

**NORTH MAHARASHTRA UNIVERSITY,  
JALGAON**



(NAAC Re-Accredited)

**FACULTY OF SCIENCE**

**SYLLABUS FOR  
M.Sc. (PART-I)  
IN BOTANY**

**To Be Implemented From  
Academic Year 2017-18**

**NORTH MAHARASHTRA UNIVERSITY, JALGAON Syllabus for Theory and  
Practical Courses for M.Sc. In Botany M.Sc. Part-I**

**(w.e.f. Academic Year 2017-2018)**

**Semester-I**

- BOT.101 Angiosperm Taxonomy
- BOT.102 Environmental Botany and Biostatistics
- BOT.103 Cytogenetics, and Molecular Biology
- BOT.104 Practical –I (Based on BOT.101)
- BOT.105 Practical –II (Based on BOT.102 and BOT.103)

**Semester-II**

- BOT.201 Diversity of Lower Cryptogams
- BOT.202 Diversity of Higher Cryptogams
- BOT.203 Plant Physiology and Biochemistry
- BOT.204 Practical –I (Based on BOT.201)
- BOT.205 Practical –II (Based on BOT.202 and BOT.203)

**Note:** i) Each theory course requires 05 lectures of 60 minutes each.

ii) Each practical course requires 02 practical's per week of 04 hours duration.

**Semester -I**  
**BOT. 101**  
**ANGIOSPERM TAXONOMY**

Total: 60 Lectures

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**Aims and Objectives:**

- i) To study conceptual development of 'taxonomy' vis-à-vis 'systematics'
  - ii) To study general range of variations in the group of angiosperms.
  - iii) To trace history of development of systems of classification emphasizing angiospermic taxa.
  - iv) To study characters of biologically important families of angiosperms
  - v) To study range of floral variations in angiospermic families, their phylogeny and evolution.
  - vi) To study various rules, principles and recommendations of plant nomenclature
  - vii) To know modern trends in taxonomy
  - viii) To study major evolutionary trends in various parts of angiospermic plants.
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**Chapter I - Introduction: (03L)**

- i) Taxonomy and Systematics: Conceptual Development
- ii) Aims and Principles
- iii) Approaches and importance
- iv) Diversity of angiosperms with respect to:
  - a) Form, structure and function
  - b) Evolutionary status of Angiosperms

**Chapter II - Classifications: History of Development: (09 L)**

- i) Review of Pre-Darwinian classifications
- ii) Review of Post-Darwinian classifications
- iii) Recent Systems

**Chapter III - Discussion of the following families with respect to salient features and points of biological importance: (10L)**

Sarraceniaceae, Lentibulariaceae, Droseraceae, Nepenthaceae,  
Cuscutaceae, Orobanchaceae, Balanophoraceae, Rafflesiaceae,  
Santalaceae, Loranthaceae, Podostemnaceae, Rhizophoraceae,  
Cactaceae, Orchidaceae, Aristolochiaceae.

**Chapter IV : Discussion of following families with reference to range of floral variations, taxonomy, phylogeny and evolutionary trends : (12 L)**

Ranunculaceae, Tiliaceae, Meliaceae, Cactaceae, Umbelliferae, Compositae, Asclepiadaceae, Scrophulariaceae, Plumbaginaceae, Amaranthaceae, Liliaceae, Orchidaceae, Scitaminae, Commelinaceae, Graminae.

**Chapter V: Sources of Taxonomic Information: Role of the following: (10 L)**

- i)** Micromorphology and Ultrastructure
- ii)** Embryology and Palynology
- iii)** Anatomy
- iv)** Photochemistry
- v)** Reproductive biology
- vi)** Plant geography and Ecology
- vii)** Genetics and Cytogenetics
- viii)** Paleobotany

**Chapter VI: General Evolutionary Trends in Angiosperms: (08L)**

- i)** Habitat and growth habit
- ii)** Leaf structure: Simple and compound, phyllotaxy
- iii)** Phyllode theory
- iv)** Evolution of inflorescence
- v)** Primitive stamen
- vi)** Primitive carpel
- vii)** Nature of inferior ovary: Foliar (Appendicular) and Receptacular (Axial) theories
- viii)** Evolution of gynoecium
- ix)** Evolution of floral nectaries
- x)** Evolution of fruit

**Chapter VII: Study of Botanical Nomenclature with respect to: (08 L)**

- i)** Scientific names and Common names
- ii)** International Code of Botanical Nomenclature (ICBN)
- iii)** Review of various codes
- iv)** Principles of the code I-V
- v)** Type method (Typification) and working of Type method
- vi)** Author citation

- vii)** Rejection of names
- viii)** Retention of names
- ix)** Conservation of names
- x)** New Names
- xi)** Names of cultivated and hybrid plants

