Solapur**

### M. Sc.- I (Botany)

**1. Introduction:** A broad introduction of computer science is provided, including the key technologies and skills needed for employment. Student can explore his / her personal interests through a variety of optional modules. Advanced intellectual, teamwork, communication and other transferable skills are developed. These students are expected to lead new generation of computer scientist. The students would be true knowledge workers prestigious to the Nation.

**2. Eligibility:** The candidate passing any of the under graduate degree, namely, B.Sc. Botany

**3. Intake capacity of Students: 24**

**4. Admission / Selection Procedure:** A student shall be held eligible for admission to the M. Sc. (Computer Science) course provided he / she has passed the B.Sc. examination in the subjects mentioned in Eligibility, and has passed the entrance examination conducted by the University. The students with B.Sc. from other universities shall be eligible if they qualify through entrance examination and they score minimum 55 percent B+ marks in the subject at the B.Sc. examination. While preparing the merit list for M. Sc. (Botany) admission, the performance at B.Sc. III and the performance at the entrance examination will be given equal weightage (50:50)

**5. Duration of the Course:** The M.Sc. is offered on full time basis, the course is of two years duration named as M.Sc. (Botany), each year is divided into two semesters for the convenience of teaching and examination. In each semester there will be teaching for 14 weeks followed by end of semester examination.

## 6. Structure of the Syllabus – M.Sc. (Botany):

### Part – I Semester-I

Paper Code	Title of the Paper	Hrs / week	Distribution of Marks for Examination			Credits
			Internal	University	Total	
<b>Hard Core - Theory</b>						
HCT 1.1	Biology and diversity of fungi, Bacteria, Viruses and Lichens.	04	20	80	100	4
HCT 1.2	Biology and diversity of Algae, Bryophytes and Pteridophytes	04	20	80	100	4
HCT 1.3	Plant Ecology	04	20	80	100	4
<b>Soft Core – Theory (Any One)</b>						
SCT 1.1	Taxonomy of Angiosperms.	04	20	80	100	4
SCT 1.2	Nursery and Gardening	04				
<b>Hard core Lab / Project</b>						
HCP 1.1	Practical based on HCT 1.1	04	10	40	50	2
HCP 1.2	Practical based on HCT 1.2	04	10	40	50	2
HCP 1.3	Practical based on HCT 1.3	04	10	40	50	2
HCP 1.4	Practical based on SCT 1.1 OR SCT 1.2	02	10	40	50	2
	Tutorial/Botanical Excursion tour/Project	01	25	-	25	1
<b>Total</b>		-	<b>145</b>	<b>480</b>	<b>625</b>	<b>25</b>

### Part – I Semester-II

Paper Code	Title of the Paper	Hrs / week	Distribution of Marks for Examination			Credits
			Internal	University	Total	
<b>Hard Core – Theory</b>						
HCT 2.1	Biology and diversity of Gymnosperms and Paleobotany	04	20	80	100	4
HCT 2.2	Tools & Techniques in Botany.	04	20	80	100	4
HCT 2.3	Cell and Molecular Biology	03	20	55	75	
<b>Soft Core – Theory (Any One)</b>						
OET 2.1	Advances in Plant Pathology.	04	20	80	100	2
OET 2.2	Mushroom Cultivation	04				
<b>Hard core Lab / Project</b>						
HCP 2.1	Practical based on HCT 2.1	04	10	40	50	2
HCP 2.2	Practical based on HCT 2.2	04	10	40	50	2
HCP 2.3	Practical based on HCT 2.3	02	10	40	50	2
<b>Open Elective (Any One)</b>						
OEP 2.1	Practical Based on OET 2.1	02	10	40	50	2
OEP 2.2	Practical Based on OET 2.2	02				
<b>Others</b>	Tutorial/Project/Seminar	01	25	-	25	1
<b>Total</b>		-	<b>165</b>	<b>535</b>	<b>700</b>	<b>25</b>

\*HCT/P is mandatory for every student who seeks M.Sc./M.A./M.C.A. degree and has to earn 3 credits each in Sem II & Sem-III. In order to Pass in the above course the students should secure at least 27 Marks for theory and 10 marks for Internal Assessment. However, these credits will not be accumulated for CGPA. In case student fails in these courses he will be declared as fail.

**7. Passing Standard:** Passing standard is same as that of other M.Sc. courses in the Solapur University. The candidate has to appear for internal evaluation of 20 marks and external evaluation (university exam) for 80 marks for each paper / practical / project. In case of theory papers internal examination/s will be conducted by the school / department. The nature of internal evaluation of practical and project will be decided by the respective schools / departments. The internal evaluation is a process of continuous assessment.

