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.
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

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

CHAPTER 2: An introduction to Algae

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. Siphonaceousthalus
   5. Pseudoparenchymatous a)Uni-axial thallus b) Multi-axial thallus
   6. Parenchymatousthalus
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

3.1. Role of algae in relation to:
   a) Industry- Agar, Alginates, Carrageenin,
   b) Sewage disposal,
3.2. Algal biotechnology in production of Single Cell Protein (SCP)

CHAPTER 4: Life cycle of Chara with respect to-

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

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

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

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

CHAPTER 9: An introduction to Bryophytes

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

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

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

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

REFERENCE BOOKS:

----------xxxxxxxxxxxx-----------
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.

CHAPTER 1: 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) Bennettitales  c) 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

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. Caesalpiniaceae
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:

4.1 Introduction

4.2 Role of following with suitable examples:

a) Cytotaxonomy (number and morphology of chromosomes)

b) Phytochemistry:
  i) Direct visible characters (starch grains and raphides)
  ii) Chemical test characters (Betalains and Alkaloids)
  iii) Proteins

---------xxxxxxx--------
REFERENCE BOOKS:


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

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

CHAPTER 2: Cell wall and Plasma membrane

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

CHAPTER 3: Cytoplasmic matrix

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

CHAPTER 4: Cell organelles

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

CHAPTER 5: Plant Cell- Nucleus, Chromosomes

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**

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**

7.1. Definition and History

7.2. Scope and Importance

---

**CHAPTER 8: DNA as Genetic Material**

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**

9.1. Introduction and types of DNA Replication

9.2. Meselson and Stahal’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**

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)

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

12.1. Operon concept
12.2. Inducible and Repressible operon

REFERENCE BOOKS:

1. Cell and Molecular Biology, P. K. Gupta
2. Cell and Molecular Biology, DeRobertis and DeRobertis 7th Edition
4. Fundamentals of Molecular Biology, Veer BalaRastogi
6. Molecular Biology of Gene, Watson J. D.
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  
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  
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


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

CHAPTER 4: Translocation of organic Solutes

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

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 Hub 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

REFERENCE BOOKS:


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, Aspection and Stratification.
2.3. Sampling techniques of population: I) Quadrat method: a) List b) List count
2.5. Raunkiaer’s law of Frequency and Frequency diagram.

CHAPTER 3: Community dynamics 05L
3.1. Succession: Definition, Causes, and, types.
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

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

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

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

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

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)

CHAPTER 11: Phytogeography 04L

11.1. Main Botanical Regions of India.
11.2. Detailed study of vegetation types in Maharashtra.

CHAPTER 12: Ecological Indicator 03L

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

CHAPTER 13: Endemism: Causes and Types 02L

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

REFERENCE BOOKS:
1. Agrawal, K.C. (1996). Environmental Biology, Agro-Botanical Publisher, Bikaner India


13. Kochhar, P. L. Plant Ecology, Genetics and Evolution, S. Nagin & Co. Ltd. New Delhi,


19. Sharma, P.D. Ecology And Environment, Rastogi publication, Meerut, India.


-------xxxxx-------
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

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

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

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

CHAPTER 9: Organ culture

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

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

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

12.1. Introduction and purpose,
12.2. Vectors (cloning and insertion vector).
12.3. Restriction enzymes- types and action

CHAPTER 13: Transformation in plants

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

14.1. Southern blotting
14.2. Northern blotting
14.3. Western blotting

CHAPTER 15: Protoplast culture

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.
REFERENCE BOOKS:

8. Gupta, P. K. 2010, Elements of Biotechnology, Rastogi Publications,

----------XXX----------
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

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

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


CHAPTER 4: Ethnobotany of some plants W.R.T. BN, Taxonomic description, Distribution, Phytochemistry and Uses of –
1. *Adhatodazeylanica*
2. *Aeglemarmelos*
3. *Azadirachta indica*
4. *Buteamonosperma*
5. *Daturametel*
6. *Madhuca indica*

**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

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

9.1. Liquor technique.
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:

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

CHAPTER 11: Plants and parts used for following purposes

11.3. Agricultural implements.
11.4. Fencing.
11.5. Fibers.

CHAPTER 12: Beyond inventorying

12.1. Importance of Inventorying.
12.2. Indigenous Biotechnology:
12.3. Ranu tablet.
12.4. Jaggery extraction.
12.5. Socio-ethnobotany.
REFERENCE BOOKS:
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