#### **REFERENCE BOOKS**

1. **Bhojwani, S.S. and S.P.Bhatnagar (1974)** The Embryology of Angiosperms, Vikas Publishing House (P.) Ltd. New Delhi, India
2. **Davis, P.H and V.H Heywood (1963)** Principles of Angiosperm Taxonomy, Oliver and Boyd, Edinburgh, Scotland.
3. **Eames, A.J. ( 1961)** Morphology of Angiosperms, McGraw-Hill, NewYork, U.S.A.
4. **Erdtman, G. (1952)** Pollen Morphology and Plant Taxonomy, Angiosperms, Almquist & Wicksell, Stockholm, Sweden.
5. **Gibbs, R.D. (1974)** Chemotaxonomy of Flowering Plants, McGill- Queen's University Press, Montreal & London, U.K.
6. **Harborne, J.B., D. Boulter and B. Turner (1971)** Chemotaxonomy of Leguminosae, Academic Press, London, U.K.
7. **Heywood, V.H. (1968)** Modern Methods in Plant Taxonomy, AcademicPress, London, U.K.
8. **Heywood, V.H. , J.B.Harborne and B.L.Turner (1977)** The Biology and Chemistry of Compositae Vol. I & II, Academic Press, London, U.K.
9. **Jain, S.K. and R.R.Rao (1977)** A Handbook of field and Herbarium Methods, Today and Tomorrow Publishers, New Delhi, India
10. **Johri, B.M. (1984)** Embryology of Angiosperms, Springer- Verlag Berlin Heidelberg New York, (U.S.A.)Tokyo, Japan
11. **Johri, B.M., K.B. Ambegaokar and P.S. Srivastava (1992)** The Familiesof Flowering Plants arranged according to a new system based on their probable

- phylogeny, Springer Publications, Switzerland.
12. **Kubitzki, K. (1977)** Plant Systematics and Evolution, Springer erlag, New York, U.S.A.
  13. **Lawrence, G.H.M. (1951)** Taxonomy of Vascular Plants, MacMillan, New York, U.S.A.
  14. **Maheshwari, P. (Ed.)** Recent Advances in the Embryology of Angiosperms, International Society of Plant Morphology, University of Delhi, Delhi, India.
  15. **Maheshwari, P. (1950)** An Introduction to Embryology of Angiosperms, Mc Graw Hill, New York, U.S.A.
  16. **Mathur Neera.** (2012) Taxonomy of Angiosperm. Sonali Publication, New Delhi.
  17. **Mondal, A.K.** (2005) Advanced Plant Taxonomy, New Central Book Agency, Kolkata.
  18. **Metcalf, C.R. and L. Chalk (1950)** Anatomy of the Dicotyledons Vol.I &II Oxford Uni. Press. Oxford, U.K.
  19. **Naik, V.N. (1984)** Taxonomy of Angiosperms Tata McGraw-Hill Publishing Co. Ltd. New Delhi, India.
  20. **Nair, R.** (2010) Taxonomy of Angiosperm. APH Publishing Corporation, New Delhi
  21. **Pandey, S.N. and S.P. Mishra.** (2008) Taxonomy of Angiosperms. Ane Books India, New Delhi.
  22. **Sambamurthy** (2005) Taxonomy of Angiosperms. I. K. International Pvt. Ltd. New Delhi.
  23. **Saxena, N.B. and Shamindra Saxena.** (2006) Plant Taxonomy, Pragati Prakashan, Meerut, India.
  24. **Sharan Suniti.**(2011) Plant Taxonomy. Pacific Books International, New Delhi.
  25. **Sharma, O.P.** (2007) Plant Taxonomy, Tata McGraw -Hill Publishing Company, New Delhi.
  26. **Singh, V. and D.K.Jain (1992)** Taxonomy of Angiosperms, Rastogi Publications, Meerut, India.
  27. **Singh, V. P. C. Pande and D.K.Jain (2013)** A Text Book of Angiosperms, Rastogi Publications, Meerut, India.
  28. **Sivarajan, V.V. (1984)** Introduction to Principles of Plant Taxonomy, Oxford and IBH Publication Co. New Delhi, India.
  29. **Smith, P.M. (1996)** The Chemotaxonomy of Plants, Edward Arnold. London, U.K.

30. **Sporne, K.R. (1974)** The Morphology of Angiosperms: The Structure and Evolution of Flowering Plants, Hutchinson University Library, London, U.K.
31. **Stace, C.A. (1980)** Plant Taxonomy and Biosystematics, Edward Arnold, London, U.K.
32. **Stebbins, G.L. (1974)** Flowering Plants: Evolution Above The Species Level, Arnold Press, London, U.K.
33. **Subrahmanyam, N.S. (2003)** Modern Plant Taxonomy. Vikas Publishing House, New Delhi.
34. **Suresh Kumar. (2002)** Text Book of Plant Taxonomy, Campus Books International, New Delhi.
35. **Swain, T. (Ed.) (1963)** Chemical Plant Taxonomy, Academic Press, London, U.K.

**Semester – I**  
**BOT. 102**  
**ENVIRONMENTAL BOTANY AND BIOSTATISTICS**

**Total: 60 Lectures**

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**Aims and Objectives:**

- i). To understand the environmental botany.
  - ii) To study the nature and its co-relation with human society.
  - iii) To study the impact of human activities on environment.
  - iv) To understand global issues concerned with environment.
  - v) To understand the sustainable development and care of environment.
  - vi) To understand the connection between material wealth & resources exploitation;
  - vii) To understand the relationship between economic growth and environmental degradation
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**Environmental Botany (40 Lectures)**

**Chapter I - Environmental Botany: (05L)**

- i) Introduction, scope and Importance
- ii) Environmental Interrelationships; The interrelated Nature of Environmental Problems
- iii) Physical environment, Biotic environment; Interrelated scientific Principles: Matter, Energy and Environment; Interactions of Environment and Organisms

**Chapter II – Environmental Ethics (04L)**

- i) Environmental Attitudes
- ii) Individual Environmental Ethics, Societal Environmental Ethics Corporate Environmental Ethics, Global Environmental Ethics
- iii) Environmental Justice

**Chapter III- Ecosystem Ecology: (02L)**

- i) Productivity of different ecosystems – Primary productivity and secondary productivity.
- iv) Human Impact on Ecosystems and Resources

**Chapter IV - Fundamentals of Remote Sensing and GIS: (06L)**

- i) Definition, concept and history of remote sensing, Electro -magnetic radiation (EMR), Energy interaction with atmosphere, interaction with Earth's surface materials.



