

**NORTH MAHARASHTRA UNIVERSITY,
JALGAON**



FACULTY OF SCIENCE

**SYLLABUS FOR
T.Y. B. Sc.
(BOTANY)
SEMESTER-V**

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

NORTH MAHARASHTRA UNIVERSITY, JALGAON
CLASS-T.Y. B.Sc.
SUBJECT- BOTANY
SEMESTER-V
PROPOSED OUT LINE OF SYLLABUS W.E.F. JUNE-2017

SEMESTER-V

- BOT. 351, Paper I: Cryptogams**
- BOT. 352, Paper II: Angiosperm Taxonomy**
- BOT. 353, Paper III: Cell and Molecular Biology**
- BOT. 354, Paper IV: Advanced Plant Physiology**
- BOT. 355, Paper V: Plant Ecology and Phytogeography**
- BOT. 356, Paper VI: OPTIONAL (Only One)**
- BOT. 356.1: Plant Biotechnology**
- BOT. 356.2: Ethnobotany**
- BOT. 356.3: Gardening**
- BOT. 356.4: Seed Technology and seed pathology**

PRACTICAL COURSES

BOT. 357, Practical Paper I: (Based on Paper I & III)

i.e. BOT. 351 and BOT. 353.

BOT. 358, Practical Paper II: (Based on Paper II & VI)

i.e. BOT. 352 and BOT. 356.1 or 356.2 or 356.3 or 356.4.

BOT. 359, Practical Paper III: (Based on Paper IV & V)

i.e. BOT. 354 and BOT. 355.

BOT. 351, PAPER – I
CRYPTOGAMS [60 Periods]
SEMESTER – V

AIMS AND OBJECTIVES:

1. To study salient features of Cryptogamic plants.
2. To make students aware of the status of cryptogams as a group in plant kingdom.
3. To study the life cycles of selected genera.
4. To study economic and ecological importance of Cryptogamic plants.

CHAPTER 1: Introduction

02L

Cryptogams- meaning. Types- Lower Cryptogams and Higher Cryptogams, brief review with examples.

CHAPTER 2: An introduction to Algae

06L

2.1 .General characters of algae

2.2 .Range of Thallus structure in Algae with suitable examples:

1. Unicellular thallus
2. Colonial thallus
3. Filamentous thallus
4. Siphonaceousthallus
5. Pseudoparenchymatous a) Uni-axial thallus b) Multi-axial thallus
6. Parenchymatousthallus

2.3 .Life cycle patterns: Haplontic, Diplontic and Diplohaplontic.

2.4 .Contribution of following Phycologists.

- i) Prof. M. O. P. Iyengar
- ii) Prof. T. V. Deshikachary

CHAPTER 3: Economic importance of algae

02L

3.1. Role of algae in relation to:

- a) Industry- Agar, Alginates, Carrageenin,
- b) Sewage disposal,

- c) Origin of Petroleum
- d) Medicines

3.2. Algal biotechnology in production of Single Cell Protein (SCP)

CHAPTER 4: Life cycle of *Chara* with respect to-

05L

4.1. Systematic position.

- ii. Occurrence
- iii. Structure of thallus

4.2. Reproduction a) Vegetative b) Sexual

4.3. Structure and development of sex organs -a) Nucule b) Globule

4.4. Fertilization and germination of zygote.

4.5. Alternation of generation.

CHAPTER 5: An introduction to Fungi

06L

5.1 .General characters of fungi

5.2 .Classification of fungi upto classes giving reasons as per Ainsworth (1973)

5.3 .Contribution of following mycologists-

- i) Prof. E. J. Buttler
- ii) Prof. C. V. Subramanian

CHAPTER 6: Economic Importance of Fungi

04L

6.1. Useful activities of fungi in relation to-

- a) Food and fodder
- b) Medicine
- c) Industries
- d) Agriculture

6.2. Harmful activities of fungi in relation to

- a) Plant pathology
- b) Spoilage of food
- c) Deterioration
- d) Toxins

CHAPTER 7: Life cycle of *Uncinula* with respect to- **03L**

- 7.1. Systematic position with reasons
- 7.2. Occurrence
- 7.3. General Characters
- 7.4. Mycelium
- 7.5. Reproduction- Asexual and Sexual
- 7.6. Structure and dehiscence of Cleistothecium
- 7.7. Disease aspect

CHAPTER 8: General account of Myxomycetes and Deuteromycetes **02 L**

CHAPTER 9: An introduction to Bryophytes **06 L**

- 9.1. Distinguishing characters of Bryophytes
- 9.2. Distribution and habitat
- 9.3. Similarities of Bryophytes with Pteridophytes
- 9.4. Economic importance of Bryophytes.
- 9.5. Contribution of following Bryologists.
 - a) Prof. Shiv Ram Kashyap
 - b) Prof. B. P. Pandey

CHAPTER 10: Life History of *Marchantia* with respect to **09 L**

- 10.1. Systematic position
- 10.2. Occurrence
- 10.3. External and internal morphology of gametophyte.
- 10.4. Reproduction-a) Vegetative b) Sexual
- 10.5. Structure of sex organs.
- 10.6. Fertilization
- 10.7. Structure and development of sporophyte
- 10.8. Dehiscence of capsule and dispersal of spores
- 10.9. Structure and germination of spores
- 10.10. Alternation of generation.

CHAPTER 11:An introduction to Pteridophytes

07L

- 11.1. General characters of Pteridophytes
- 11.2. Ecological and Economic importance of Pteridophytes
- 11.3. Contribution of following Pteridologists
 - a) S. S. Bir
 - b) N. S. Parihar
- 11.4. Heterospory and seed habit
- 11.5. Types of stele and Stelar evolution

Chapter 12: Life history of *Marselia* with respect to

08L

- 12.1 . Systematic position
- 12.2 . Occurrence
- 12.3 . External and internal morphology of sporophyte
- 12.4 . Reproduction- vegetative and sexual
- 12.5 . External and internal morphology of sporocarp
- 12.6 . Dehiscence of the sporocarp
- 12.7 . Structure of microspore and megaspore
- 12.8 . Structure of male and female gametophytes
- 12.9 . Fertilization
- 12.10 . Development and structure of embryo
- 12.11 . Alternation of generation

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BOT.352, PAPER-II
ANGIOSPERM TAXONOMY [60 Periods]
SEMESTER- V

AIMS AND OBJECTIVES:

1. To study status of angiosperms in plant kingdom
2. To study origin of Angiosperms with respect to time, place, origin and probable ancestors.
3. To study Pre-Darwinian and Post- Darwinian systems of Classification.
4. To study various angiosperm families emphasizing their morphology, distinctive features and biology.
5. To know the role of cytology and Phytochemistry in Taxonomy.

CHAPTER1: Angiosperms:

10L

- 1.1 Angiosperms : Highly evolved group of plants
- 1.2 Taxonomy : Aims of taxonomy
- 1.3 Origin of Angiosperms: w.r.t.
 - i) Time, place and origin of Angiosperms
 - ii) Probable ancestors of angiosperms:
 - a)Pteridospermales b)Bennettitalesc)Gnetales

CHAPTER 2: Systems of Classification

10L

- 2.1. Concept of Pre-Darwinian and Post-Darwinian systems of classification:
- 2.2. Phases of classification
- 2.3 . Concept of primitive flowers :
 - a) Englerian thought
 - b) Ranalian thought
- 2.4. Study of Systems of Classification w.r.t. outline, merits and demerits of the Followings:
 - a) Hutchinson's system b) Engler and Prantl's system

CHAPTER 3: Study of Angiosperm Families

32L

3.1. (Sensu Bentham and Hooker's system of classification) Study of following families w.r.t geographical distribution, systematic position, morphological characters (vegetative and floral), salient features, floral formula and economic importance of the following families.

1. Annonaceae
2. Cruciferae [Brassicaceae]
3. Rutaceae
4. Caesalpinaceae
5. Myrtaceae
6. Cucurbitaceae
7. Compositae[Asteraceae]
8. Sapotaceae
9. Asclepiadaceae
10. Convolvulaceae
11. Labiate (Lamiaceae)
12. Polygonaceae
13. Casuarinaceae
14. Orchidaceae
15. Amaryllidaceae
16. Scitaminae: Musaceae

3.2. Biological importance of 1) Orchidaceae 2) Asclepiadaceae

CHAPTER 4: Modern Trends in Taxonomy:

02L

4.1 Introduction

4.2 Role of following with suitable examples :

a) Cytotaxonomy (number and morphology of chromosomes)

02L

b) Phytochemistry:

04L

i) Direct visible characters (starch grains and raphides)

ii) Chemical test characters (Betalains and Alkaloides)

iii) Proteins

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BOT. 353, PAPER- III
CELL AND MOLECULAR BIOLOGY [60 Periods]
SEMESTER-V

AIMS AND OBJECTIVES:

1. To introduce the students with “Cell Science”.
2. To study Cell wall Plasma membrane, Cell organelles and cell division.
3. To study the scope and importance of molecular biology.
4. To study the biochemical nature of nucleic acids, their role in living systems, experimental evidences to prove DNA as a genetic material.
5. To understand the process of synthesis of proteins and role of genetic code in polypeptide formation.

CHAPTER 1: Introduction to cell biology **3L**

- 1.1 . Definition and Brief History
- 1.2 . Prokaryotic and Eukaryotic cell
- 1.3 . Scope and Importance

CHAPTER 2: Cell wall and Plasma membrane **4L**

Morphology, Ultra-structure, Chemical composition, Functions of Cell wall, Plasma membrane. (Lamellar model and fluid mosaic model)

CHAPTER 3: Cytoplasmic matrix **3L**

- 3.1. Physical nature of Cytoplasmic matrix
- 3.2. Chemical organization- organic and inorganic compounds of cytoplasmic matrix.

CHAPTER 4: Cell organelles **10L**

Morphology, Ultrastructure, Chemical composition, Functions of Endoplasmic Reticulum, Golgi apparatus, Lysosomes, Mitochondria, Chloroplast, Vacuoles, Ribosomes

CHAPTER 5: Plant Cell- Nucleus, Chromosomes **5L**

- 5.1. **Nucleus**- Morphology, Ultra-structure, Nucleoplasm, Nucleolus, Functions

5.2. **Chromosome-** Number, Morphology, Structure, Euchromatin and Heterochromatin and Karyotype

5.3. Special types of chromosome: Lamp-brush chromosome and salivary gland chromosome

CHAPTER 6: Cell cycle and cell division **5L**

6.1. Definition of cell cycle

6.2. Brief explanation of Cell Cycle

6.3. Cell division: Mitosis and Meiosis

6.4. Significance of Mitosis and Meiosis

CHAPTER 7: Introduction to Molecular Biology **2L**

7.1. Definition and History

7.2. Scope and Importance

CHAPTER 8: DNA as Genetic Material **6L**

8.1. Discovery of genetic material

8.2. Watson and Crick's model of DNA, Rosalind Franklin work

8.3. Chargaff rule

8.4. Forms of DNA: A-DNA, B-DNA, Z-DNA

CHAPTER 9: DNA Replication **8L**

9.1. Introduction and types of DNA Replication

9.2. Meselson and Stahl's Experiment

9.3. Molecular Mechanism of DNA Replication

9.4. Sanger Method of DNA Sequencing

9.5. Central Dogma of Molecular Biology

CHAPTER 10: Transcription **4L**

10.1. Types of RNA and its role (m-RNA, r-RNA, t-RNA)

10.2. Definition and Mechanism of Transcription in Prokaryotes

CHAPTER 11:Genetic Code and Translation (Protein synthesis)

8L

- 11.1. Definition, Concept and Properties of Genetic code
- 11.2. Work of Nirenberg
- 11.3. Definition of Translation
- 11.4. Mechanism of Translation, Initiation, Elongation and Termination