A student who failed in Term End examination (theory) & passed in Internal assessment of a paper (subject) shall be given FC (Failed in Term End Exam) Grade. Such student will have to appear for Term End examination only. A student who fails in Internal assessment and passed in Term End examination (Theory) shall be given FR (Failed in Internal Assessment) Grade. Such student will have to appear for Term End examination as well as internal assessment.

In case of year down candidates from the mark scheme the candidates shall appear for the same 80 marks paper of the external examination and his performance shall be scaled to 100 marks.

8. Nature of theory question paper

Time 3 Hours

Total Marks -80

Instructions

- 1) Q. 1 and 2 compulsory
- 2) attempt any three questions from Q.No. 3 to Q.No. 7
- 3) Figure to right indicate full marks .

Q.1 A).Choose correct alternative. (MCQ) – 10 Marks

B) Fill in the blanks OR True false – 06 Marks

Q.2. Answer the following . - 16 (4X4)

A)

B)

C)

D)

Q.3. Answer the following. (10+6 OR 8+8)

A)

B)

Q.4. Answer the following. (10+6 OR 8+8)

A)

B)

Q.5. Answer the following. (10+6 OR 8+8)

A)

B)

Q.6. Answer the following. (10+6 OR 8+8)

A)

B)

Q.7. Answer the following. (10+6 OR 8+8)

A)

B)

**M.Sc. (Botany) – Part – I**  
**SEMESTER - I**

**HCT 1.1: Biology and diversity of fungi, Bacteria, Viruses and Lichens**  
**(L-60)**

**Unit – I**

**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.

**(10)**

**Unit – II**

Taxonomical groups to understand life cycle patterns, growth, reproduction and phylogeny with respect to following major classes up to the level of order (Ainsworth`s 1973 system to be followed)

**(20)**

<b>Division</b>	<b>Class</b>	<b>Order</b>
A) Myxomycota	1) Myxomycetes	Stemonitales
	2) Plasmodiophoromycetes	Plasmodiophoromycetales
B) Eumycota		
<b>Sub division –</b>		
1) Mastigomycotina	1) Chytridiomycet	Chytridiales
	2) Oomycetes	Peronosporales
2) Zygomycotina	1) Zygomycetes	Mucorales
3) Ascomycotina	1)Hemiascomycetes	Taphrinales
	2) Plectomycetes	Eurotiales
	3)Pyrenomycetes	Meliolales, Xylariales, Claricepitales
	4)Disomycetes	Pezizales
	5)Loculoascomycetes	Dothideales

4) Basidiomycotina	1) Teliomycetes	Uridinales , Ustilaginales
	2) Hymenomycetes	Polyporales , Agaricales ,
	3) Gastromycetes	Lycoperlales , Nidullariales
5) Deuteromycotina	1) Hyphomycetes	Hypomycetales, Tuberculariales
	2) Coelomycetes	Sphaeropsidales , Melanconiales

**Unit – III**

Economic importance of fungi : - Fungi in industry , medicine and food , Mushroom cultivation , Mycorrhizae , fungi as biocontrol agents , fungal as allergens and human pathogens. **(10)**

**Unit – IV**

Archaeobacteria and Eubacteria : - General account , ultrastructure , nutrition and reproduction , nitrogen fixing bacteria and industrial uses. **(10)**

**Unit – V**

**Viruses** : - Characteristics , Ultrastructure , nutrition isolation and purification , chemical nature , replication , transmission and economic importance. Management of pomegranate diseases (Bacterial blight, wilt complex of pomegranate, leaf spot, scab, antracnose)

**Lichens**-Distribution, in Forms, Biology and Economic importance. **(10)**

## HCP 1.1

### Practicals based on HCT 1.1

1) Study of various forms of bacteria, Gram positive and Gram negative technique.

2) Isolation of plant pathogenic bacteria.

3) Study of different diseases:-

a) Bean Mosaic Virus (BMV)

b) Leaf curl of Papaya

c) Bunchy top of banana

d) Study of TMV electron photo micro graph

e) Bacterial blight of pomegranate

f) Wilt diseases of pomegranate

g) Leaf spot diseases of pomegranate

h) Scab diseases of pomegranate

i) Anthracnose of pomegranate

4-5).A) Isolation and identification of water, soil, air and host fungi.

B) Fungal spore germination.

6-12) Detailed study of following types from each of the following orders:-

Practical no-12 Lichens:- Types, Classification, Morphology and anatomy.