- ii) GIS: Definition, history and introduction, components of GIS, Concept of data, information, knowledge Data: spatial and non-spatial data, raster and vector data, GIS file formats.
- iii) Applications of RS and GIS in Forestry and Ecology: forest density, Forest type mapping, inventory of forests, delineation of degraded forests, damage assessment, Landscape characterization, Biomass assessment, Forest ecosystem management

**Chapter V Forestry: (05L)**

- i) Agro forestry ii) Social forestry iii) Forest conservation iv) Wetland Management
- v) Water Management : a) The Water issue and hydrologic Cycle b) Kinds of Water use c) Water use Planning Issues

**Chapter VI - Solid Wastes: (03 L)**

- i) Introduction
- ii) Types and Sources of Solid Wastes
- iii) Solid Waste Management (Collection, Resource & Disposal Recovery and sustainable management)

**Chapter VII - Environmental Management : (05L)**

- i) Concept, Scope and Procedure of EIA
- ii) Environment Management Plan (EMP)
- iii) Environmental Auditing
- iv) Green Belt
- v) Kyoto Protocol

**Chapter VIII - Environmental Legislation: (06L)**

- i) Forest Conservation Act
- ii) General account of legislation related to environment
- iii) Wild life Protection Act – 1972
- iv) Water Act – 1976
- v) Environment Protection Act – 1985

vi) Biodiversity Act (2002)

**Chapter IX** - Global Environmental Issues and Conference: (04L)

i) Global Warming, Green House Effect, Acid Rain, Ozone layer depletion

ii) Earth Summit, The United Nations Conference on the Human & Environment, 1992, United Nations conference on climate change 2009

**(II) Biostatistics (20 Lectures)**

**Chapter X**- Sampling Methods: (02L)

**Chapter XI** - Measure of Central Tendencies: (02L)

i) Mean

ii) Mode

iii) Median

iv) Properties, merits and demerits of central tendency

**Chapter XII** - Measure of Dispersion: (03L)

i) Range

ii) Standard Deviation, Mean Deviation

iii) Coefficient of Variation, Co-efficient of co-relation

iv) Standard Error

**Chapter XIII** - Distribution: (02L)

Probability and Distribution (Normal)

**Chapter XIV**- Test of Significance: (02L)

i) Concept of Significance

ii) Students test

iii) Chi square ( $X^2$ ) test

**Chapter XV** - Analysis of Variance (ANOVA) (05L)

i) Introduction and Application in Biology

ii) ANOVA table and F ratio, least significant difference

## REFERENCE BOOKS:

1. **Ambasht, R. S. (1976)** Principles of Ecology (I st Eds.) Students Publications, Varanasi, India.
2. **Arumugam, N (1996)** Concept of Ecology (VII th Eds.) Saras Publication, Kanyakumari, India.
- 3 **Bagyaraj, D.J..et.al. (1999)** Modern Approaches And Innovation In Soil Management, Rastogi Publications, Meerut, India
4. **Baily, N. T. J. (1959)** Statistical Methods in Biology, ELBS and the English University Press Ltd. U.K.
5. **Dash, M. C. (1994)** Fundamentals of Ecology. Tata McGraw Hill Publication Comp. Ltd. New Delhi, India .
6. **Gupta, S. C. (1998)** Fundamentals of Statistics, Himalaya Publishing House, New Delhi, India.
7. **Kang-Tsung Chang. (2002)** Introduction to Geographical Information System. McGraw Hill, U.K.
8. **Panda, B. C. (2005)** Remote sensing Principles and applications, Viva Books Private , New Delhi, India.
9. **Prayag, V. R. and Dixit, P. G. (1998)** Statistics – Discrete Probability and Probability Distribution.
- 10 **Rao, K. S. (1993)** Practical Ecology, Anmol Publication, New Delhi, India.
11. **Reddy M. A. (2006)** Textbook of Remote sensing and geographical information systems, B.S. Publications, Hyderabad, India.
12. **Rosner, B. (1982)** Foundations in Biostatistics. Duxbury Press, Bosten.
13. **Roy, P.S. and R.S. Dwivedi.** Remote Sensing Applications, Technical Report of NRSC/ISRO.
14. **Santra, S. C. (2001)** Environmental Science, New Central Book Agency Pvt. Ltd., Delhi, India.
- 15 **Saxena, M. M. (1990)** Applied Environmental Biology (Resource and management) AgroBotanical Publisher, Bikaner, India.
- 16 **Seth, S.M., S.K. Jain and M.K. Jain .(2002).** Remote Sensing and GIS application studies at National Institute of Hydrology, Roorkee, U.P., India.
17. **Sharma, P. D. (1993)** Ecology and Environment, Rastogi Publications, Meerut, India.
18. **Sudhir, M. A., M. Alankara Masillamani, M. A. (2003)** Environmental Issues, Reliance Publishing House, New Delhi, India.
- 19 **Tor Bernhardsen (2002)** Geographic Information System- an introduction, 3rd edition, , Wiley Publication, New York, USA.
20. **Triwedi, P. R. (1990)** Encyclopedia of World Environment. A. P. H. Publishing Corporation, Delhi, India.
21. **Eldon D. Enger and Bradley F. Smith (1995)** Environmental Science A Study of Interrelationship (V<sup>th</sup> Eds.) Wm.C. Brown Publishers Chicago