CHAPTER 12: Gene Regulation in prokaryotes

2L

- 12.1. Operon concept
- 12.2. Inducible and Repressible operon

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1. Cell and Molecular Biology, P. K. Gupta
2. Cell and Molecular Biology, DeRobertis and DeRobertis 7th Edition
3. Cell Biology, C. B. Powar, Himalaya Publishing House
4. Fundamentals of Molecular Biology, Veer BalaRastogi
5. A Text Book of Cell and Molecular Biology, RastogiPublication, Meerut. India, Gupta, P.K. (1999)
6. Molecular Biology of Gene, Watson J. D.
7. Cell Biology, Genetics, Molecular biology, Evolution and Ecology.3rd edition S. Chand &co.New Delhi, India.Verma, P. S., V. K. Agrawal. (2008)

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BOT. 354, PAPER-IV
ADVANCED PLANT PHYSIOLOGY [60 Periods]
SEMESTER-V

AIMS AND OBJECTIVES:

- 1) To learn and understand about mineral nutrition in plants.
- 2) To study the growth and developmental processes in plants.
- 3) To learn about movement in plants.
- 4) To study the process of translocation of solutes in plants
- 5) To Study the nitrogen metabolism and its importance

CHAPTER 1: Mineral Nutrition and Absorption of Minerals **15L**

- 1.1. General role of mineral elements in plants, Micro and Macro elements, essential and non-essential elements.
- 1.2. Specific functions and deficiency symptoms of following elements: Nitrogen, Sulphur, Phosphorous, Potassium, Magnesium, Iron, Boron.
- 1.3. Brief understanding of organic and inorganic fertilizers, hydroponics.
- 1.4. Sites of absorption of mineral ions.
- 1.5. Mechanism of mineral salt absorption.
- 1.6. Theories: Ion exchange theory, carbonic acid exchange, Donnon's equilibrium, cytochrome pump hypothesis and Protein-Lecithin theory (Bennets&Clark Hypothesis)

CHAPTER 2: Plant Growth and Development **15L**

- 2.1. Introduction, Definitions of growth, Development and Differentiation.
- 2.2. Phases of Growth and Growth curve.
- 2.3. Introduction and roles of following phytohormones.
 - a) Auxins
 - b) Gibberellins
 - c) Cytokinins
 - d) Ethylene
 - e) Abscisic Acid.
- 2.4. Factors affecting growth.

CHAPTER 3: Physiology of Flowering **10L**

3.1. Photoperiodism: Discovery, Classification of Plants:- Short Day, Long Day and Day Neutral Plants. Photoperiodic Induction, Inductive cycles, role of phytochrome in photoperiodism

3.2. Vernalization: Discovery, Perception of temperature, Mechanism of Vernalization, hormonal replacement of Vernalization

CHAPTER 4: Translocation of organic Solutes **10L**

4.1. Introduction, conductive tissue, direction of translocation

4.2. Phloem loading and unloading

4.3. Mechanism of phloem conduction: Diffusion hypothesis, Munch hypothesis

CHAPTER 5: Nitrogen Metabolism **10L**

5.1. Introduction

5.2. Ammonification, nitrification, nitrate assimilations and Denitrification

5.3. Types of Nitrogen fixation:

a) Physical nitrogen fixation

b) Biological Nitrogen Fixation: i) Symbiotic and ii) Non-symbiotic Nitrogen fixation

5.4. Nif, nod and Hup genes

5.5. Mechanism of symbiotic nitrogen fixation

5.6. Effect of environmental factors on Nitrogen fixation:

a) Temperature, b) water stress, c) Water logging, d) Salinity

5.7. Importance of nitrogen fixation in agriculture

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2. Daniel, M. (1991) Methods in Plant Chemistry and Economic Botany. Kaiyani Publishers, Ludhiana, India.
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BOT.355, PAPER-V
PLANTECOLOGY AND PHYTOGEOGRAPHY[60 Periods]
SEMESTER-V

AIMS AND OBJECTIVES:

1. To know scope and importance of the discipline.
2. To study plant communities and ecological adaptations in plants
3. To know about conservation of biodiversity, Non-conventional Energy and Pollution.
4. To study botanical regions of India and vegetation types of Maharashtra.
5. To study Bioremediation, Global warming and climate change.

PLANT ECOLOGY (50 Periods)

CHAPTER 1: Plant Ecology **02L**

Definition, concept and scope of ecology, Branches of ecology

CHAPTER 2: Phytosociology **05L**

- 2.1. Introduction, definition
- 2.2. Qualitative characters-Physiognomy, Phenology, Periodicity, Aspect and Stratification.
- 2.3. Sampling techniques of population: I) Quadrat method-: a) List b) List count
- 2.4. Quantitative characters-: a) Frequency b) Density c) Abundance.
- 2.5. Raunkiaer's law of Frequency and Frequency diagram.

CHAPTER 3: Community dynamics **05L**

- 3.1. Succession: Definition, Causes, and, types.
- 3.2. Process of Succession: Xerosere and Hydrosere.
- 3.3. Climax concept: Monoclimax, Polyclimax
- 3.4. Ecological Niche

CHAPTER 4: Ecological adaptations **04L**

Adaptation to water Morphological and anatomical adaptation Hydrophytes and Xerophyte

CHAPTER 5: Ecosystems **06L**

- 5.1. Concept and kind (Natural and Man-made).
- 5.2. Components of natural ecosystem.
- 5.3. Natural-Pond ecosystem and Man-made-crop land ecosystem.
- 5.4. Food Chain, Food webs, and Homeostasis.
- 5.6. Effect of man on natural Ecosystem.

CHAPTER 6: Biodiversity and its conservation **06L**

- 6.1. Definition and importance
 - 6.2. Types of Biodiversity- Genetic, Species, Ecosystem
 - 6.3. Indian Hot Spots of Biodiversity- Eastern Himalayas and Western Ghat
 - 6.4. Conservation of Biodiversity-In-situ and Ex-situ
- In-situ Conservation-** Biosphere Reserve, National Park, wildlife Sanctuaries.
Ex-situ conservation- Botanical Garden/ Herbal Garden, Seed (Germ plasm) banks, Pollen Bank

CHAPTER 7: Energy Conservation **07L**

- 7.1. Sources of energy: Conventional and Non-conventional energy
- 7.2. Non-conventional sources of energy: a) solar energy b) wind energy
c) Tidal Energy d) Biomass based energy
- 7.3. Prospective alternatives for energy: a) Petro Plants, b) Biogas.

CHAPTER 8: Pollution **07L**

- 8.1. Air Pollution-Sources, types, Effect of air pollution on plants, effect of air pollutant on Humans.
- 8.2. Water Pollution-Causes, Effect, control measures
- 8.3. Global Warming and Climate change- Greenhouse effect, Ozone depletion, EL NINO and LA NINA
- 8.4 International efforts to tackle climate change

CHAPTER 9: Biogeochemical cycles **04L**

- 9.1. Elements and their
- 9.2. The cycling process
- 9.3. Biogeochemical cycles:

Types: a) Gaseous nutrient cycles-Carbon, Oxygen and Nitrogen cycle.

b) Sedimentary nutrient cycle.

CHAPTER 10: Bioremediation **04L**

10.1. Introduction need and scope of bioremediation

10.2. Phytoremediation- a) Recovery of heavy metals from soil.

b) Reclamation of industrial waste and municipal waste water.

PHYTOGEOGRAPHY (10 Periods)

CHAPTER11: Phytogeography **04L**

11.1. Main Botanical Regions of India.

11.2. Detailed study of vegetation types in Maharashtra.

CHAPTER12: Ecological Indicator **03L**

12.1. Introduction

12.2. Plant as indicators:-soil pH, ground water, minerals, metals and pollution

CHAPTER13:Endemism :Causes and Types **02L**

CHAPTER 14:Biogeography- Dispersal: Barriers and means of dispersal**01L**

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21. Swaminathan, M. S. And Kocchar, S. L.(Eds.)(1989).Plant and Society. Macmillan Publications Ltd. London, U.K.
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BOT. 356.1, PAPER-VI[OPTIONAL PEPR-I]

PLANT BIOTECHNOLOGY [60 periods]

SEMESTER-V

AIMS AND OBJECTIVES:

1. To introduce the students with current status and future of biotechnology in India.
2. To acquaint with advance knowledge of different instruments related to biotechnology.
3. To acquaint with the importance of interdisciplinary approaches of Biotechnology.
4. To recognize the impact of biotechnology on socioeconomic aspects of life.
5. To develop the knowledge of industrial application of biotechnology.
6. To develop the skills among the students for employment or entrepreneurship.

CHAPTER 1: Biotechnology

02L

- 1.1 .Origin of biotechnology,
- 1.2 .History,
- 1.3 .Definition and Scope.

CHAPTER 2: Laboratory organization

03L

- 2.1. Planning and personal safety.
- 2.2 .Laboratory requirements

CHAPTER 3: Isolation and cultivation of economically important microbes 03L

- 3.1 .Purification of single cell protein (*Scenedesmus*, *Spirulina*),

CHAPTER 4: Production of primary and secondary metabolites by microbes 04L

- 4.1 .Bio fertilizers.
- 4.2 .Biodiesel biotechnology(cultivation and biodiesel Extraction methods from *Jatropha*)

CHAPTER 5: Plant genome organization

06L

- 5.1 .Chloroplast genome
- 5.2 .Agrobacterium ,
- 5.3 .Edible vaccines,
- 5.4 .Transgenic plants, BT - cotton,
- 5.5 .Bioethics.

CHAPTER 6: Plant Cell and Tissue Culture **05L**

- 6.1. History of plant tissue culture research
- 6.2. Basic principles of plant tissue culture
- 6.3. Callus culture, Meristem culture, Organ culture,
- 6.4. Totipotency of cells, differentiation, dedifferentiation and redifferentiation.

CHAPTER 7: Methodology **06L**

- 7.1 .Sterilization (physical and chemical methods),
- 7.2 .Plant cell culture methods,
- 7.3 .Culture media, media composition,
- 7.4 .MS media preparation, Phytohormones,
- 7.5 .Medium for micro-propagation,
- 7.6 .Callus induction.
- 7.7 .Callus subculture maintenance,
- 7.8 .Morphogenesis in callus.

CHAPTER 8: Endosperm culture **02L**

- 8.1 .Media requirements,
- 8.2 .Morphogenetic potential
- 8.3 .Application

CHAPTER 9: Organ culture **04L**

- 9.1 .Shoot tip culture,
- 9.2 .Apical Meristem culture,
- 9.3 .Embryo culture:- culture requirements, applications embryo rescue technique
- 9.4 .Ovary culture,
- 9.5 .Pollen culture.

CHAPTER 10: Synthetic seeds **03L**

- 10.1 .History of the development of synthetic seeds
- 10.2 .Limitation of synthetic seeds,
- 10.3 .Production of synthetic seeds,
- 10.4 .Artificial seeds,
- 10.5 .Uses of artificial seeds (Commercial production and uses)

CHAPTER 11:Tissue culture and crop improvement	04L
11.1 .History of transgenic plants,	
11.2 .Agrobacterium mediated gene transfer technology	
11.3 .Agrobacterium tumifaciens genetic aspects	
11.4 .Ti plasmid.	
CHAPTER 12: Genetic engineering	04L
12.1 .Introduction and purpose,	
12.2 .Vectors (cloning and insertion vector).	
12.3 .Restriction enzymes- types and action	
CHAPTER 13:Transformation in plants	05L
13.1 .Vector-mediated or indirect gene transfer	
13.2 .Vector-less or direct gene transfer	
13.3 .Chemical mediated gene transfer	
13.4 .Microinjection	
13.5 .Electroporation	
13.6 .Particle bombardment	
CHAPTER 14: Blotting techniques	03L
14.1 .Southern blotting	
14.2 .Northern blotting	
14.3 .Western blotting	
CHAPTER 15: Protoplast culture	06L
15.1 .Protoplast isolation and purification and culture,	
15.2 .Media (F5 - medium Frearson et al 1973 Nagata and Takeba 1971, Modified B5 medium),	
15.3 .Methods of isolation (enzymatic isolation),	
15.4 .Isolation from leaves, shoot and root apex, Pollen grain etc.	
15.5 .Protoplast fusion.	