Class	Order	Types
Myxomycetes	Stemonitales	Stemonitidis
Plasmodiophoromycetes	Plasmodiophorales	Plasmodiophora
Chytridiomycetes	Chytridiales	Physoderma / Synchronium
Oomycetes	Peronosporales	Albugo / Plasmopara / Bremia
Zygomycetes	Mucorales	Mucor / Rhizopus
Hemiascomycetes	Taphrinales	
Plectomycetes	Eurotiales	Penicillium , Aspergillus
Pyrenomycetes	Meliolales	Meliola
	Erysiphales	Erysiphaceae , Uncinula
	Clavicipitales	Claviceps
Discomycetes	Pezizales	Peziza
Loculoascomycetes	Dothideales	Capnodium / Asterina
Teliomycetes	Uredinales	Melanospora / Uromyces
Ustilaginales		
Hymenomycetes	Tremellales	Tremella
	Agaricales	Agaricus
	Polyporales	Polyporus, Ganoderma
Gastromycetes	Lycoperdales	Lycoperdon
	Nidulariales	Cyathus
Deteuromycetes	Hypomycetales	Alternaria
	Melanconiales	Colletotrichum
	Sphaeropsidales	Phoma

\* Available plant disease material ( available diseases ) and fungal diseases of local crops .

1. Submission of at least 10 specimens of fungi .

2. Excursion report .



### Reference Books:

- 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 Cummins G.B. (1971)
- 18) The Rusts of Leguminaceae & Compositae 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 publication , Meerut.

## **HCT 1.2: Biology and diversity of Algae, Bryophytes and Pteridophytes (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 Systems. **(10)**

### **Unit – II**

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. **(15)**

### **Unit – III**

**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. **(15)**

### **Unit – IV**

**Pteridology :-** Diversity in Pteridophytes with respect to morphology , anatomy , reproduction and modern trends in classification , Telome concept and stelar evolution . **(10)**

### **Unit – V**

Salient features , phylogeny and inter-relationship of the following classes – Psilopsida – Psilotum, Mesopteris , Lycopsida - Lycopodium, Selaginella , Isoetes , Sphenopsida – Equisetum, Pteropsida – Ophioglossum, Angiopteris, Gleichenia , Pteris, Salvinia , Azolla. Current trends of Research in Pteridophytes . **(10)**

## HCP 1.2

### Practical based on HCT 1.2

- 1-4. 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)
- 5-7. 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)
- 8-11. 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  
Excursion report

### Reference Books:

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

### Journals

- 1) Phycos
- 2) Phycologia
- 3) Seaweed Research
- 4) Mahasagar
- 5) 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

## HCT 1.3. Plant Ecology

(L-60)

### Unit – I

(15)

Types of ecosystem, Marine and fresh water ecosystems, structural components , relationship between structure and function . Succession: - Allogenic and autogenic succession, climatic climax, models of plant succession. Wetlands and their characteristics, examples – mangroves and lakes

### Unit – II

(15)

1) EIA, MAB, Biosphere reserves, IUCN, Environmental awareness programmes.

2) Remote Sensing: General information on remote sensing technique and its applications particularly in vegetation analysis and wild life management.

### Unit – III

(10)

**1) Population Ecology:** Characteristics of a population; Density, Natality, Mortality, Age distribution, Population growth, Population Fluctuations, Biotic potential, Dispersal, Dispersion, Regulation of Population Density.

**2) Community Ecology:** Characteristics of Community

a) Analytical Characters: Qualitative and Quantitative Characters

b) Synthetic characters and

Study of Plant community

### Unit – IV

(10)

Pollution ecology:- Effect of air pollution on vegetation, water pollution and water hyacinth , land pollution due to pesticide residue and their effects on soil . Climate change : - Green house gases ( CO<sub>2</sub> , CH<sub>4</sub> , H<sub>2</sub>O , CFC s ) , Ozone layer and depletion , consequences of climate changes ( CO<sub>2</sub> fertilization , global warming , sea level rise , UV radiation )

### Unit – V

(10)

Phytoremediation / Bioremediation: - Definition, Mechanism: Phytoextraction, Rhizofiltration , Phytostabilization , Phytovolatilization.

## HCP 1.3

### Practical based on HCT 1.3

1. Study of Phytoplanktons
2. Evaluation of abiotic components of aquatic ecosystems such as pH , Temperature Transparency.
3. Determination of alkalinity and hardness of water .
4. Determination of phytomass .
5. Study of species diversity index .
6. Study of satellite imagery and interpretation .
7. Determination of texture and field capacity of soil .
- Study of chemical characteristics of the soils .
8. Estimation of primary productivity of an aquatic ecosystem .
9. Growth of water hyacinth in polluted and non – polluted water or seed germination studies in polluted and non – polluted water
10. Heavy metal analysis of different soils .
11. Study of Phytoremediation
12. Ecological report based on tour and / or analysis .