**Important Web links:**

<http://www.geospatialworld.net/Paper/Application/index.aspx>

<http://www.isro.org/scripts/remotesensingapplications.aspx>

<http://www.itc.nl/ilwis/applications/application14.asp>

**Semester -I**  
**BOT 103**  
**CYTOGENETICS AND MOLECULAR BIOLOGY**  
**Total 60 Lectures**

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**Aims and Objectives:**

- i) To study structural organization and variation in chromosome as well as karyotype analysis.
  - ii) To study extra-chromosomal inheritance in plant system.
  - iii) To study molecular biology in relation to genetic material, its inheritance, modification, replication and repair.
  - iv) To study transcription, translation post translation modification of protein.
  - v) To study gene regulation in prokaryotes and eukaryotes.
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**CYTOGENETICS**

- Chapter I: Cytogenetic:-** (02)  
Definition, history and application in biology
- Chapter II: Cell and its components:-** (05)  
Definition of cell, types of cell, Prokaryotic cell structure, eukaryotic cell structure, various cellular organelles found in prokaryotic and eukaryotic (Plant) cell and there functions.
- Chapter III: Cell Cycle, its Regulation and control:** (04)  
Mitosis, Meiosis, Check Points, Cyclins and Cyclin dependent Kinases. Apoptosis and program cell death.
- Chapter IV: Karyotyping :-** (07)  
Chromosome Structure, Types of chromosomes on the basis of centromere, variation in chromosome structure-(Deletion, Duplication, Inversion and Translocation), Variation in chromosome Number (Euploidy, Eneuploidy, methods of inducing Auto and Alloploidy). Banding pattern Q, C, G, and R-bandings, Special types of chromosomes.
- Chapter V: In-situ hybridisation :- GISH , FISH** (01)
- Chapter VI: Transposons:- Definition , history , types, and importance.** (02)

**Chapter VII:** Cytoplasmic inheritance: (03)

Cytoplasmic inheritance involving Chloroplast (*Mirabilis jalapa*, *Zea mays*), Mitochondria (Male sterility in higher plant).

**Chapter VIII:** Linkage group, linkage map construction correlation with Restriction mapping (Restriction enzymes, construction of RE map). (04)

**Chapter IX:** Cancer: - Oncogenes proto-oncogenes, metastasis, agent causing cancer, RB protein and E2F. (02)

## MOLECULAR BIOLOGY

**Chapter X:** Introduction: - Definition, milestones of molecular biology, scope and importance. (01)

**Chapter XI:** Nucleic acids:- basic properties and moieties of nucleic acids, discovery and types. (01)

**Chapter XII:** DNA :- physical and chemical properties, various types of DNA. Molecular organisation of chromosome and chromatin, nucleosome solenoid, scaffold etc. (04)

**Chapter XIII:** DNA replication, repair and recombination (Unit of replication, enzymes involved, replication origin and replication fork, DNA damage and repair mechanisms, homologous and site-specific recombination). (04)

**Chapter XIV:** Genetic recombination: Molecular mechanism of recombination, role of RecA and RecBCD enzymes Chromosome mapping, linkage group, genetic markers, construction of linkage maps, correlation of genetic and physical maps. (04)

**Chapter XV:** Gene mutation:- Mutagens, Molecular basis of mutation, Mechanism of Spontaneous and induced mutation. (03)

**Chapter XVI:** RNA:- Physical and chemical properties of RNA, RNA synthesis and processing (transcription factors and machinery, formation of initiation complex, transcription activator and repressor, RNA polymerases, capping, elongation, and termination, RNA processing, RNA editing, splicing, and polyadenylation, structure and function of different types of RNA, RNA transport). (04)

**Chapter XVII:** Protein synthesis and processing (Ribosome, formation of initiation complex, initiation factors and their regulation, elongation and elongation factors, termination, genetic code, aminoacylation of tRNA, tRNA-identity, aminoacyl tRNA synthetase, and translational proof-reading, translational inhibitors, Post- translational modification of proteins). **(05)**

**Chapter XVIII:** Gene regulation : in Prokaryotes( operon concept, LAC operon TRP operon); in eukaryotes : Eukaryotic transcriptional regulation (promoter enhancer and silencer, Gene battery) and post transcriptional regulation. **(04)**