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BOT. 356.2, PAPER-V,[OPTIONAL PAPER-II]

ETHNOBOTANY [60 Periods]

SEMESTER-V

AIMS AND OBJECTIVES:

1. To know scope and importance of Ethnobotany; and its relation to economic Botany.
2. To expose various disciplines of ethnobotany and its development in Indian concept.
3. To study sources of ethnobotany.
4. To aware the students about ethnology of certain tribes in Maharashtra.
5. To study Indian ethno medicines used against human and veterinary diseases.
6. To study role of ethnobotany emphasizing conservation, abstract concrete relationship in Indian concept.

CHAPTER 1: Ethnobotany: An Organized Science **06L**

- 1.1. Introduction, definition and scope.
- 1.2. Man and Plant relationship: Concrete and Abstract.
- 1.3. Comparison of Ethnobotany and Economic Botany.
- 1.4. Landmarks of Indian Ethnobotany.
- 1.5. Sub-disciplines of Ethnobotany.

CHAPTER 2: Methods in Ethnobotanical Studies **04L**

- 2.1. Ethnobotanical field work.
- 2.2. Herbaria as an aid to ethnobotanical study.
- 2.3. Ethnobotanical study with the help of literature.
- 2.4. Archeological remains.

CHAPTER 3: Ethnology of Tribes in North Maharashtra **04L**

1. Pawara 2. Bhil 3. Kokani 4. Thakur 5. Banjaras 6. Gadia Lohar

CHAPTER 4: Ethnobotany of some plants W.R.T. BN, Taxonomic description, Distribution, Phytochemistry and Uses of – **06L**

1. *Adhatodazeylanica*
2. *Aeglemarmelos*
3. *Azadirachtaindica*
4. *Buteamonosperma*
5. *Daturametel*
6. *Madhucaindica*

CHAPTER 5: Study of Ethnobotany of plants from Indian region used against-08L

Human Diseases: w.r.t. Botanical Name of plants, family, parts used, mode of preparation and administration of medicine, for followings.

- a) Cough, Cold, Bronchial problems.
- b) Headache, Toothache.
- c) Arthritis and Rheumatism.
- d) Fever.
- e) Stomach problems: Indigestion, Worms, Diarrhoea, and Dysentery.
- f) Diabetes.
- g) Antivenom.

CHAPTER 6: Veterinary Diseases

06L

- 6.1. Diarrhoea and Dysentery.
- 6.2. Foot and Mouth disease.
- 6.4. Yoke galls.
- 6.5. Bone fracture.

CHAPTER 7: Ethnobotany of North Maharashtra: w.r.t. Botanical Sources and administration

04L

- 7.1. Ethnobotany of food plants and beverages.
- 7.2. Plants used as Toothbrush.
- 7.3. Fish stupefying.
- 7.4. Ethnology of vernacular names.
- 7.5. Fodder resources.

CHAPTER 8: Cosmetics, Decoration and Adornment used by Tribals **04L**

- 8.1. Introduction.
- 8.2. Floral Adornment.
- 8.3. Dyes, Perfume, Hair care, Tattooing.
- 8.4. Ornaments, wall painting, Decoration.

CHAPTER 9: Tribal Intoxicants and Masticatores **04L**

- 9.1. Liquor technique.
- 9.2. Plant materials used with raw materials – Opium, Bhang, *Nicotiana*.
- 9.3. Certain significant masticatories of Tribals areas.

CHAPTER 10: Abstract Relationship: w.r.t. plant/parts used, family, people/tribe concerned with themes and quotations of the following: **04L**

- a. Folksongs.
- b. Folk proverbs.
- c. Plants motifs.
- d. Sacred plants.

CHAPTER 11: Plants and parts used for following purposes **05L**

- 11.1. House construction: a) Doors and Windows b) Walls c) Roofs d) Furniture.
- 11.2. Musical instruments.
- 11.3. Agricultural implements.
- 11.4. Fencing.
- 11.5. Fibers.

CHAPTER 12: Beyond inventorying **05L**

- 12.1. Importance of Inventorying.
- 12.2. Indigenous Biotechnology:
- 12.3. Ranu tablet.
- 12.4. Jaggery extraction.
- 12.5. Socio-ethnobotany.
- 12.6. Kitchen gardens.

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**BOT 356.3, PAPER VI [OPTIONAL PAPER- III]
GARDENING [60 Periods]
SEMESTER-V**

AIMS AND OBJECTIVES

1. To know the concept of garden.
2. To study the special types of gardens.
3. To study the different features of garden.
4. To study the different ornamental garden plants.
5. To study about the techniques of pot-culture, Bonsai, Topiary, Lawn.

CHAPTER 1: Introduction

08L

- 1.1. Definition of garden and gardening.
- 1.2. Importance of garden.
- 1.3. Special types of gardens-
 - i) Rock garden.
 - ii) Water garden.
 - iii) Bog/ Marsh garden.
 - iv) Roof garden.
 - v) Vertical garden.
 - vi) Terrace garden.
 - vii) Temple garden.

CHAPTER 2: Planning of Gardens

07L

- 2.1. Consideration of following in planning-
Originality in planning, color scheme, fragrance, privacy
- 2.2. Study of physical, structural and biological features of the gardens such as-
 - a) Fences
 - b) Hedges
 - c) Borders
 - d) Paths
 - e) Avenues
 - f) Arches
 - g) Pergolas
 - h) Green house

CHAPTER 3: Soil Management

05L

- 3.1. Soil: Nature & Types.
- 3.2. Manures.
- 3.3. Fertilizers.
- 3.4. Agrochemicals- Insecticides, Pesticides & Fungicides.
- 3.5. Irrigation techniques.

CHAPTER 4: Garden Tools and Implements

05L

- 4.1. Sickle, Trowel, Rake, Hoe, Secateurs, Pruning shears, Grafting and Budding knife.
- 4.2. Use & maintenance of following-
 - a) Mower
 - b) Sprayer

CHAPTER 5: Study of Ornamental Plants

10L

- 5.1. With reference to botanical name, cultivation practices, ornamental value and place of choice with at least 2 examples each of:-
 - a) Annuals
 - b) Shrubs
 - c) Climbers
 - d) Special group of ornamental plants –
 - i) Palms ii) Ferns iii) Bamboos iv) Cycads v) Ornamental grasses

CHAPTER 6: Indoor Gardening

05L

- 6.1. Definition of Indoor gardening.
- 6.2. Characters of Indoor plants.
- 6.3. Containers.
- 6.4. Environmental factors.
- 6.5. Selection of indoor plants.
- 6.6. Potting media.
- 6.7. Watering tips.
- 6.8. Maintenance of indoor plants.
- 6.9. Hanging basket.

CHAPTER 7: Pot Culture **05L**

- 7.1. Definition of pot culture.
- 7.2. Importance of pot culture.
- 7.3. Potting compost.
- 7.4. Potting.
- 7.5. Watering.
- 7.6. Staking & tying.
- 7.7. Feeding.
- 7.8. Root pruning.
- 7.9. Maintenance.

CHAPTER 8: Bonsai Technique **05L**

Principle, Containers, Selection of plants, Techniques, Styles and Maintenance.

CHAPTER 9: Topiary **05L**

- 9.1. Introduction.
- 9.2. Selection of plants.
- 9.3. Methods/training.
- 9.4. Importance.

CHAPTER 10: Lawns **05L**

- 10.1. Preparation of soil.
- 10.2. Selection of grasses.
- 10.3. Planting methods.
- 10.4. Maintenance and after care.
- 10.5. Importance.

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BOT. 356.4, PAPER -VI (OPTIONAL PAPER - IV)
SEED TECHNOLOGY AND SEED PATHOLOGY [60 Periods]
SEMESTER-V

AIMS AND OBJECTIVES:

1. To know scope and importance of the discipline.
2. To study various techniques in seed production.
3. To study various factors related to seed production.
4. To study seed protection aspects.
5. To study commercial aspects of seed production.

SEED TECHNOLOGY (Periods: 40)

CHAPTER 1: Seed:	03L
1.1. Definition	
1.2. Development of seed	
1.3. Functions of seed parts	
CHAPTER 2: Seed Technology:	02L
2.1. Definition	
2.2. Role and goals of seed technology in crop production	
CHAPTER 3: Seed Dormancy	04L
3.1. Causes of seed dormancy.	
3.2. Methods of breaking the seed dormancy.	
CHAPTER 4: Principles of Quality Seed Production:	05L
4.1 .Stage of Seed Multiplication.	
4.2. Seed purity, Genetic purity.	
CHAPTER 5: Methods of certified seed production	03L
5.1 .Isolation	
5.2 .Seed inspection	
5.3 .Roguing	
CHAPTER 6: Types of cultivars (variety)	05L

- 6.1. Composite
- 6.2. Synthetic
- 6.3. Hybrid
- 6.4. Role of producer
- 6.5. Seed production agencies.

CHAPTER 7: Harvesting **02L**

- 7.1. Drying
- 7.2. Processing
- 7.3. Seed sampling,

CHAPTER 8: Seed testing **07L**

- 8.1. Physical purity
- 8.2 .Genetic purity
- 8.3 .Seed viability and vigour
- 8.4 .Seed Law and Seed Certification.
- 8.5 .Seed certification agency – Structure, role and duties.

CHAPTER 9: Seed Deterioration: **04L**

- 9.1. Causes and remedial measures.
- 9.2. Seed storage, pest and diseases of seed, seed aging.

CHAPTER 10. Seed Marketing agencies **05L**

- 10.1. Planning and economics of seed production.
- 10.2. Seed processing & packing.

SEED PATHOLOGY (Periods 20)

CHAPTER 11: SEED PATHOLOGY: **08L**

- 11.1. Introduction
- 11.2 . Significance of seed
- 11.3. Types of micro- organism associated with seeds and diseases caused by them.

CHAPTER 12: Location of seed borne inoculum and seed infection: 12L

- 12.1 .Factors affecting the seed infection.
- 12.2 .Longevity of seed borne diseases.
- 12.3.Control of seed borne pathogens.
- 12.4 .Quarantine and post – entry quarantine.

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REFERENCE BOOKS

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2. **L. O. Copeland, M. B. Mc Donald. (2001).** Kluwer Academic Publications, 2nd Printing (2004)(Now part of springer science & business media.)
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PRACTICAL COURSES

PRACTICAL PAPER I-BOT. 357: (Based on Paper I & III)

i.e. BOT. 351 and BOT. 353.

Practical Based on BOT.-351, CRYPTOGAMS

- Practical 1** - Study of range of thallus structure in algae with the help of materials or Permanent slides (any one from the examples):
- Unicellular thallus-*Chlamydomonas, Chlorella*.
 - Colonial thallus –*Pandorina, Eudorina, Volvox, Hydrodictyon*
 - Filamentous thallus - *Pithophora, Chaetophora, Coleochaetae, Stigeoclonium, Drapanaldia, Fritscheilla and Oedogonium*.
 - Siphonaceous thallus -*Vaucheria, Caulerpa*
 - Pseudoparenchymatous (Uniaxial/Multiaxial) thallus –
Batrachospermum, Polysiphonia.
 - Parenchymatous thallus -*Ulva, Enteromorpha*

Practical 2- Study of life cycle of Chara

Practical 3- Study of life cycle of *Uncinula*

Practical 4- Study of life cycle of *Marchantia*

Practical 5- Study of life cycle of *Marselia*

Practical 6- Study of types of stele in Pteridophytes (P. S.)