### Reference Books:

- 1) Plant Ecology by R.S. Ambst (1990)
- 2) Environmental Impact Assessment , Technology Assessment by V.T. Covell (1985)
- 3) Environmental Impact Assessment of Govardhan (1993) by Their Dam
- 4) Ecology workbook by R. Misra
- 5) Environmental management of mining operations by B.B. Dhar (1990)
- 6) Progress of plant Ecology in India by R. Misra (1973)
- 7) Ecology : The experimental analysis of distribution and abundance by C.J. Krebs , Harper and Row (1978)
- 8) Ecology of halophytes by R.J. Reimold and W. H. Queens (1974)
- 9) Structure and functioning by A.H.J. Freyden & J.W. Weldendrop (1978)
- 10) Air pollution and forests by W.H. Smith (1981)
- 11) Plant population ecology by A.J. Dary et. al ., (1998)
- 12) Plant succession and indicators by F.E. Clements
- 13) Plant ecology by Weaver and Clemens
- 14) The Plant community by Hanson & Churchil (1961)
- 15) Principles of environmental biology by P.K. Nair (1979)
- 16) Fundamentals of ecology by E.P. Odum(1996)
- 17) Ecology by E.P. Odum
- 18) Progress of plant ecology [ Vol. I ] by Ed.R. Misra,et,al(1973)
- 19) Quantitative and dynamic ecology by K.A. Kershaw (1964)
- 20) Patterns of primary production in the biosphere by H.F.H.Lieth (1978)
- 21) Taxonomy and Ecology by V.H. Heywood
- 22) Plant strategies and vegetation process by J.P. Grime
- 23) Manual of plant ecology by K.C. Misra(1989)
- 24) Plant Ecology by Dash
- 25) Plant Ecology by Vasishtha
- 26) Plant Ecology by Verma

## **SCT 1.1: Taxonomy of Angiosperms (L-60)**

### **Unit – I**

**Taxonomy-** Aims, principles and functions. Types of Taxonomy- numerical, chemotaxonomy, alpha Taxonomy, omega taxonomy, chemotaxonomy, numerical taxonomy, serotaxonomy. **(10)**

### **Unit – II**

**General evolutionary trends-** Habitat and habit, vegetative and reproductive structures of flowering plants. Species concept – classical, modern, typological, non-dimensional, multidimensional. **(10)**

### **Unit – III**

**Nomenclature** –ICBN – 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. **(15)**

### **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. **(10)**

### **Unit – V**

Salient features, morphological diversity and economic importance of plant families Amaranthaceae, Casuarinaceae, Urticaceae, Polygonaceae, Tiliaceae, Sapotaceae, Myrtaceae, Euphorbeaceae, papillionaceae, caesalpinaceae, Lamiaceae, verbenaceae, Meliaceae, Bignonaceae, Araceae, Amaryllidaceae, Commelinaceae, Orichidaceae, poaceae, **(15)**

## HCP 1.4

### Practical Based on SCT 1.1

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 Indian region, Vol.I
- Benson, L.1957. Plant classification
- Benson, l.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. Morphology of Angiosperms.
- 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 Agiosperms.
- Nayar, M.P.1996. Hot spot of endemic plants of India, Nepal and Bhutan.
- Quicke, Donald I.J.1993 Principles and Techniques of contemporary tadonomy.
- Rao.R.R. 1994. Biodiversity of India (FloristicAspects).
- Rendle, A.B. 1925. The classification of flowring 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 bosphere: a global initiative to discover, describe, and classify the world's species. Technical report. Published by SA200, New York Botanical Gardnes.

## **SCT 1.2. Nursery and Gardening**

**(L- 60)**

**Unit 1:** Nursery: definition, objectives and scope and building up of infrastructure for nursery, planning and seasonal activities - Planting - direct seeding and transplants. (12 Lectures)

**Unit 2:** Seed: Structure and types - Seed dormancy; causes and methods of breaking dormancy - Seed storage: Seed banks, factors affecting seed viability, genetic erosion - Seed production technology - seed testing and certification (12 Lectures)

**Unit 3:**Vegetative propagation: air-layering, cutting, selection of cutting, collecting season, treatment of cutting, rooting medium and planting of cuttings - Hardening of plants - green house - mist chamber, shed root, shade house and glass house. (12Lectures)