#### REFERENCE BOOKS:

1. **Benjamin Lewin(2009)** Genes– VI, VII, VIII and IX; Oxford , Univ. Press ,USA .
2. **Chaudhari , B.D. (2000)**Elementary Principles of plant Breeding(2nd Edt.)Oxford& IBH pub. New Delhi, India.
3. **De Robertis and De Robertis (2005)** Cell and Molecular Biology, 8thEd, Lippincott William and Wilkins U.S.A.
4. **Eldon John Gardner, Michel J. Simmons and D. Peter Snustad(1991)** Princiles of genetics 8thEd . Wiley India edition, New Delhi, India.
5. **Gupta, P. K. (2007)** Genetics: Classical to Modern. Rastogi Publications , Meerut, India.
6. **Hartl D L and Jones E W (1998)** Genetics Principles and Analysis ; (4thed.). Jones and Barflett Publishers, USA.
7. **Hexter W and Yost Jr. H T., (1977)** The Science of Genetics ; Prentice Hall of India Pvt. Ltd. , New Delhi, India.
8. **Kar and Halder, (2009)**Cell Biology Genetics Molecular Biology; New Central Book Agency (P) Ltd. Kolkata, India.
9. **Karp, G. (1999)** Cells and Molecular Biology concepts and Experiments; Hohn Wiley & Sons Inc. USA.
10. **Phundan Singh, (1996)** Essentials of Plant Breeding; Kalyani publication , New Delhi, India.
11. **Powar,C. B. (1992)** Cell Biology, Himalaya Publishing House Nagpur, India.
12. **Powar, C. B (2003)** Genetics I & II Himalaya Publishing House, Nagpur, India.

13. **Swanson, C. P. T. Merz, and W.J. Young (1982)** Cytogenetics ; Prentice Hall of India Pvt. Ltd., New Delhi, India.

14. **Russel, P.J. (1998)** Genetics (5th edition); The Benjamin/ Cummings Publishing Company Inc., USA.

15. **Verma, Agarwal, (2005)** Cell Biology, Genetics, Molecular Biology, Evolution and Ecology: S.Chand and Company , New Delhi, India.



**BOT 104 Practical –I**  
**(Based on BOT. 101 Angiosperm Taxonomy)**

(Total: 24 Practicals)

**Practicals1-18:** Study of following families with respect to morphological characters using botanical terms, floral formula, floral diagram and classification giving reasons as per Bentham and Hooker's system covering major groups of it (Any 20 families locally available as per syllabus)

**Practicals19-20:** Identification of genus and species with the help of flora of the plant materials from the families mentioned in syllabus.

**Practicals21-22:** Preparation of artificial, bracketed/indented dichotomous keys based on vegetative and reproductive characters.

**Practicals23-24:** Study of Morphological and biological peculiarities of the following:

- i) Insectivorous plants: *Drosera, Utricularia, Nepenthes*
- ii) Parasitic plants: *Striga, Cuscuta, Dendrophthoe, Viscum*
- iii) Aquatic plants: *Limnophila, Pneumatophore*
- iv) Inflorescences: Spadix, Cyathium, Catkin
- v) Flowers: Orchid and Cleistogamous flowers.
- vi) Phyllode: Australian *Acacia*
- vii) Velamen tissue of Epiphytic Orchid

- Note:**
- i) Botanical excursions and submission of scientific excursion reports from one locally and vegetationally different locality are compulsory.
  - ii) Duly certified journals are compulsory at the time of practical examination.

**Following floras may be consulted for practical purpose:**

1. **Cooke, T. (1958)** Flora of Presidency of Bombay Vol.I-II, Botanical Survey of India, Calcutta, India.
2. **Hooker, J.D.(1872-1897)** Flora of British India, Vol. I-VII, Reeves & Co., London.
3. **Kamble, S.Y. and S.G. Pradhan (1988)** Flora of Akola District, Maharashtra, Botanical Survey of India, Calcutta, India.
4. **Kshirsagar, S.R. and D.A.Patil (2008)** Flora of Jalgaon District, Maharashtra, Bishen Singh Mahendra Pal Singh, Dehra Dun, India.
5. **Kulkarni, B.G. (1988)** Flora of Sindhudurg, Botanical Survey of India, Calcutta, India.
6. **Lakshminarasimhan, P. & B.D. Sharma (1991)** Flora of Nashik District, Botanical Survey of India, Calcutta, India.
7. **Naik, V.N. (1999)** Flora of Marathwada, Vol. I-II, Amrut Prakashan, Station Road, Aurangabad, India.
8. **Patil, D.A. (2003)** Flora of Dhule and Nandurbar District (Maharashtra). Bishen Singh Mahendra Pal Singh, Dehra Dun, India.
9. **Shah, G.L. (1978)** Flora of Gujarat State, Vol. 1-2, Vallabh Vidyanagar, Gujarat, India.

**BOT 105 Practical –II (Based  
on Bot 102 and Bot 103)  
(Total: 24 Practicals)**

**Practicals 1- 4:** Practicals on study of vegetation by using following methods for Estimation of FICC, IVI, frequency, Density, Abundance and Histogram.

- a) Quadrature Method: - i) List count Quadrature ii) Chart Quadrature
- b) Transect Method: -i) Line Transect ii) Belt Transect
- c) Physiognomic Method : - i) Biological Spectrum.

**Practical 5:** Estimation of Biomass

**Practical 6:** Instruments used for collection of meteorological data (any six)

**Practical7:** Estimation of Phosphatic fertilizers from agricultural soil using colorimeter / Spectrophotometer.

**Practical8:** Element of visual interpretation of aerial photograph or satellite image.

**Practical9:** Details and use of mirror stereoscope and pochet stereoscope for interpretation.

**Practical10-12:** Examples based on Biological Data

- a) Measure of Central Tendencies
- b) Measure of Dispersion
- c) Test of significance X test and t- test
- d) Normal Distribution

**Practical 13:** Preparation of Cytological fixative (Carnoy's fluid I, II, Navashin' s fluid etc.)

**Practical 14:** Preparation of stains, Aceto-carmine/ aceto orcein, Haematoxylene, and Feulgen

**Practical 15-16:** Squash and smear preparations to study Mitosis in onion root tips and Meiosis in *Zea mays* or *Allium cepa* or *Rhoeo discolor* flower buds (Aceto carmine or aceto orcein).