NOTE: Study tour is compulsory. Students are expected to submit two forms of Algae and Fungi each. Photographs of any two forms of Bryophytes and Pteridophytes along with tour report.

Practical Based on BOT. 353, GENETICS AND MOLECULAR BIOLOGY

Practical 1. Preparation of fixative and stains (Acetocarmine or suitable cytological stain)

Practical 2. Study of Mitosis techniques (Root tip of onion or any suitable material)

Practical 3. Study of Meiosis techniques (PS)

Practical 4. Study of polytene chromosome from Chironomus larvae

Practical 5. Isolation of DNA from any plant material (e.g. Cauliflower, Banana etc.) or any suitable plant material

Practical 6. Mitochondrial staining by Janus green stain.

NOTE: Submission of temporary slide of mitotic stages (at least 4 slides)

PRACTICAL PAPER II- BOT.358 (Based on paper II and VI)

i.e. BOT.352 and BOT. 356 (1, 2, 3,4).

Practical Based on BOT.352-ANGIOSPERM TAXONOMY

Practical 1-5. Study of any ten plant families representing **different groups** of angiosperms w.r.t systematic position, morphological characters (vegetative and floral), floral formula and floral diagram (*sensu* Bentham and Hooker system).

Practical 6. Identification of genera and species by using local, regional, state and national flora.

NOTE :

- i) Excursion tour to be organized
- ii) Submission of herbarium sheets of any five wild plants and tour report are compulsory at the time of examination.
- iii) Not to disturb any rare, endangered, endemic and medicinal plants.

Practicals based on BOT.356.1 PLANT BIOTECHNOLOGY

Practical1. Principle working and uses of laminar air flow hood, autoclave, hot air oven, electrophoresis and centrifuge.

Practical2. Sterilization of glassware and instruments steam sterilization and dry sterilization.

Practical3. MS media preparation.

Practical4. Selection and surface sterilization of explant and Inoculation of explant on media for Callus culture.

Practical5. Micropropagation of explant.

Practical6. Encapsulation of embryo in sodium alginate for preparation of synthetic seed.

NOTE: - Visit to any one plant-biotechnology related industry.

Practicals based on BOT.356.2- ETHANOBOTANY

Practical 1 & 2. Ethnobotany of some plants W.R.T. BN, Taxonomic description, Distribution, Phytochemistry and Uses of –

1. *Adhatodazeylanica*

2. *Aeglemarmelos*

3. *Azadirachtaindica*

4. *Buteamonosperma*

5. *Daturametel*

6. *Madhucaindica*

Practical3& 4. Ethnobotany of some plants used by Tribals as Cosmetics, Decoration and Adornment w.r.t. vernacular names, botanical names, family, plant parts used, and uses, Dyes, Perfume, Hair care, Tattooing, Ornaments, wall painting, Decoration.

Practical5 & 6. Study of the following plants with reference to their vernacular names, botanical names, family, plant parts used, uses, mode of preparation and administration from local area with the help of plants or their parts or specimens.

A) Food Plants: Tubers: *Dioscoreabulbifera*(KaduKand)

B) Beverages: Flowers: *Madhucalongifoia*(Mahu)

C) Oil yielding: Seeds: *Madhucalongifoia*(Mahu, Tolambi)

D) Fiber yielding: Stem: *Helicterisisora*(Murud Sheng)

E)Bidi Wrapper: Leaves: **a)***Diospyrosmelanoxylon*(Tendu) **b)***Bauhinia malabaricum*(Kustya)

F) Tooth Brush Stem: **a)***Pongamia pinnata*(Karanj) **b)***Cassia auriculata*(Avali)

c)*Acacia nilotica* (Babul) **d)***Azadirachta indica*(Neem)

Practicals based on BOT.356.3- GARDENING

Practical 1.Techniques of pot-culture.

Practical 2.Observation, listing and uses of various garden tools (Any Five).

Practical 3.Study of different indoor plants (Any Five).

Practical 4.Study of ornamental plants such as

a) Annual b) Shrub c) Climber d) Palm e) Cycad

f) Fern g) Ornamental grass h) Bamboo

w.r.t. Botanical name, ornamental value and place of choice (Only one example of each).

Practical 5.Preparation of hanging basket.

Practical6.Visit to suitable garden to study various salient features such as:

Layout, components, list of plants and special features (if any).

NOTE: Students should submit the following at the time of examination

a) Report of visit to garden

b) Well maintained specimens from the following

- i) Potted indoor plant
- ii) Hanging basket

Practical based on BOT. 356.4 -SEED TECHNOLOGY AND SEED PATHOLOGY

Practical1. Physical purity test

Practical2. Germination test (Maize & Ground nut)

Practical 3. Seed moisture test.

Practical4. Seed viability test. (Tetrazolium test & ferric chloride for legume seeds)

Practical5. Detection of seed microflora.

Practical6. Seed processing, grading, packing.

NOTE: Students should submit at least five diseased specimens along with the report of the field trip at the time of practical examination.

Practical Paper III- BOT. 359: (Based on Paper IV & V)

i.e. BOT. 354 and BOT. 355.

Practical's Based on BOT. 354-Advanced Plant Physiology

Practical1&2. Qualitative assessment of microelements in plant ash (P, K, Mg, Mn, Ca, Na,)

Practical3&4. Separation of amino acids from germinating seeds by ascending paper Chromatography.

Practical5. Effect of hormone on germinating seeds.

Practical6. Demonstration of exudation from Phloem tissue.

Practical's Based on BOT. 355- PLANT ECOLOGY AND PHYTOGEOGRAPHY

Practical1. To determine the minimum size of the quadrat by 'species area curve method'.

Practical2. To study the vegetation by list count quadrat method. Calculate frequency density, abundance and plot a graph. of frequency classes.

Practical3. Study of soil with reference to soil texture, water holding capacity, pH, and test for carbonate, nitrate, and sulphate.

Practical4. Demonstration, working and uses of any three of the following ecological instruments: i) Rain gauge ii) Cup anemometer iii) Hair hygrometer iv) Soil thermometer v) Minimum and maximum thermometer vi) Dry and wet bulb thermometer

Practical5. Study of morphological and anatomical adaptation in locally available hydrophyte and Xerophyte (any two of each)

Practical6. Measurement of water quality based on –hardness, Dissolved oxygen, free CO₂, Chloride, Total alkalinity.

**NORTH MAHARASHTRA UNIVERSITY,
JALGAON**



FACULTY OF SCIENCE

SYLLABUS FOR

T.Y.B.Sc. IN

BOTANY

SEM-VI

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

NORTH MAHARASHTRA UNIVERSITY, JALGAON
CLASS-T.Y.B.Sc.
SUBJECT- BOTANY
PROPOSED OUT LINE OF SYLLABUS W.E.F. JUNE-2017

SEMESTER-VI

- BOT. 361 Paper I : Gymnosperms & Paleobotany**
BOT. 362 Paper II : Anatomy & Embryology
BOT. 363 Paper III : Genetics, Plant Breeding and Evolution
BOT. 364 Paper IV : Plant Biochemistry
BOT. 365 Paper V : Applied Botany
BOT. 366 Paper VI: OPTIONAL (Only One)
BOT. 366.1 : Botanical Techniques
BOT. 366.2 : Medico-botany and Pharmacognosy
BOT. 366.3 : Horticulture
BOT. 366.4 : Plant Protection

PRACTICAL COURSES

- BOT. 367 Practical Paper I: BOT-361, BOT-363. BOT.**
(Based on Paper I & III)
BOT. 368 Practical Paper II: BOT-362 and BOT-366.1/ BOT-366.2/ BOT-366.3/ BOT-366.4
(Based on Paper II & VI)
BOT. 369 Practical Paper III: BOT-364 and BOT.365
(Based on Paper IV & V)

NORTH MAHARSHTRA UNIVERSITY, JALGAON

SEMESTER - VI

Syllabus for T.Y.B.Sc. Botany

BOT. 361: PAPER I

GYMNOSPERMS & PALEOBOTANY

(Total Periods: 60)

AIMS & OBJECTIVES:

1. To study Gymnosperms with respect to distinguishing characters, comparison with Angiosperms, economic importance and classification.
2. To study the life cycles of *Pinus* and *Gnetum*.
3. To study the scope of Paleobotany, types of fossils and geological time scale.
4. To study the various fossil genera representing different fossil groups

GYMNOSPERMS

(Periods: 35)

Chapter 1. General topics

07

1.1 Introduction

1.2 Distinguishing features of the group

1.3 Comparison of Gymnospermic features with Angiosperms

1.4 Economic importance of Gymnosperms

1.5 Classification of Gymnosperms by K. R. Sporne up to orders giving reasons

Chapter 2. Life cycle of *Pinus* with respect to:

14

2.1 Distribution in India

2.2 Systematic position

2.3 External morphology

2.4 Internal morphology

a) Primary structure of root, stem and leaf

b) Secondary structure of stem

2.5 Reproductive structures (development of male and female gametophyte is not expected)

a) Male cone

- b) Male gametophyte
- c) Female cone
- d) Female gametophyte

2.6 Pollination

2.7 Fertilization

2.8 Structure of embryo and polyembryony

9. Seed: structure and germination

10. Alternation of generations

Chapter 3. Life cycle of *Gnetum* with respect to:

14

3.1. Distribution in India

3.2 Systematic position

3.3 External morphology

3.4 Internal morphology

a) Primary structure of root, stem and leaf

b) Anomalous Secondary growth in *Gnetum ula*

3.5 Reproductive structure (development of male and female gametophyte is not expected)

a) Male cone

b) Male gametophyte

c) Female cone

d) Female gametophyte

3.6 Pollination

3.7 Fertilization.

3.8 Structure of embryo and polyembryony

3.9 Seed structure and germination

3.10 Alternation of generations.

3.11 Resemblance with Angiosperms.

PALEOBOTANY

(Periods 25)

Chapter 4. General topics

03

4.1 Introduction

4.2 Definition and scope of Paleobotany.

4.3 Contribution of Prof. Birbal Sahni in paleobotany

Chapter 5. Fossils:

10

5.1 Definition

5.2 Fossilization process ,conditions favourable for fossilization

5.3 Geological time scale. - Eras, Periods, Epochs and major plant groups

5.4 Types of fossils: Impression, Compression, Petrification, Cast, Coal ball, Amber

5.5 Concept of form genus, fossil nomenclature

5.6 Major fossil plant groups located in India.

Chapter 6. Study of the following fossil groups with respect to morphology and structure:

12

1. Psilopsida: *Rhynia*

2. Lycopside: i) *Lepidodendron* (Stem) ii) *Lepidostrobus*

3. Sphenopsida: i) *Calamites* (Stem) ii) *Annularia* (Leaf)

4. Pteridopsperms: *Lyginopteris oldhamia* (Stem)

5. Bennettitales: *Cycadeoidea* (Flower)

6. Angiosperms: i) *Sahnipushpam* .ii) *Enigmocarpon*

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PALEOBOTANY:

1. Delevoryas T. (1962) Morphology & Evolution of fossil plants, Holt Reinhart & Winston, New York.
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3. Stewart Wilson. N. (1983). Paleobotany and evolution of plants, Cambridge University Press.
4. Arnold, Chester, R (1972). An introduction to paleobotany McGraw-Hill Publ. Co. Ltd., New York.
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8. S. V. Meyen, Chapman and Hall, Fundamentals of Paleobotany Cambridge University Press, Cambridge, London, U.K.
9. Norman F. Hughes 1976 Paleobotany of Angiosperms origin, Cambridge University Press, Cambridge, London, U.K.