**Unit 4:**Gardening: definition, objectives and scope - different types of gardening - landscape and home gardening - parks and its components - plant materials and design - computer applications in landscaping - Gardening operations: soil laying, manuring, watering, management of pests and diseases and harvesting. (12 Lectures)

**Unit 5:** Sowing/raising of seeds and seedlings - Transplanting of seedlings - Study of cultivation of different vegetables: cabbage, brinjal, lady's finger, onion, garlic, tomatoes, and carrots - Storage and marketing procedures. (12 Lectures)

### **Practicals based on SCT 1.2 :**

- 1) Study of Land preparation and sowing of vegetable crops.
- 2) Preparation of nursery beds for raising vegetable seedlings
- 3) Identification of important vegetable crops at different growth stages on the basis of different morphological traits
- 4) Identification of seeds of vegetable crops
- 5) Calculation of seed requirement for important vegetable crops
- 6) Methods of irrigation and drainage for the cultivation of vegetable crops
- 7) Identification of organic manures and chemical fertilizers.
- 8) Identification of deficiency symptoms of nutrients in vegetable crops.
- 9) Identification of common weeds in vegetable gardens and preparation of herbarium
- 10) Visit to local vegetable nursery and acquaintance with different nursery management practices



**References :**

1. Bose T.K. & Mukherjee, D., 1972, Gardening in India, Oxford & IBH Publishing Co., New Delhi.
2. Sandhu, M.K., 1989, Plant Propagation, Wile Eastern Ltd., Bangalore, Madras.
3. Kumar, N., 1997, Introduction to Horticulture, Rajalakshmi Publications, Nagercoil.
4. Edmond Musser & Andres, Fundamentals of Horticulture, McGraw Hill Book Co., New Delhi.
5. Agrawal, P.K. 1993, Hand Book of Seed Technology, Dept. of Agriculture and Cooperation, National Seed Corporation Ltd., New Delhi.
6. Janick Jules. 1979. Horticultural Science. (3rd Ed.), W.H. Freeman and Co., S

**M.Sc. (Botany) – Part – I**

**SEMESTER II**

**HCT 2.1: Biology and diversity of Gymnosperms and Paleobotany (L-60)**

**Unit – I**

Diversity of Gymnosperms with respect to morphology, anatomy, reproduction, modern trends in classification **(10)**

**Unit – II**

Salient features, phylogeny, affinities and inter- relationships of the following orders – Cycadales, Coniferales, Ginkgales, Taxales, Ephedrales and Welwitschiales, Economic importance of Gymnosperms **(15)**

**Unit – III**

Process of fossilization, types of fossils, techniques used in fossil studies. **(10)**

**Unit – IV**

Studies of morphology, anatomy, and evolutionary trends of following groups of plants- Psilophytales, Filicales, Pteridospermales, Bennettiales, Cycadales, Cordaitales, Coniferales and Angiosperms. Indian fossil flora. **(10)**

**Unit – V** Studies of morphology and anatomy of following fossils genera **(15)**

**Psilophytales-** Rhynia, Astroxylon, Psilophyton

**Lepidodendrales-** Lepidodendron, Stigmaria, Lepidocarpus.

**Calamitales-** Arthropitys, calamostachys, Annularia.

**Coenopteridales-** Staraurrpteris, Botryopteris, Etaupteris.

**Filicales-** Rodeites, Gleichemites

**Pteridospermales-** Lygenopteris, Medullosa, Pachytesta

**Coniferales-** Elatocladus, Brachyphyllum

**Cycadales-** Ptilophyllum Dictyozamites

**Angiosperms-** Palmoxyton, Enigmocarpon, Sahnianthus

## HCP 2.1

### Practical Based on HCT 2.1

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*.

6-11. Practicals 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**- *Staraurppteris*, *Botryopteris*, *Etappteris*.
  - **Filicales**- *Rodeites*, *Gleichenites*
  - **Pteridosperales**- *Lygenopteris*, *Medullosa*, *Pachytesta*
  - **Coniferales**- *Elatocladus*, *Brachyphyllum*
  - **Cycadales**- *Ptilophyllum* *Dictyozamites*
  - **Angiosperms**- *Palmoxylon*, *Enigmocarpon*, *Sahnianthus*
- 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. Chamberlain C.J. [1966] *Gymnosperms. Structures and evolution.*
3. Coulter & Chamberlain 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 & Tommorrow's 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. Darroch, W.C. [1960] *Principles of Paleobotany*
  4. Surange K.R. *Indian Fossil Pteridophytes*
- Shukla A. C. and Mishra S.D. [1975] *Essentials of Paleobotany*