**Practical 17:** Squash or smear preparations to study Mitosis or Meiosis in suitable material using Haematoxylene, or Feulgen stain (any one).

**Practical 18:** Determination of Mitotic index and Metaphase frequency in *Allium cepa* or other plant material.

**Practical 19:** Demonstration of salivary gland chromosome preparations (*Chironomus* larvae/*Drosophila*).

**Practical 20:** Estimation of RNA by Orcinol Method.

**Practical 21-22:** Isolation and estimation of DNA from suitable plant material.

**Practical 23:** Study of chromosomal aberrations in plant (*Rhoeo discolor*).

**Practical 24:** Isolation and Janus green staining of mitochondria.

**Semester- II**  
**BOT 201**  
**Diversity of Lower Cryptogams**  
**Total 60 Lectures**  
**Algae (30 Lecturers)**

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**Aims and Objectives:**

- i) To study salient features of Algae and Fungi.
  - ii) To study diversity of lower Cryptogamic plants in nature.
  - iii) To study the life cycle patterns in lower cryptogams.
  - iv) To study algae and fungi for human welfare.
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**Chapter I: Introduction of Algae** **(10)**

- i)– Introduction to the algae
- ii) – Review of algological studies : In India & Maharashtra.
- iii) – General characteristics of algae and similarities and differences with Fungi and Bryophytes.
- iv) – Diversified habitats
- v)–Reproductive diversity and perennation.
- vi) – General account of vegetative thallus structure
- vii)– Life cycle patterns : Monophasic, Diphasic & Triphasic
- viii)– Economic aspects : Useful & Harmful.

**Chapter II: Classification of algae upto order with suitable examples.** **(03)**

- i)– Comparative survey of important system of classification :
  - Fritsch's system of classification (1945)
  - Parkar's System of classification (1962)
  - V. J Chapman & D. J Chapman system (1973)
- ii) Comparative account of range of cell organization in Chlorophyceae, Bacillariophyceae, Phaeophyceae, Rhodophyceae & Myxophyceae in brief.

**Chapter III: Cytology of algal cell** **(03)**

- i)– Details of a Prokaryotic & Eukaryotic cell
- ii)Pigmentation : Kinds of pigments and their properties.

**Chapter IV: Study of important class of Algae:** **(14)**

**a) Myxophyceae**

- i) – General characters & Primitive characteristics
- ii) – Thallus organization & cell structure
- iii) – Ultra structure & functions of Heterocyst
- iv) – Nitrogen fixation & metabolism
- v) –Reproduction
- vi) – Ecology of Blue green algae
- vii) –Phylogeny & interrelationship

- b) Chlorophyceae**
  - i)- General characters
  - ii)- Range of thallus structure & cell structure
  - iii)- Method of reproduction & life cycle pattern
  - iv)- Phylogeny & interrelationship
- c) Phaeophyceae**
  - i)- General characters
  - ii)- Ranges of thallus structure & Anatomy
  - iii)- Method of reproduction & life cycle patterns
  - iv)- Phyllogeny & interrelationship
- d) Rhodophyceae**
  - i)- General characters
  - ii)- Rangs of thallus cell structure & Calcification
  - iii)- Method of reproduction & life cycle pattern
  - iv)- Phylogeny & interrelationship
- e) Xanthophyceae –**
  - i)- General characters
  - ii)- Phylogeny & interrelationship
- f) Bacillariophyceae –**
  - i)-Cell structure & silicification
  - ii)-Clascification & reproduction
  - iii)- Phylogeny & interrelationship
- g) Euglenophyceae –**
  - i) - General characters
  - ii) - Cell structure
  - iii) - Phylogeny & interrelationship

## **Fungi (30 Lectures)**

### **Chapter V -Fungi – Introduction: (6L)**

- i) Distinguishing characters
- ii) Thallus- unicellular and multicellular filamentous
- iii) Nutrition
- iv) Hyphal modifications in Fungi
- v) Evolutionary trends in fungi
- vi) Classification of fungi up to classes as per - Ainsworth et al., system of classification (1973).
- vii) Economic importance- Fungi in biotechnology, fungi as food

### **ChapterVI - Myxomycotina: (03L)**

- i) Distinguishing characters
- ii) Structure of thallus and reproductive bodies

iii) Life cycle pattern with reference to *Pysarum*.

**Chapter VII -Mastigomycotina: (03L)**

- i) Distinguishing characters
- ii) Thallus structure and reproduction (Asexual and sexual)
- iii) Life cycle pattern with reference to *Plasmopara*.