SEMESTER-VI
BOT. 362: Paper-II
ANATOMY AND EMBRYOLOGY (60 Periods)

AIMS & OBJECTIVES:

1. To know scope & importance of Anatomy and Embryology
2. To study various tissue systems.
3. To study normal and anomalous secondary growth in plants and their causes.
4. To give exposure to techniques in anatomy
5. To study structure and development in microsporangium and megasporangium
6. To study microsporogenesis and megasporogenesis
7. To study male and female gametophytes
8. To study fertilization, endosperm and embryogeny

ANATOMY

Chapter 1. Introduction **02L**

- 1.1. Definition
- 1.2. Scope and importance of anatomy

Chapter 2. The Tissue **08L**

- 2.1. Definition
- 2.2. Meristem or Meristematic tissue
- 2.3. Permanent Tissue:
 - a) Simple tissue: Parenchyma, Collenchyma, Sclerenchyma: Fibers, Sclerids or Stone Cells
 - b) Complex tissue:
 - i) Xylem: Tracheids, Vessels, Xylem Parenchyma and Xylem Sclerenchyma
 - ii) Phloem: Sieve elements, Companion cell, Phloem parenchyma and Phloem sclerenchyma
- 2.4 Types of vascular bundles- Radial, Conjoint collateral and Concentric (Subtypes)

Chapter 3. Tissue systems in plants **08L**

3.1. Epidermal Tissue System:

- a) Definition, structure and functions
- b) Cutinization, cuticularisation, lignification, suberisation, silicification
- c) Structure and types of Stomata: Ranunculaceous, Cruciferous, Caryophyllaceous, Rubiaceus and Gramineous
- d) Epidermal outgrowths or Trichomes: Unicellular, Multicellular, Stellate, Peltate scales

3.2. Mechanical Tissue System:

Principles involved in inflexibility, incompressibility, inextensibility and shearing stress

3.3. Secretory tissue system:

- a) Gland-Digestive gland
- b) Nectaries
- c) Resin ducts
- d) Oil ducts
- e) Laticiferous ducts
- f) Hydathodes

Chapter 4. Normal Secondary Growth

05L

4.1. Definition and significance

4.2. Process in stem: Annual and Perennial

4.3. Development and structure of Periderm and Bark, Tyloses, Growth rings, Lenticels

Chapter 5. Anomalous Secondary Growth

06L

5.1. Definition

5.2. Causes of variations: Unusual origin of the cambium, Unusual behavior of the cambium

5.3. Study of adaptive secondary growth in stem: *Salvadora*, *Bignonia*

Root: *Raphanus sativus* (Radish), *Beta vulgaris* (Beet)

5.4. Study of non-adaptive secondary growth in stem of *Boerhavia diffusa*

Chapter 6. Techniques in Anatomy

04L

6.1. Sectioning and Techniques of staining:

- a) Temporary Staining
- b) Permanent double stained procedure

6.2. Maceration: (Jeffery's method) Procedure, chemical used and significance

EMBRYOLOGY

Chapter 7. Introduction 02L

7.1. Definition

7.2. Scope and importance of embryology

Chapter 8. Microsporangium 04L

8.1. Structure of tetrasporangiate anther:

a) The Anther Wall: Epidermis, Endothecium, Middle layers and Tapetum

b) Types of tapetum: i) Amoeboid or Plasmodial, ii) Secretory or Glandular iii)

Functions of

Tapetum

c) Sporogenous tissue

Chapter 9. Microsporogenesis and Development of Male Gametophyte 04L

9.1. Microsporogenesis:

a) Meiosis in spore mother cells

b) Cytokinesis : Successive and Simultaneous type

c) Types of pollen tetrad: Linear, Isobilateral, Tetrahedral, Decussate, T-Shaped

9.2. Structure and development of male gametophyte

Chapter 10. Megasporangium (Ovule) 08L

10.1. Definition, Structure and functions of ovule parts

10.2. Types of Ovules: Orthotropous, Anatropous, Amphitropous, Campylotropous, Circinotropous and Hemi-anatropous or Hemitropous

10.3. Megasporogenesis and Development of Female Gametophyte (Embryo Sac):

a) Megasporogenesis

b) Development of female gametophyte (Embryo sac): Structure of typical (8 nucleated) embryo sac

c) Types of embryo sac: Monosporic (*Polygonum*), Bisporic (*Allium*) and Tetrasporic (*Peperomia*)

Chapter 11. Pollination and Fertilization

03L

- 11.1 Pollination and types of pollination- Anemophily, Hydrophily, Zoophily, Entemophily
- 11.2. Entry of Pollen tube into Ovule: i) Porogamy ii) Chalazogamy iii) Mesogamy
- 11.3. Discharge of pollen tube contents in embryo sac, fusion of gametes, syngamy and triple fusion
- 11.4. Significance of double fertilization.

Chapter 12. Endosperm

02L

- 12.1. Definition
- 12.2. Types of endosperm: i) Nuclear, ii) Cellular, and iii) Helobial
- 12.3. Ruminant endosperm
- 12.4. Functions of Endosperm

Chapter 13. Embryo

04L

- 13.1. Definition
- 13.2. Embryo development in dicot- *Capsella bursa-pastoris*
- 13.3. Embryo development in monocot-*Sagittaria*

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2. Chandurkar, P.J. (1971) Plant Anatomy (3rd Ed.), Oxford and IBH Publishing Co. New Delhi and Bombay, India
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5. Esau, K. (1977) Anatomy of Seed Plants, 2nd Ed. John Wiley & Sons. New York.
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T.Y.B.SC.BOTANY SEM- VI
Paper - III BOT : 363
GENETICS, PLANT BREEDING AND EVOLUTION
- GENETICS – (26 Periods)

Aims and Objective

1. To introduce the students with “Science of Heredity”.
2. To study the role of genes in evolution of species.
3. To study linkage, segregation and mutation of genes during evolution.
4. To introduce the student with science of plant breeding
5. To introduce the student with branch of plant breeding for the survival of human being from starvation.
6. To study the techniques of production of new superior crop varieties.
7. To study the evolution in living organisms

CHAPTER-1 - Genetics: Definition, History and Scope **(4 L)**

- 1.1 Genetics and Epigenetics
- 1.2 Heredity and Variation
- 1.3 Sexuality a Source of variation-Sexuality in plants
- 1.4 Historical back-ground of heredity-
 - i) Inheritance of acquired characters,
 - ii) Pangenesis and Epigenesis
 - iii) Germplasm theory
- 1.5 Scope and significance of Genetics.

CHAPTER –2 - Mendelism and Neo-Mendelism **(8 L)**

- 2.1 Mendel’s work- considerations about material
- 2.2 Mendel’s Procedure and laws-
 - i) Law of Dominance
 - ii) Law of purity of gametes
 - iii) Law of independent assortment
- 2.3 Monohybrid and dihybrid cross
- 2.4 Neo-Mendelism-Allelic genetic interaction And Non-allelic genetic interaction
- 2.5 Modified ratios-
 - 1) Lethal gene in Snapdragon (2:1 ratio)
 - 2) Dihybrid ratio in plants-
 - i) 9:7 ratio (Complementary gene)
 - ii) 15:1 ratio (Duplicate cumulative gene)
 - iii) 12:3:1 ratio (Dominant Epistatic gene)

CHAPTER – 3 - Multiple alleles **(4 L)**

- 3.1 Definition characteristics

- 3.2 Detection of number of alleles in a series
- 3.3 Isoalleles and pseudoalleles
- 3.4 Multiple alleles in *Nicotiana* species

CHAPTER – 4 – Linkage and Crossing Over (6 L)

- 4.1 Concept and history of linkage
- 4.2 Coupling and Repulsion hypothesis
- 4.3 Linkage in maize (Hutchinson's test cross)
- 4.4 Definition and process of Crossing Over
- 4.5 Types of Crossing Over- Single and Double Crossing Over
- 4.6 Three point test cross

CHAPTER – 5 – Chromosomal Aberration (4 L)

- 5.1 Duplication and Deficiencies
- 5.2 Translocation and Inversion
- 5.3 Cytology of Translocation and Inversion.

PLANT BREEDING (26 Periods)

CHAPTER – 6– Introduction (2 L)

- 6.1 Definition and Principles
- 6.2 Aims and Objective
- 6.3 Scope and Importance

CHAPTER - 7 – Mode of reproduction in Relation to Breeding Methods (3 L)

- 7.1 Methods of Reproduction- Vegetative, Asexual and Sexual.
- 7.2 Mode of Reproduction – Self Pollination, Cross Pollination and Geitonogamy.

CHAPTER - 8 - Plant Introduction and Acclimatization (3 L)

- 8.1 Plant Introduction – meaning and need,
- 8.2 Acclimatization – definition and purposes.
- 8.3 Procedure of plant introduction, purpose, merits and demerits.

CHAPTER - 9 - Selection (5 L)

- 9.1 Definition and Procedure of the following
- 9.2 Merits and Demerits of the following
 - a) Mass Selection
 - b) Pure line Selection
 - c) Recurrent Selection
 - d) Clonal Selection

CHAPTER – 10 - Hybridization and Methods of Hybridization (10 L)

- 10.1 Definition and Types of Hybridization
- 10.2 Hybridization Procedure
 - a) Selection of Parents
 - b) Selfing of Parents
 - c) Hybridization Technique
 - d) Harvesting hybrid seeds and raising F₁ generation
 - e) Trials, Multiplication and distribution
- 10.3 Hybrid Vigour
- 10.4 Methods
 - i) Pedigree
 - ii) Single cross
 - iii) Back cross

CHAPTER – 11 - Polyploidy (3 L)

- 11.1 Meaning and types
- 11.2 Role of Polyploidy in crop evolution. E.g. Wheat, *Raphano Brassica, Nicotiana*.
- 11.3 Utilization of Allopolyploidy in Plant Breeding.
- 11.4 Utilization of Autopolyploidy in plant Breeding

- EVOLUTION -

CHAPTER – 12 – Introduction to Evolution (5 L)

- 12.1 Meaning of Evolution
- 12.2 Theories of Evolution –
 - i) Lamarkism and Neo-Lamarkism
 - ii) Darwinism and Neo-Darwinism
 - iii) Mutation theory of Hugo de Vries
 - iv) Synthetic theory

CHAPTER- 13- Speciation (3 L)

- 13.1 Species and Races
- 13.2 Concepts of Species
- 13.3 Methods of Speciation – Allopatric, parapatric, sympatric mode of speciation, Chromosomal speciation

BOT- 364 PAPER- IV
PLANT BIOCHEMISTRY [Periods 60]
Semester-VI

AIMS AND OBJECTIVES:

1. To introduce the students with current status of Biochemistry.
2. To recognize the impact of Biochemistry on socioeconomic aspects of life.
3. To develop the knowledge of industrial application of Biochemistry
4. To inculcate the students with the importance of Biomolecules.