## HCT 2.2: Tools and Techniques in Botany (L-60)

### Unit – I

**Preparatory techniques :-** Standard units of expression , pH and buffers (5)

### Unit – II

**Biostatistics :-** Coefficient of variation , confidence limits , probability , binomial distributions , test of statistical significance , simple correlation and regression , Analysis of variance . Analysis and presentation of biological data with the help of computer softwares used in Biology, Biological sequence databases, NCBI-gene bank, DDBJ, EMBL, Protein databases; sequence search tool BLAST& its types. (15)

### Unit – III

**Microscopy:-** Principles and applications of phase contrast ,fluorescence, Scanning and transmission electron microscopes, Cytophotometry, Immuno fluorescence microscopy and photomicrography (10)

### Unit – IV

**Separation Techniques:-** Principles and application of gel filtration , ion exchange and affinity chromatography , gas chromatography , HPLC , Gel electrophoresis , isoelectric focusing , ultracentrifugation .

**Principles and applications of Colorimetry and spectrophotometry :-** visible , UV , fluorescence , NMR ,ESR spectroscopy , atomic absorption and flame spectrophotometry .

**Cytological techniques :-** Fixatives , treatments , stains , permanent preparation , banding – O – banding (15)

### Unit – V

**Tracer techniques:-** Principles and applications in biology , Dosimetry , radioisotopes , half – life of radioisotopes , effect of radiation on biological systems , radioactivity counting systems

**Collection and preservation of plant materials :-**Herbarium technique - preparation significance , important herbaria in India , Herbarium - A brief account of principles & methodology (15)

## HCP 2.2

### Practical Based on HCT 2.2

1. Preparation of standard solutions , stains and buffers
2. Study of density gradient centrifugation .
3. Isolation and purification of proteins / enzymes .
4. Thin layer chromatography for lipid or amino acid separation .
5. Verification of Beer and Lambert`s law with spectrophotometer
6. Determination of correlation coefficient .
7. Analysis of variance .
8. Analysis of data with the help of computer - Histogram,idiograms etc,e-herbaria .
9. Study of electron micrograph - SEM and TEM
10. Study of pollen germination acetolysis
- 11-12 Study of instruments :-
  - 1) Refrigerated centrifuge
  - 2) PH meter, Conductivity Bridge
  - 3) Autoradiogram
  - 4) Flame photometer
  - 5) Microphotographic system
  - 6) Gel electrophoresis system
  - 7) Spectrophotometer / colorimeter.

### Reference Books:

- Practical cytology, applied genetics and Bio-statistics- Goswami H. K. and R. Goswami. Himalayan Publ. House, Bombay (1993)
- Methods in plant molecular biology – M. A. Schwer and Zeclinskin publ. Academic Press New York (1989)
  - Photosynthesis and production in a changing environment. A field and laboratory manual- Hall, Scurlik, Bolhar Nordenkampt, Leagood and Long Chapman and Hall Publ. (1993)
  - Experimental plant physiology – J. Arditti and Dunn, Publ. Academic Press (1970).
  - Techniques in Bioproductivity and photosynthesis by – Coombs, Hall, Long and Sourlock, Pergamon press Oxford (1985)
  - Methods in enzymology- Colowick and Kaplan Academic Press.
  - A Handbook of field and herbarium techniques- S. K. Jain and R. R. Rao (1977), New Delhi : Today and Tomorrow's Printers and Publishers, c1977
  - Practical Biochemistry: Principles and Techniques. Ed. E. Wilson and J. Walker (2000) Cambridge Publ.
  - Modern Experimental Biochemistry-Boyer, R.(2005). Pearsa, Education, Singapore.
  - Methods in Experimental Biology.-Ralph, R. (1975).Blakie, London
  - An Introduction to Biometry- Mungikar, A. M. (1997), Saraswati Printing Press Aurangabad.
  - Research Methodology For Biological Sciences (01 Edition, 2013)- Gurumani, N. (2013), MJP Publishers
  - Botanical histochemistry: principles and practice- William A. Jensen (1962), W. H. Freeman, 1962 the University of Michigan
  - Flow Cytometry : First Principles (Second Edition)- Givan A.L. (2001), Wiley- Liss, Inc.
  - Flow Cytometry Protocols (2nd edition), Methods in Molecular Biology (Volume 263)- Editors Hawley T.S. and Hawley R.G. (2004), Totowa, NJ: Humana Press
  - Handbook of Histopathological and Histochemical Techniques (Including Museum Techniques) (Third Edition)- Culling C.F.A. (1974), Elsevier Ltd.