**Chapter VIII -Zygomycotina: (03L)**

- i) Distinguishing characters
- ii) Thallus structure, Heterothallism
- iii) Sexual reproduction, Evolution of Asexual reproduction
- iv) Life cycle pattern with reference to *Mucor*

**Chapter IX -Ascomycotina: (05L)**

- i) Distinguishing characters
- ii) Thallus structure, structure of asci, Concept of Hamathecium and centrum, Types of ascocarps
- iii) Life cycle pattern with reference to *Eurotium*

**Chapter X-Basidiomycotina: (05L)**

- i) Distinguishing characters
- ii) Thallus structure, Types and Structure of Basidia and basidiocarps
- iii) Life cycle pattern with reference to Teliomycetes

**Chapter XI - Deuteromycotina: (03L)**

- i) Distinguishing characters
- ii) Thallus structure, fructifications
- iii) Types of conidia

**Chapter XII Fungi of special habitats: (2L)**

- i) Fungi in wood decay
- ii) Freshwater fungi
- iii) Mycorrhiza
- iv) Dermatophytes

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**Semester- II**  
**BOT.202**  
**Diversity of Higher Cryptogams**  
**Total:- 60 Lectures**

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**Aims and Objectives:**

- i) To make students aware of the status of higher cryptogams as a group in plant kingdom.
  - ii) To study habit and habitat of the higher cryptogams in the field.
  - iii) To study distinguishing features, interrelationships, phylogeny and evolutionary tendencies of selected orders with their affinities.
  - iv) To study economic importance of higher cryptogamic plants.
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**BRYOPHYTA (30 Lectures)**

**Chapter I Introduction (06 L)**

- i) Classification of Bryophytes proposed by G.M. Smith up to orders with reasons
- ii) Distribution of Bryophytes in India and their Ecology
- iii) Contribution of Indian Bryologists
  - a) Pof. Shiv Ram Kashyap
  - b) Prof. S.K. Pande

**Chapter II Distinguishing features, interrelationships, phylogeny and evolutionary tendencies of the following orders: (20 L)**

- i) Hepaticae:
  - Sphero carpales
  - Marchantiales
  - Jungermanniales
  - Calobryales
- ii) Anthocerotae : Anthocerotales
- iii) Musci :
  - Sphagnales
  - Andreaeales
  - Polytrichales

**Chapter III General Topics: (04 L)**

- i) Evolution of gametophytes and sporophytes of Bryophyta
- ii) Economic importance of Bryophyta

## PTERIDOPHYTA (30 Lectures)

### Introduction:

(06 L)

- i) Classification of pteridophytes proposed by Reimers up to orders with reasons
- ii) Distribution of pteridophytes in India
- iii) Contribution of Indian Pteridologists:
  - a) S.S. Bir
  - b) B.K. Nayar

### Chapter IV Morphology, anatomy, and comparative discussion of sporophytes, gametophytes, interrelationships, evolutionary tendencies and phylogeny of following living orders: (20 L)

- i) Psilotopsida
  - a) Psilotales
- ii) Lycopsidea
  - a) Lycopodiales
  - b) Selaginellales
  - c) Isoetales
- iii) Sphenopsida
  - a) Equisetales
- iv) Pteropsida
  - a) Marattiales
  - b) Ophioglossales
  - c) Osmundales
  - d) Filicales (Any two families)
  - e) Marsileales
  - f) Salviniiales

### Chapter V General Topics

(04 L)

- i) Soral evolution
- ii) Economic importance of Pteridophytes

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**Semester- II**  
**BOT.203**  
**PLANT PHYSIOLOGY AND BIOCHEMISTRY**  
**(Total 60 Lectures)**

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**Aims and Objectives:**

- i) To understand plant structures in the context of physiological functions of plants.
  - ii) To study the growth and development of plants and its regulations
  - iii) To understand the physiological details of photosynthesis and respiration.
  - iv) To understand lipid metabolism in plants .
  - v) To understand the stress of plants and its adaptations.
  - vi) To study the metabolites synthesized by plants.
  - vii) To study the redox systems of plants
- 

**PLANT PHYSIOLOGY (40 Lectures)**

**Chapter I** - Introduction, Scope and Importance **(02L)**

**Chapter II** - Phytohormones **(06L)**

- i) Bioassay of Auxins, Gibberellins, Cytokinins.
- ii) Transport and storage of hormones.
- iii) Physiological effect of Auxins, Gibberellins and Cytokinins.

**Chapter III** - Photosynthesis: **(10L)**

- i) Introduction and Definition
- ii) Brief account of photosynthetic pigments
- iii) Light reaction
- iv) Dark reaction
- v) CAM Pathway and its Significance
- vi) Formation of Starch, sucrose and fructose
- vii) Factors affecting the rate of photosynthesis-Light, temperature, water, O<sub>2</sub> and CO<sub>2</sub>

**Chapter IV** - Respiration: **(10L)**

- i) Introduction and Definition
- ii) Respiratory Quotient (RQ)
- iii) Formation of Hexose sugars from reserve carbohydrates
- iv) Mechanism: a) Glycolysis b) Krebs' cycle c) Electron transport system (ETS)
- v) Fermentation:
  - a) Alcoholic fermentation
  - b) Acetic acid fermentation
  - c) Lactic acid fermentation

- vi) Factors affecting the rate of respiration

**Chapter V – Fat Metabolism (08L)**

- i) Introduction
- ii) Synthesis of fatty acids and glycerol
- iii) Condensation of fatty acids and glycerol
- iv) Glyoxylate cycle (C<sub>2</sub> cycle)

**Chapter VI - Stress Physiology: (04L)**

- i) Definition
- ii) Types of Stress
  - a) Water stress-Drought, Cold and Salt
  - b) Temperature stress-High and Low

**BIOCHEMISTRY (20 Lectures)**

**Chapter VII - Introduction: (03L)**

- i) Definition, Scope and Importance
- ii) Hydrogen ion Concentration
- iii) P<sub>H</sub> and Buffers

**Chapter VIII - Primary and Secondary Plant Metabolites (06L)**

- i) Brief account of primary plant metabolites
- ii) Brief account of secondary plant metabolites
- iii) Biosynthesis of Terpenes, Phenols and Nitrogenous compounds and their role.