Chapter-1. Biochemistry: 04

- 1.1 Definition, Scope and Importance
- 1.2 Hydrogen ion concentration
- 1.3 P_H and Buffers

Chapter-2 – Biomolecules 14

- 2.1 Carbohydrates:** Definition and classification of carbohydrates.
 - a) Mono-, di- and tri- saccharides. Polysaccharides and mucopolysaccharides.
- 2.2 Lipids:** Definition and classification of lipid (simple. Compound and derived)
 - a) Structure, classification and properties of fatty acids
 - b) Essential and non-essential fatty acid
- 2.3 Amino acids, peptides and proteins:** Definition. Classification and properties of amino acids, essential and nonessential amino acids.
 - a) Peptides - Definition of peptide bond, Structure and function of peptides
 - b) Proteins - Classification, physico-chemical properties, structure [primary and secondary]

Chapter-3. Plant Secondary Metabolites: 12

- Definition, characteristics (source, structure, general properties) of:-
- a) Tannins b) Lignin c) Phenolic compounds d) Alkaloids e) Terpenoids
 - f) Flavonoids g) Vitamins h) Phytohormones

Chapter-4: Enzymes: 06

- 4.1 Introduction and Definition
- 4.2 Nomenclature of enzymes
- 4.3 Classification of enzymes, properties.
- 4.4 Enzyme specificity
- 4.5 Mechanism of enzyme action :-
 - a) Lock and Key model
 - b) Induced fit model
- 4.6 Enzyme inhibitors activators
- 4.7 Isozymes and their significance.

Chapter-5 Bio-physicochemical Techniques: 14

- 5.1 Principle and application of:
 - a) ultra-filtration, b) distillation assembly c) Soxhlet apparatus
- 5.2 Spectrophotometer:** Beer's and Lambert's law and its significance.
 - a) Principle and application of spectrophotometer.

5.3 Isotopes in Biochemistry: Radioactivity: principle and application, Application of radioisotopes in biochemistry.

5.4 Electrophoresis: Principle, types and applications

5.5 Centrifugation: Principle and theory of RCF and applications of centrifuges.

Chapter-6. Biosensors:

10

6.1 Concept of biosensors, biochips, biofilms and bio-Surfactants

6.2 Types of biosensors- conventional and microbial.

6.3 Environmental, medical and industrial applications of biosensors

REFERENCE BOOKS:

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12. Holmes and H.Peck Analytical biochemistry-, academic press, New York.
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Semester VI
Bot. 365
Botany Paper – V
Applied Botany

Total lectures- 60

AIMS AND OBJECTIVES:

1. To know importance and scope of botanical science in the industries.
2. To study role of microbial plants in fermentations process.
3. To study the process of cultivation of cash crops.
4. To study some plants which are used as herbal cosmetics.
5. To study technique of plant tissue culture and its application.
6. To study the role plants in forensic science.

Chapter-1: Applied Botany **(02)**

1:1 Introduction, Scope and importance

Chapter-2: Forensic Science **(04)**

2.1 Introduction, Definition, Scope and Importance

2.2 Role of following plants in Forensic Botany

- a) *Cannabis sativa* (Jute)
- b) *Jatropha curcas* (Chandrajyot)
- c) *Argemone mexicana* (Yellow poppy)
- d) *Abrus precatorius* (Gunj)
- e) *Datura metal* (Datura)

Chapter-3: Herbal Cosmetics **(08)**

3:1 Herbal Cosmetics

- i. Introduction and Definition and multiple benefits of medicinal plants
- ii. Types of Herbal cosmetics w.r.t. Botanical source, characteristics, plant part used and uses of the following:
 - A. Skin Care: (i) Korphad (ii) Sandal wood (iii) Turmeric (iv) Cucumber
 - B. Hair Care: (i) Henna (ii) Hibiscus (iii) Amla (iv) Shikekai
 - C. Dental Care: (i) Neem (ii) Babool (iii) Khair (iv) Bakul
- iii. Preparation of Aloe *vera* gel (for skin)

iv. Preparation of jaswand gel (for hair)

3:2 Ayurvedic Medicines

Preparation of following Ayurvedic medicines with respect to Botanical Source, Part used and methods of preparation:

i. Triphala churna

ii. Kumariasav

iii. Arjunarishta (Aristha)

Iv. Rosha and Khas oil

Chapter-4: Cash Crops

(08)

4:1 Cash Crops

i. Banana and Sugarcane: Scientific name, Family, Characteristics and Utility.

ii. Importance and Commercial significance of Cash crops Banana and sugarcane

iii. Introduction and advantages regarding

Cultivation & Processing

iv. Commercial significance

Chapter-5: Fermentation Technology

(10)

5.1 Introduction, Definition and Types: Aerobic and Anaerobic

5.2 Microbes involved in fermentation.

5.3 Industrial production of Vinegar, Citric acid Streptomycin w. r. to

i) Pure culture

ii) Substrate

iii) Sterilization

iv) Fermentation

v) Recovery of end product

Chapter-6: Social forestry**(06)**

- 6.1 Introduction, definition, scope and importance
- 6.2 Social forestry practices- Farm forestry, recreation forestry, extension forestry
- 6.3 Choice of species for social forestry
- 6.4 Tree crop husbandry of any one of the following with reference to :
 - a) Method of propagation b) Planting and after care c) Harvesting & uses.
- 1. Eucalyptus/ Neem / Subabhul
- 6.5 Social forestry: A tool of integrated rural development.

Chapter-7: Plant Tissue Culture**(08)**

- 7:1 Introduction and Definition
- 7:2 Concepts Of plant tissue culture and Totipotency
- 7:3 General steps involved in Plant Tissue Culture
 - i. Murashige and Skoog's (M.S) Medium Composition Preparation
 - ii. Explant
 - iii. Surface sterilization
 - iv. Inoculation
 - v. Incubation
 - vi. Callus formation
 - vii. Subculture
 - viii. Organogenesis and formation of plantlet
 - ix. Hardening
- 7:4 Applications of tissue culture: production of pathogen free plants and somaclonal-Variants, production of stress resistant plants and synthetic seeds

Chapter-8: Post harvest Management of Fruits & Vegetables**(08)**

- 8.1- Introduction, Definition & Importance

8.2- Maturity, harvesting & handling in relation to Shelf life & quality of Fruits, Vegetables & Flowers, Intercultural, earthing up, fertilizer application, irrigation, mulching, stacking.

8.3 Maturity & harvesting indices w.r.t. **Fruits-** Mango, Banana, **Vegetables;** Tomato, Fenugreek
Flowers-Mogara/Jasmine, Tuberose.

8.4 Methods of pre cooling (0(zero) energy chamber), grading, packing, storage & transport of fruits, Vegetables & flowers.

8.5 Methods of hastening & delay in ripening.

Chapter-9: Adulteration in Plant Products

(06)

9:1 Introduction and definition

9:2 Standard characteristics, possible adulterants, detection tests for adulteration and hazardous effects of following:

- a. Cereals: Bajra
- b. Pulses: Chick pea (Gram)
- c. Oils: Groundnut oil
- d. Spices: Black Pepper, Red Pepper and Turmeric.
- e. Beverages: Tea and Coffee

Reference Books

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- 11 M. Sitaram Rao . Social Forestry
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**BOT. 366.1: PAPER- VI (OPTIONAL-I)
BOTANICAL TECHNIQUES [60 Periods]**

AIMS AND OBJECTIVES

1. To study the scope and importance of Botanical techniques.
2. To know about instruments and their utility in subject Botany.
3. To know about measurement of microorganisms by studying micrometry.
4. To study the different stains and staining.
5. To study the killing, fixing and Microtomy of plant material.
6. To study Chromatography and cultural techniques in Botany.
7. To understand the methods used in whole mount preparation, wood maceration and cytology.

Chapter 1. Introduction, Scope and importance of botanical techniques: **02**

Chapter 2. Microscope: **06**

Introduction, Principle and working of Dissecting microscope, Light microscope, Phase contrast microscope, Electron microscope

Chapter 3. Stains and staining: **07**

- 2.1. Theory of Staining
- 2.2. Type and procedure of staining for following
 - (a) Bacterial
 - (b) Fungal
 - (c) Cytological
 - (d) Anatomical
- 2.3. Temporary and permanent double stained preparation of free hand sections.

Chapter 4. Study of Different Instruments: **08**

- 3.1. Study of Rotary Microtome
- 3.2. Camera lucida- Mirror, Presmatic
- 3.3. Laminar air flow
- 3.4. Autoclave
- 3.5. Oven
- 3.6. Incubator

Chapter 5 Microtomy:	07
(A) Killing and Fixing of Material.	
a) Collection of material	
b) Types of Fixatives	
c) Techniques of fixing	
(B) Technique	
a) Washing	b) Dehydration
c) Cleaning	d) Infiltration
e) Embedding	f) Sectioning
g) Mounting of ribbon	h) Staining
Chapter 6. Micrometry:	06
5.1 Introduction	
5.2 Stage micrometer	
5.3 Ocular micrometer	
5.4 Calibration of microscope- under low power High power and Oil emulsion	
5.5 Measurements	
Chapter 7. Culture Techniques:	09
6.1 Concept of mixed and pure culture	
6.2 Glassware - Types	
6.3 Sterilization Methods for glassware and media	
6.4 Nutritional requirements for various organisms	
6.5 Common media used for cultivation of Algae, Fungi and Bacteria	
a) Allen and Arnoni medium for algae	
b) PDA medium for Fungi	
c) Nutrient Agar, MacConkeys Agar medium for Bacteria	
6.6 Source of inoculums for algae, Fungi, Bacteria	
6.7 Enrichment and isolation method	
a) Streak plate method	
b) Pour plate / dilution method	
c) Slide culture	
Chapter 8. Whole mount, Cytological method and wood maceration:	05
7.1. Permanent whole mount museum specimens	
7.2. Cytological methods:	
a) Smear	
b) Squash	
c) Making of smear and squash permanent	

7.3. Wood maceration techniques

Chapter 9. Chromatography : **05**

8.1 Introduction – Definition and principle of chromatography

8.2 Types(Any Two)

a) Paper chromatography -Unidirectional - Ascending and descending

b) Two dimensional

c) Thin layer chromatography -Plate and column

8.3 Procedure for preparation of paper chromatogram and thin layer chromatogram

8.4 RF Value

Chapter 10. Spectrophotometry: **02**

9.1. Introduction

9.2. Principle and Working of spectrophotometer

9.3. Application of spectrophotometer

Chapter 11. General principles of Biophysical Chemistry Instruments **03**

10.1 pH Meter

10.2 Centrifuge

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BOTANICAL TECHNIQUES:

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2. Dwivedi, J.N. and R.B. Singh (1990). Essentials of Plant Techniques ,Scientific Publishers, Jodhpur, India
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13. Verma P. S. and Agrawal V.K. 2006, "Cell Biology", Genetics, Molecular Biology, Evolution and Ecology S. Chand and Company New Delhi.

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Semester VI

BOT. 366.2 PAPER-VI (OPTIONAL- II)

Medico-Botany and Pharmacognosy (60 L)

Pharmacognosy (40L)

AIMS AND OBJECTIVES:

- 1) To know history, scope and importance of Pharmacognosy & Medical botany.
- 2) To study classification, cultivation, collection and processing of plant drugs.
- 3) To study morphology, botanical and chemical characterization and Quantitative microscopy of certain drugs.
- 4) To study common household plant drugs
- 5) To prepare Ayurvedic recipes.
- 6) To study some plants used for perfumes.
- 7) To make student aware about biopiracy and legislation about medicinal plants.