## HCT 2.3:

# Cell and Molecular Biology of plants (L-60)

### UNIT – I

**Plasma membrane** - structure, composition, models, function, sites for ATPases, Ion carriers, channels and pumps, receptors.

**Plasmodesmata**- structure, role in movement of molecules and macromolecules, comparison with gap junctions. **(15)**

### UNIT – II

**Chloroplast**- ultrastructure, genome organization, gene expression, RNA editing, nucleochloroplastic interactions.

**Mitochondrion**- ultrastructure, genome organization, biogenesis. Plant vacuole-Tonoplast membrane, ATPases, transporters, as storage organelle. **(10)**

### UNIT – III

**Chromosomal organization:** nucleosome organization, models of DNA replications, damage and repair of DNA. Satellite DNA, selfish DNA, promiscuous DNA, mini and micro satellite DNA-structure, function and methods of detection Working with sheets: Sorting, Filtering, Validation, Consolidation, and Subtotal. **(15)**

### UNIT-IV

**Genetic code**- Discovery, concept, properties, contribution of Nirenberg and Khorana. Structure and function of microtubules and microfilaments, endoplasmic reticulum, golgi bodies. Cell cycle and apoptosis- control mechanisms, role of cyclins and cyclin dependent kinases, retinoblastoma and E2F proteins, cytokinesis and cell plate formation, mechanisms of programmed cell death, P53 protein / gene caspases **(10)**

### UNIT-IV

**Techniques in cell Biology**- Immunotechniques, in situ hybridization to locate transcripts in cell types, FISH, GISH, confocal microscopy. Enzymes kinetics and enzyme regulation. **(10)**

## HCP 2.3

### Practical Based on HCT 2.3

- 1) To study the effect of temperature/chemicals on membrane permeability
- 2) Staining the chromosomes with Schiff's reagent.
- 3) Isolation of plant DNA.
- 4) Estimation of plant DNA by colorimetric method
- 5) Isolation of plant RNA.
- 6) Estimation of plant RNA by colorimetric method.
- 7) Meiotic studies in higher plants.
- 8) Determination of mitotic index
- 9) Detection of mitochondria in plant cells.
- 10) Isolation of mitochondria and the activity of its marker enzyme, succinate dehydrogenase
- 11) Estimation of chlorophylls/ isolation of chloroplasts
- 12) Detection of enzyme activity and effect of pH/ temperature on enzyme activity

### Reference Books:

- Lewin B. 2000 Genes VII Oxford University Press, New York
- Wolfe, S.L. (1993) Molecular and cell Biology-Wadsworth publishing Co. California, U.S.A.
- Krishnamourthy, K.V. (2000) Methods in Cell Wall chemistry. CRC Press, Boca Raton, Florida.
- Buchanan, B.B., Griessman W and Jones, R.L. 2000. Biochemistry and Molecular Biology of Plants American Society of plant Physiologist, Maryland, U.S.A.
- De, D.N. 2000, Plant cell vacuoles. An introduction, CSIRO publication, Collingwood, Australia.
- Hall, J.L. and Moore A.L. 1983 Isolation of And organelles for plant cells, Academic Press, London.
- Harris, N. and Oparka, K.J. 1994. Plant cell Biology: A Practical Approach, IRL press at Oxford university Press, Oxford, U.K.
- Shans, C.H. (1988), Plant Molecular Biology : A Practical Approach , IRL Press, Oxford.
- Bruce Alberts et.al. (1983) Biology of the Cell. Garland publ. Inc. New York.
- Charlothe J. Avers (1986) : Molecular Cell Biology, Addison Wesley publishing company.
- Sandhya Mitra (1988) Elements of Molecular Biology MacMillan India Limited.
- H.D. Kumar (1983): Molecular Biology and Biotechnology Vikas Publ. House Pvt. Ltd.
- C.B. Powar (1992) : Cell Biology: Himalaya Publ. House.
- De. Robertes. et.al. (1992) : Cell Biology, Philadelphia W.B. Sanders.
- Watson, J.D. et. Al. (1987): Molecular Biology of gene (IV Edition) The Benjamin/Commings Pub. Co. Inc. Mento Part California.
- Stumpf P.K. and Conn. E.E. (1981) : Plant biochemistry ; 'The Cell' Comprehensive Treatise, Academic Press.
- Darnell J. and D. Baltimore (1986) Lodich : Molecular Cell Biology, Scientific American Books.
- K. Sivarama Sastry. G. Padmanaban and C. Subramanyam (1994) : Text book of Molecular Biology, Mac Millan India Ltd..