**Chapter IX - Biological Oxidation and Reduction: (06L)**

- i) Introduction
- ii) Oxidation & reduction reactions
- iii) Redox reaction in biological system
- iv) Oxidation-reduction potential and measurement
- iv) Biologically important Redox Systems.

**Chapter X -Biosignaling: (05L)**

- i) General features of Signal and Transduction
- ii) G-protein mediator, couple receptor
- iii) Receptor Gateway

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**BOT 204 Practical-I**  
**(Based on BOT 201 (Total Practicals – 24))**

**Algae : (12 Practicals)**

Morphological observations, description and classification according to Fritsch with reason of taxa belonging to at least two examples from each order.

**Practicals 1- 2:** Cyanophyta: Any 10 forms

**Practicals 3-6** :Chlorophyta:Any 25 forms

**Practical 7** :Charophyceae- *Chara, Nitella*

**Practicals 8-9** : Xanthophyceae – *Vaucheria, Botrydium*  
Bacillariophyceae- *Navicula, Pinnularia, Fragillaria, Synedra, Nitzchia,*  
*Cymbella, Cyclotella, Pleurosigma, Gyrosigma, Coconeis,* ( any 4 forms)

**Practical 10** : Phaeophyta – Any 5 forms

**Practical 11** : Rhodophyta- Any 4 forms

**Practical 12:** Preparation of temporary and permanent algal slides

**Fungi: (12 Practicals)**

**Practical 13:** Preparation of cotton blue, Lactophenol and culture medium - PDA  
Representative genera belonging to following subdivisions of fungi with respect to vegetative, reproductive structures and classification with reasons according to Ainsworth et al. (1973).

**Practical 14:** Myxomycotina – (Any three genera)

**Practical 15:** Mastigomycotina – (Any Four genera)

**Practical 16:** Zygomycotina – (Any three genera )

**Practicals 17-19:** Ascomycotina - (Any Nine genera)

**Practicals 20-22:** Basidiomycotina- (Any Nine genera)

**Practical 23-24 :** Deuteromycotina - (Any Six genera)

Note: i) Excursion tour is compulsory to observe algae and fungi in nature. Tour report along with photographs must be submitted at the time of practical examination. ii) Duly certified journals are compulsory at the time of practical examination.

## REFERENCES

### Algae:

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### Fungi:

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**BOT 2.5 Practical II (Based on BOT 202 & BOT 203) (Total Practicals – 24)**

**Bryophyta (6 Practicals)**

**Morphological, Anatomical and Reproductive studies of the following:**

**Practicals 1 -2:** Marchantiales: *Plagiochasma, Targionia, Asterella Conocephallum & Dumortiera.*

**Practicals 3-4:** Jungermanniales: *Pellia, Fossombronia, Pallavicinia, Porella and Frullania .*

**Practical 5:** Anthocerotales – *Anthoceros, Notothylus*

**Practical 6:** Musci: *Polytrichum, Pogonatum, Sphagnum*

**Pteridophyta (6 Practicals)**

**Morphological, Anatomical and Reproductive studies of the following**

**Practical 7:** *Lycopodium, Isoetes*

**Practical 8:** *Ophioglossum, Osmunda*

**Practical 9:** *Gleichenia, Pteris, Adiantum.*

**Practical 10:** *Asplenium, Lygodium.*

**Practical 11:** *Pleopeltis, Cheilanthes*

**Practical 12:** *Marsilea, Salvinia, Azolla*

**Note:**

- i) Excursion tour is compulsory to observe Bryophytes and Pteridophytes in nature. Tour report along with photographs must be submitted at the time of practical examination.**
- ii) Duly certified journals are compulsory at the time of practical examination.**

### **Plant Physiology and Biochemistry (12 practicals)**

**Practical 13:** Determine diurnal fluctuations in titrable acid number (TAN) values of CAM succulents (e.g. Aloe, Bryophyllum, Kalanchoe - any one)

**Practical 14:** Determine the absorption spectrum of chlorophyll pigments and estimate the amount of Chl-a, Chl-b and total Chlorophylls by spectrophotometer method.

**Practicals 15 & 16:** Extraction and separation of free amino acid of germinating seed by circular paper chromatography.

**Practical 17:** Extraction and separation of free sugars from ripe fruits by ascending paper Chromatography.

**Practical 18:** To extract and estimate the amount of Ascorbic acid present in green paper (Raw)/ Lemon (Fresh).

**Practicals 19-20:** Extraction and Detection of secondary plant metabolites from suitable plant material i) Alkaloids ii) Phenols iii) Terpenoids iv) Proteins.

**Practical 21:** Estimation of amount of CO<sub>2</sub> evolved during respiration (Germinating Pea seeds).

**Practical 22:** Estimation of ether soluble fat oil of *Ricinus/ Arachis* seeds by Soxhlet apparatus.

**Practical 23:** To study the activity of enzyme lipase in germinating seeds (Source-*Arachis /Ricinus*) any one.

**Practical 24:** Estimation of alcohol in fermented grape juice.