Chapter 1. Introduction of Pharmacognosy: 06

- 1.1 Definition, History and scope
- 1.2 Important systems of medicine
- 1.3 Organized and unorganized crude drug's

Chapter 2. Classification of Drugs Plant: 06

- 2.1 Taxonomical, morphological, chemical, therapeutic and alphabetical
- 2.2 Chemical nature of crude drug
- 2.3 Concept of therapeutic active chemical constituents

Chapter 3. Cultivation of Plant Drug:

08

3.1 Methods of propagation

- a) Sexual b) Asexual

3.2 Factors affecting cultivation

- a) Temperature and humidity
- b) Rainfall
- c) Soil and Soil fertility
- d) Fertilizers
- e) Pest and pest control

Chapter 4. Collection and processing of crude drugs:

10

4.1 Collection

- a) Root
- b) Stem and bark
- c) Leaf
- d) Flower
- e) Fruits and Seeds
- f) Gums and resins

4.2 Processing

- a) Harvesting
- b) Drying
- c) Garbling/Dressing,
- d) Packing
- e). Storage

Chapter 5. Analytical Pharmacognosy:

08

5.1 Drug adulteration and types of adulterants

5.2 Methods of drug evaluations in brief

- a. Morphological
- b. Microscopic
- c. Chemical
- d. Physical
- e. Biological

Chapter 6. Quantitative microscopy of drugs, stomatal index, of the following: 02

1. *Datura innoxia* / *Datura metel* (Datura)
2. *Justicia adhatoda* [Syn.*Adhatoda zeylanica*] (Adulsa)

Medico Botany

20L

Chapter 7. Introduction: Definition and History of medico Botany.

02

Chapter 8. Medicinal uses of common house-hold plants "Grandmaa's Pouch" 08

1. *Allium sativum* (Garlic)
2. *Trachyspermum ammi* (Ajwan)
3. *Curcuma domestica* (Halad)
4. *Ocimum sanctum* (Tulsi)
5. *Zingiber officinale* (Ginger)
6. *Helicteris isora* (Murud sheng)
7. *Cassia fistula* (Bahava)
8. *Gardenia gummifera* (Dikamali)

Chapter 9. Preparation of following Ayurvedic medicines with respect to Botanical source, part used, method of preparation: 04

- 9.1. Triphala churna

9.2. Kumari asav

9.3. Arjunarishtha

Chapter 10. Plant perfumes and cosmetic from the following: 04

10.1. *Cymbopogon martinii* (Rosha grass)

10.2. *Cymbopogon citratus* (Lemon grass)

10.3. *Rosa indica* (Gulab)

10.4. *Santalum album* (Chandan)

Chapter 11. 1) Biopiracy of medicinal plants from India. 02

2) Drug legislation and patenting (Act related to quality control and patenting)

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1. Deshmukh L.P.(2012) Encyclopidia of Medinal Plant of the world (1 to 10), Oxfer Publication] New Delhi

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Semester-VI

BOT.366.3 Paper VI :(Optional Paper-III)

HORTICULTURE

(60 Lectures)

AIMS AND OBJECTIVES:

1. To know horticulture, its scope, disciplines and importance
2. To know horticulture zones of Maharashtra and India
3. To understand different horticultural practices and their methods
4. To study importance, principles and types of Bahar treatment
5. To study role played by green and polyhouses in horticulture
6. To study production technology, harvesting techniques and marketing of crops grown especially in Khandesh region of Maharashtra
7. To understand methods of preservation and preparation of preserved products prevailing especially in this part of the state

Chapter 1. Introduction:

03

- 1.1 Definition, scope and importance
- 1.2 Horticultural zone of Maharashtra and India
- 1.3 Different disciplines of horticulture
 - a. Pomology
 - b. Olericulture
 - c. Floriculture
 - d. Ornamental horticulture
 - e. Landscape horticulture

Chapter 2. Horticultural Plants

04

- 2.1 Classification of horticultural crops, vegetable, fruits, ornamental plants, spices and flowers
- 2.2 Nutritive value of fruits and vegetables

Chapter 2. Propagation of Horticultural plants:

03

- 2.1 Sexual propagation: Advantage and Disadvantages
- 2.2 Asexual propagation:
 - a) Advantages and disadvantages
 - b) Methods of Asexual propagation in brief

Chapter 3. Cutting:

03

- 3.1 Definition
- 3.2 Methods of cutting:
 - a) Stem cutting: Soft wood cutting, Hard wood cutting
 - b) Leaf cutting
 - c) Root cutting

Chapter 4. Layering: 03

- 4.1 Definition
- 4.2 Methods of layering:
 - a) Simple layering
 - b) Compound layering
 - c) Serpentine layering
 - d) Air layering or Gootee

Chapter 5. Grafting: 03

- 5.1 Definition
- 5.2 Methods of grafting:
 - a) Whip grafting
 - b) Wedge grafting
 - c) Tongue grafting

Chapter 6. Budding: 02

- 6.1 Definition
- 6.2 Methods of budding
 - a) 'T' Shape budding
 - b) Patch budding

Chapter 7. Special Practices in Horticulture 08

- 7.1 Training and Pruning of Plants
 - a) Definition
 - b) Difference between training and pruning
 - c) Objectives of training and pruning
 - d) Advantage of training and pruning
- 7.2 Bahar Treatment:
 - a) Definition, Principles and importance
 - b) Types of Bahar (Methods not expected)
 - i) Ambe Bahar
 - ii) Mrig Bahar
 - iii) Hasth Bahar

Chapter 8. Fruit(Grapes) and Vegetable(Tomato) Production technology .w.r.t 08

- 8.1 Introduction
- 8.2 Soil and Climate requirement
- 8.3 Commercial varieties
- 8.4 Pest and disease management
- 8.5 Harvesting and post harvest management

Chapter 10. Preservation of Fruits and Vegetables:

15

- 10.1 Introduction, Scope and importance of fruits and vegetables preservation.
- 10.2 Methods of preservation
 - a) Temporary preservation
 - i. Asepsis
 - ii. Exclusion of moisture i.e. Drying of vegetables e.g. Potato Cabbage, Onion, Bitter Gourd, Green pea, Spinach.
 - iii. Use of mild antiseptic
 - iv. Pasteurization
 - v. Low temperature
 - b) Permanent preservation
 - i. Sterilization and processing: use of sugar, salt, vinegar or preservation by food additives i.e. chemical preservatives: citric acid, potassium metabisulphate, sodium benzoate, Sulphur dioxide
 - ii. Drying, Dehydration and concentration of fruits and vegetables
 - iii. Ionizing radiations
- 10.3 Preparation of preserved product
 - a) Mix fruit jam
 - b) Wood apple or Guava jelly
 - c) Lemon / Orange squash
 - d) Tomato ketchup

Chapter 11. Poly house and Green house technology with reference to Ornamental Horticulture

08

- 11.1 Scope and importance
- 11.2 Types of structure
 - a. Green house
 - b. Poly house
 - c. Glass house
 - d. Plastic tunnel
 - e. Conservatory
- 11.3 Construction of Various structures – materials, requirements and cost

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NORTH MAHARASHTRA UNIVERSITY, JALGAON

T. Y. BSc Botany Syllabus

Paper – VI

BOT. 366.4 : PLANT PROTECTION (Optional paper-IV)

TOTAL PERIODS- 60

AIMS AND OBJECTIVES

1. To know Scope and importance of Plant Protection
2. To know terminologies in Plant Protection
3. To study the causes of Plant diseases
4. To study the control measures of Plant diseases

Chapter 1 : Plant Protection :

03

1.1: Introduction , Definition , Scope and Importance

1.2 : A short historical account of plant pathology with reference to the work of following plant pathologists

- i)Theophrastus ii) Prevost iii)De- Bery iv) E. J. Butler
- v) B. B. Munkur vi) K. C. Mehta vii) Robert Koch

Chapter 2 : Terminology :

03

2.1 : Definition of the following terms

- i)Disease ii) Pathogen iii) Host iv) Parasite v) Hyperparasite vi) Inoculum vii) Penetration
- viii) Infection ix) Pathogenesis x) Pathogenecity xi) Etiology xii) Incubation period
- xiii) Disease cycle xiv) Symptoms xv) Epidemiology

Chapter 3 : Study of diseases:

10

3.1 : Inanimate diseases :

- i) Diseases caused due to nutritional deficiencies of the following elements-
 - a) Fe-chlorosis
 - b) Bo- Mango necrosis
- ii) Diseases due to unfavourable temperature freezing injury to Potato - Black heart of potato, Sun scaled of vegetables

3.2 : Animate diseases :

- i) Viral diseases - TMV/PMV
- ii) Bacterial diseases - Citrus canker
- iii) Fungal diseases - a) Powdary mildew of grapes / Teak/ *Acacia*
 - b) Downy mildew of Bajara (Green ear disease)
 - c) Ergot of Bajara

- d) Rust of Wheat (*Puccinia*)
- e) Tikka disease of groundnut
- f) Grain smut of Jawar
- g) Red rot of sugarcane
- h) Wilting of seedlings by *Fusarium*
- i) Bunchy top of Banana
- j) Whip smut of Sugarcane

Chapter 4 : General principals of disease control : 03

- 4.1 : Preventive therapy -
 - i) Avoidance of pathogen , ii) Exclusion of the inoculum, iii) Eradication ,
 - iv) Protection v) Disease resistance
- 4.2 : Curation theory – i) Physical (Surgery and hot treatment)

Chapter 5 : Mechanical Control 10

- 5.1 : Choice of geographic area, selection of field, proper time of sowing, use of disease escaping varieties, selection of seeds and planting stock, high budding
- 5.2 : Control through cultural practices-
 - i) Crop rotation ii) Mixed cropping iii) Removal and destruction of diseased plants and plant organs, rouging , destruction of alternate and collateral hosts
- 5.3 : Field Sanitation
 - i) Destruction of crop residue , ii) Deep ploughing , iii) Improved soil drainage system
 - iv) fallowing v) Flooding vi) Crop –free period / crop free zone , vii) Depth of sowing of seeds viii) Regulation of fertility level of soil
- 5.4 : Soil treatment i) Heat ii) Flooding iii) Fallowing iv) Use of chemicals
- 5.5 : Elimination of pathogen from infected plant material
 - i) Sorting ii) Drying and aging of seeds iii) Thermal treatment iv) Chemical treatment

Chapter 6 : Biological control : 05

- 6.1 : Introduction, Definition
- 6.2 : Biological control and biostatic control
- 6.3 : Methods:
 - i) Amendment of soil with organic matters ii) Predaceous fungi method
- 6.4 : Mechanism:
 - i) Antibiosis, ii) Exploitation iii) Competition

Chapter 7 : Legal control : 03

- 7.1 : Introduction, Plant quarantine, Limitations and importance
- 7.2 : Plant quarantine organization in the world and in India

Chapter 8 : Chemical control : 12

- 8.1 : Introduction and importance
- 8.2 : Criteria of a good fungicide, weedicides and bacteriocides
- 8.3: Chemicals used in plant disease control, nature of mode of action and uses

- i) Sulphur : Inorganic compounds; Sulphur powder , Wettable sulphur, and Lime sulphur
- ii) Copper : Bourdeaux mixture, Burgundy mixture, copper oxychloride
- iii) Mercury : (Inorganic compounds) ; Mercuric chloride, mercurous chloride
- iv) Antibiotics : Streptomycine, Tetracycline, Groseofulvin and Aureofungin
- v) Soil fumigants : Method of applying antipathogenic chemicals

vi) Study of following types of Instruments (Sprayers, Dusters) and discuss used in diseased control-

- a) Knapsac sprayer b) Mist blower c) Rotary hand duster d) Soil injector e) manually operated / hand sprayer

Chapter 9 : Control through disease resistance : 03

9.1 : Introduction, use of resistant varieties, difference between disease escape, tolerance and disease resistance

9.2 : Development of resistant varieties-

- i) Selection ii) Hybridization iii) Mutation

Chapter 10 : Defense of plants : 08

10.1 : Introduction

10.2 : Disease resistance in plants

- i) Structural protection (epidermal, stomatal and mechanical) ii) Chemical protection (chemical of the surface layer, exudation of toxic chemicals) iii) Absence of nutrients
- iv) Absence of common antigens v) Histological defense vi) Accumulation of toxic substance vii) hypersensitive defense reaction viii) Defense through growth substances and enzymes ix) Tolerance to disease