## **OET 2.1: Advances in Plant Pathology (L-60)**

### **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.

### **Unit – II**

**MLO:** classification, morphology and characteristics of MLO, Identification Techniques of MLOs. Mechanism of infection – Prepenetration, penetration , post penetration and colonization.

### **Unit – III**

Defense mechanism against pathogen- structural, physiological, genetical and chemical, systematic acquired resistance Role of environmental factors on disease development, Epidemiology- slow and rapid epiphytotic, Disease forecasting, assessment of disease incidence and crop loss

### **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. Viral diseases- TMV, BMV

### **Unit – V**

Phytoplasma diseases -Little leaf, GSD 3. Bacterial diseases- Canker, Blight, Leafspot. Fungal diseases- club root, white rust, Downy mildew , powdery mildew Rusts, smuts Ergot, Leaf spot, fruit rot , study of seed borne pathogens.. Nematodes- Root knot of vegetables. Algal diseases- Red rust. Phanerogamic diseases- Total and partial stem and root parasites



**OEP 2.1**  
**Practicals based on paper OET 2.1**

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

**Reference Books:**

- Mehrotra. R.S. (1980)- plant pathology.  
Agrios, G.N. (1978)-plant pathology .  
Ny vail, R.F.(1979) – Field Crop Diseases Hondbook.  
Stingh, R.S. (1963) – Plant diseases  
Padoley, S.K. and P.B. Mistry – A manual of plant pathology.  
Gangopadhyay,S. (1984)- Clinical plant pethology.  
Rangaswami, G.(1979) Diseases ofcrop plants in India.  
Mahadevan A.andR.Sridhar (1982)- Methods in physiological plant pathology.  
Aneja, K.R.(1993) – Experiments in Microbiology plant Pathalogy and Tissue culture.  
Gangulee, H.C.&A.K. kar (1992) – College Botany Vol. II.  
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.  
Kuljit,J.(1969)- The Biology ofparasitis flowing plants.Univ.of California Press, U.S.A.  
Plank, J.E. Van der (1963)- Plant diseases, Epidemics and Control.  
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  
Micobiology and plant pathology by P.D. Sharma . Rastogi publication Shivaji road ,Meerut.

## OET 2.2- Mushroom Culture Technology

( L- 60)

**Unit 1:**Introduction, history. Nutritional and medicinal value of edible mushrooms; Poisonous mushrooms.Types of edible mushrooms available in India - Volvariella volvacea, Pleurotus citrinopileatus, Agaricus bisporus. (12 Lectures)

**Unit 2:**Cultivation Technology : Infrastructure: substrates (locally available) Polythene bag, vessels, Inoculation hook, inoculation loop, low cost stove, sieves, culture rack, mushroom unit (Thatched house) water sprayer, tray, small polythene bag. (12 Lectuers)

**Unit 3:** Pure culture: Medium, sterilization, preparation of spawn, multiplication. Mushroom bed preparation - paddy straw, sugarcane trash, maize straw, banana leaves. Factors affecting the mushroom bed preparation - Low cost technology, Composting technology in mushroom production. (12 Lectures)

**Unit 4:**Storage and nutrition : Short-term storage (Refrigeration - upto 24 hours) Long term Storage (canning, pickels, papads), drying, storage in saltsolutions. Nutrition - Proteins - amino acids, mineral elements nutrition - Carbohydrates, Crude fibre content - Vitamins. (12 Lectures)

**Unit 5:** Food Preparation:Types of foods prepared from mushroom.Research Centres - National level and Regional level.Cost benefit ratio - Marketing in India and abroad, Export Value. (12 lectures)

## **Practicals**

- 1) Identification of edible and poisonous mushroom
- 2) Media preparation for mushroom
- 3) Isolation techniques used in mushroom cultivation
- 4) Study of spawn preparation method
- 5) Study of sterilization techniques in mushroom cultivation
- 6) Study of substrate preparation of mushroom
- 7) Study of environmental factors which affect growth of mushroom
- 8) Study of effect of different types of compost on mushroom growth
- 9) Study of nutritional quality of mushroom
- 10) Estimation of protein contain in mushroom

## **References:**

1. Marimuthu, T. Krishnamoorthy, A.S. Sivaprakasam, K. and Jayarajan. R (1991) Oyster Mushrooms, Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore.
2. Swaminathan, M. (1990) Food and Nutrition. Bappco, The Bangalore Printing and Publishing Co. Ltd., No. 88, Mysore Road, Bangalore – 560018
3. Tewari, Pankaj Kapoor, S.C., (1988). Mushroom cultivation, Mittal Publications, Delhi.
4. Nita Bahl (1984-1988) Hand book of Mushrooms, II Edition, Vol. I & Vol. II.