10.3 : Nematology :

- i) Introduction
- ii) Study of the following Nematodal diseases w.r.t. causal organism, symptoms and control-
 - a) Ear cockles of Wheat b) Molya disease of Barley

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BOT- 367: PRACTICAL PAPER-I

BASED ON THEORY PAPERS - I & III (BOT- 361 ,BOT- 363)

GYMNOSPERMS & PALEOBOTANY

GYMNOSPERMS

Practical 1-2. Study of *Pinus* with the help of permanent slides and plant material

- i) External morphology
- ii) T. S. of stem (Temporary double stained preparation)
- iii) T. S. of needle(Temporary double stained preparation)
- iv) Morphology of male cone –Entire cone, specimen, T. S. and L. S.of cone (P. S.)
- v) Morphology of female cone – Entire cone, specimen, T. S. and L. S.of cone (P.S.)
- vi) Mounting of pollen grains
- vii) V. S. of mature ovule (Permanent slide)

Practical 3-4. Study of *Gnetum* with the help of permanent slides and plant material

- i) External morphology
- ii) T. S. of stem (permanent slide)
- iii) T. S. of leaf (permanent slide)
- iv) Secondary growth in the stem of *G. ula* (Permanent slide)
- v) Morphology of male cone – Entire cone,specimen, T. S. and L. S. (Permanent slide)
- vi) Morphology of female cone – Entire cone,specimen, T. S. and L. S.(Permanent slide)
- vii) V. S. of mature ovule (Permanent slide)

PALEOBOTANY

Practical 5 Study of different types of fossils (Any three as per syllabus)

Practical 6 Study of the following with the help of slides and/ or specimens

- i) *Rhynia*
- ii) *Lepidodendron* (Stem)
- iii) *Lepidostrobus*
- iv) *Calamites*
- v) *Annularia* (Leaf)
- vi) *Lyginopteris*
- vii) *Cycadeoidea* (Flower)
- viii) *Sahnipushpam*
- ix) *Enigmocarpon*

Paper - III BOT : 363 Genetics, Plant Breeding and Evolution

Practical 1: Solving of problems on monohybrid and dihybrid cross.

Practical 2: Isolation of DNA from suitable plant material

Practical 3: Study of factors promoting self pollination (By demonstration Flower/Photograph)

- Bisexuality (Hermaphroditism)----- (Wheat, Rice)
- Cleistogamy----- (Wheat, Rice)
- Homogamy----- (Tomato, Lady's finger)

Practical 4: Study of factors promoting cross pollination (By demonstration Flower/Photograph)

- Dichogamy (i) Protandry----- (Maize)
(ii) protogyny----- (Pearl millet)
- Unisexuality (i) Monoecious----- (Maize, Pumpkins)
(ii) Dioecious----- (Hemp, Asparagus)
- Self incompatibility ----- (Radish, Cabbage)

Practical 5: Techniques of Hybridization in Self Pollinated and Cross Pollinated Crops.

Practical 6: Methods of estimation of Heterosis (i) Mid- Parent Heterosis
(ii) Better parent Heterosis
(iii) Standard Heterosis

BOT- 368: PRACTICAL PAPER-II

**BASED ON THEORY PAPERS - II& VI (BOT- 362 , BOT- 366.1/ BOT- 366.2/ BOT- 366.3/
BOT- 366.4)**

Anatomy and Embryology

1. Study of epidermal tissue system as per theory syllabus based on locally available materials
 - a) Types of Stomata
 - b) Types of Trichomes
2. Study of mechanical tissue system with at least one example each from root, stem and leaf
3. Study of normal secondary growth in stem and root of woody dicots (double stained preparation)
 - i) Stem – Sunflower/ Neem
 - ii) Root- *Cicer*
4. Study of anomalous secondary growth in the stem of the following Plants (double stained preparation)
 - i) *Salvadora*
 - ii) *Raphanus/ Daucus*
 - iii) *Nyctanthes*
 - iv) *Boerrhavia*
5. Maceration of vascular tissue of any two suitable materials and observation of xylem elements
6. Study of the following with the help of permanent slides
 - a) T. S. of Microsporangium.
 - b) Types of ovules
 - c) Dicot embryo, e.g. *Capsella* and Monocot embryo, e.g. *Sagittaria*

Botanical techniques

1. Study of botanical instruments (Any four) as per theory.
- 2 to 4 . Microtomy of suitable material
5. Maceration of Vascular tissues
- 6-7. Calibration of Microscope and measurement of spore.

Medico-botany and Pharmacognosy

PHARMACOGNOSY

1&2 : Microscopic and Macroscopic characters for recognizing Botanical source, External Morphology, Epidermal features like trichomes, stomata types, stomatal number, and stomatal index of following

- a. Adulsa (*Adathoda zeylanica*)
- b. Datura (*Datura metel*)

3 : Preliminary photochemical screening for the powder drug of following (any one)

- a. Rhizome- Adruk (*Zizngiber officinalis*)
- b Leaf – Adulsa (*Adathoda zeylanica*)

4 : Preparation of following drug (any two)

- a. Triphala Churna
- b. Kumari asav
- c. Arjunarisht

Medico botany

5&6: Botanical source, Plant part used and Medicinal uses of common house-hold plants (Any 6)

1. *Allium sativum* (Garlic)
2. *Trachyspermum ammi* (Ajwan)
3. *Curcuma domestica* (Halad)
4. *Ocimum sanctum* (Tulsi)
5. *Zingiber officinale* (Ginger)
6. *Helicteris isora* (Murud sheng)
7. *Cassia fistula* (Bahava)
8. *Gardenia gummifera* (Dikamali)

Horticulture

1. Study of Garden tools and Equipments:- Sprayer, Duster, Pruning knife , Sprinkler, micro-irrigation system etc.
2. Study of Propagation requirement- i) Media ii) Containers iii) Potting iv) Repotting
3. Study of Phenology of any two fruits, vegetables or flowering crops.
4. Study of propagation methods
 - a. Cutting
 - b. Layering
 - c. Budding
 - d. Grafting
- 5.& 6. Preparation of different types of fruit products & Food products
 - a. Mix fruit jam
 - b. Wood apple or Guava jelly
 - c. Lemon / Orange Squash
 - d. Tomato Ketchup

Submission :- Any Five temporary preserved food products.

(Potato, Onion, Kokam, Bitter guard, Cabbage, Fenugreek, Raw Banana, Gawar, Bean fruits etc.)

*Visit to any one Nursery unit, Commercial Orchard, Floriculture unit is compulsory.

Plant Protection

- Pract. No.1, 2 & 3:** Study of following plant diseases with reference to the causal organism, symptoms, nature of damage done and control measures (**Any nine**)
- 1) Powdery mildew 2) Downy mildew 3) Whip smut of sugarcane 4) Grain smut of Jawar 5) Citrus cankar 6) Tikka disease of groundnut 7) Red rot of sugarcane 8) Wilting of seedings by *Fusarium* 9) Bunchy top of Banana 10) Yellow vein mosaic of Lady's finger 11) Ergot of bajara 12) Rust of Wheat (Puccinia)
- Pract. No. : 4** Preparation and application of bordeaux mixture / Burgundy `s mixture on diseased plants and observation of its effect.
- Pract. No. : 5** Demonstration of various chemicals used as Fungicides, Bactericides Weedicides, and Nematicides.(**Any Two**) and application of them on the diseased plants and observation of their effects.
- Pract. No. : 6** Demonstration of different types of Sprayers/Dusters/Instruments and discuss used in diseased control. (Knapsac sprayer , Mist blower , Rotary hand duster ,Soil injector and any one manually operated / hand sprayer.(**Any three**)

Note : 1. Visit to a nearby agriculture collage/ university to observe various methods of disease control. Field trips to collect sample of diseased materials.

2. Students should submit at least 5 diseased specimen / Photographs along with the report of the field trips at the time of practical examination.

BOT- 369: PRACTICAL PAPER-III

BASED ON THEORY PAPERS - IV & V (BOT- 364 and BOT- 365)

Plant Biochemistry

Practical 1: Biochemical tests for: a) Carbohydrate b) Proteins c) lipids from suitable plant source

Practical 2: Biochemical tests for: a) Tannins b) Alkaloids c) Phenols from suitable plant source

Practical 3: To study the effect of temperature on activity of enzyme amylase

Practical 4: To study the principle and working and uses of a) spectrophotometer / calorimeter
b) centrifuge.

Practical 5: Isolation and estimation of lipids from oil seeds by using Soxhlet apparatus.

Practical 6: To study the lipase activity by using germinating oily seeds.

Applied Botany

Practical 1 Formulation and preparation of MS media

Practical 2 & study of following instruments:

Autoclave, Laminar air flow, Hot air oven, Incubator

Practical 3: Citric acid assay.

Practical 4: Detection of adulteration in plant products using suitable tests (Any four)

- | | |
|------------------------------|---|
| a. Cereal grains: Bajra | b. Pulse: Chick pea (Gram) |
| c. Oils: Groundnut oil | d. Spices: black pepper, red pepper, turmeric |
| e. Beverages: Tea and Coffee | |

Practical 5: Preparation of *Aloe vera* jel & Jaswand jel

Practical 6: Botanical name and uses of following plant material in forensic science

- | | |
|------------------------------|------------------------------|
| (a) <i>Argemone mexicana</i> | (b) <i>Abrus precatorius</i> |
| (c) <i>Jatropha curcas</i> | (d) <i>Datura metal.</i> |

EQUIVALANCE OF PAPERS

SEM –I

Paper	Code	Title of New Paper (To be implemented from June 2017)	Paper	Code	Title of old Paper
I	BOT. 351	Cryptogams	I	BOT. 351	Diversity of Lower Cryptogams
II	BOT. 352	Taxonomy of Angiosperms	II	BOT. 352	Taxonomy of Angiosperms
III	BOT. 353	Cell and Molecular Biology	III	BOT. 353	Genetics and Molecular Biology
IV	BOT. 354	Advanced Plant Physiology	IV	BOT. 354	Advanced Plant Physiology
V	BOT. 355	Plant Ecology and Phytogeography	V	BOT. 355	Plant Ecology and Phytogeography
		Optional Papers [Any one]			Optional Papers [Any one]
VI	BOT. 356.1	Plant Biotechnology	VI	BOT. 356.1	Plant Biotechnology
VI	BOT. 356.2	Ethnobotany	VI	BOT. 356.4	Ethnobotany
VI	BOT. 356.3	Gardening	VI	BOT. 356.2	Gardening
VI	BOT. 356.4	Seed Technology and seed pathology	VI	BOT. 356.3	Seed Technology and seed pathology

SEM –II

Paper	Code	Title of New Paper(To be implemented from June 2017)	Paper	Code	Title of old Paper
I	BOT. 361	Gymnosperms & Paleobotany	I	BOT. 361	Diversity of Higher Cryptogams
II	BOT. 362	Anatomy and Embryology	II	BOT. 362	Gymnosperms & Paleobotany
III	BOT. 363	Genetics , Plant Breeding and Evolution	III	BOT. 363	Plant Breeding
IV	BOT. 364	Plant Biochemistry	IV	BOT. 364	Plant Biochemistry
V	BOT. 365	Applied Botany	V	BOT. 365	Embryology & Palynology
		Optional Paper[Any one]			Optional Paper[Any one]
VI	BOT. 366.1	Botanical Techniques	VI	BOT. 366.1	Botanical Techniques

VI	BOT. 366.2	Medico-botany and Pharmacognosy	VI	BOT. 366.2	Pharmacognosy
VI	BOT. 366.3	Horticulture	VI	BOT. 366.4	Horticulture
VI	BOT. 366.4	Plant Protection	VI	BOT. 366.3	Plant Pathology