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

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

3.2. Manures.
3.3. Fertilizers.
3.4. Agrochemicals- Insecticides, Pesticides & Fungicides.
3.5. Irrigation techniques.

CHAPTER 4: Garden Tools and Implements

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

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

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.
6.9. Hanging basket.
CHAPTER 7: Pot Culture

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

CHAPTER 8: Bonsai Technique

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

CHAPTER 9: Topiary

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

CHAPTER 10: Lawns

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

REFERENCE BOOKS:-

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:

1.1. Definition

1.2. Development of seed

1.3. Functions of seed parts

CHAPTER 2: Seed Technology:

2.1. Definition

2.2. Role and goals of seed technology in crop production

CHAPTER 3: Seed Dormancy


3.2. Methods of breaking the seed dormancy.

CHAPTER 4: Principles of Quality Seed Production:

4.1. Stage of Seed Multiplication.

4.2. Seed purity, Genetic purity.

CHAPTER 5: Methods of certified seed production

5.1. Isolation

5.2. Seed inspection

5.3. Roguing

CHAPTER 6: Types of cultivars (variety)
6.1. Composite
6.2. Synthetic
6.3. Hybrid
6.4. Role of producer
6.5. Seed production agencies.

CHAPTER 7: Harvesting
7.1. Drying
7.2. Processing
7.3. Seed sampling,

CHAPTER 8: Seed testing
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:
9.2. Seed storage, pest and diseases of seed, seed aging.

CHAPTER 10. Seed Marketing agencies
10.1. Planning and economics of seed production.
10.2. Seed processing & packing.

SEED PATHOLOGY (Periods 20)
CHAPTER 11: SEED PATHOLOGY:
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:

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.

REFERENCE BOOKS


---------XXXXXX---------
PRACTICAL COURSES

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

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

Practical Based on BOT.-351, CRYPTOGRAMS

**Practical 1** - Study of range of thallus structure in algae with the help of materials or Permanent slides (any one from the examples):

a) Unicellular thallus - *Chlamydomonas, Chlorella*.

b) Colonial thallus – *Pandorina, Eudorina, Volvox, Hydrodictyon*.

c) Filamentous thallus - *Pithophora, Chaetophora, Coleochaetae, Stigeoclonium, Drapanalidia, Fritscheilla, and Oedogonium*.

d) Siphonaceous thallus - *Vaucheria, Caulerpa*.

e) Pseudoparenchymatous (Uniaxial/Multiaxial) thallus – *Batrachospermum, Polysiphonia*.

f) 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 polypeptide 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. Micropropogation of explant.


**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. *Azadirachta indica*
4. *Buteamonosperma*
5. *Daturametel*
6. *Madhuca indica*

**Practical 3 & 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.

**Practical 5 & 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: *Dioscorea bulbifera* (Kadu Kand)
B) Beverages: Flowers: *Madhuca longiflora* (Mahu)
C) Oil yielding: Seeds: *Madhuca longiflora* (Mahu, Tolambi)
D) Fiber yielding: Stem: *Helicteris isora* (Murud Sheng)
E) Bidi Wrapper: Leaves: a) *Diospyros melanoxylon* (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.

Practical 6. 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**

**Practical 1.** Physical purity test
**Practical 2.** Germination test (Maize & Ground nut)
**Practical 3.** Seed moisture test.
**Practical 4.** Seed viability test. (Tetrazolium test & ferric chloride for legume seeds)
**Practical 5.** Detection of seed microflora.
**Practical 6.** 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 quadrature 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 gauze 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)

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)
   (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**

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:**

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:

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

4.1 Introduction
4.2 Definition and scope of Paleobotany.
4.3 Contribution of Prof. Birbal Sahni in paleobotany

Chapter 5. Fossils:

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:

1. Psilopsida: Rhynia
2. Lycopsida: 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) Enigmocarpom

REFERENCE BOOKS

GYMNOSPERMS:


**PALEOBOTANY:**
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, Rubiaceous and Graminaceous
   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: Salvadoria, 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

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

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

Chapter 13. Embryo

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

REFERENCES BOOKS:
10. Pandey, B.P. (1954) Plant Anatomy, S. Chand & CO.(P)Ltd. New Delhi, India
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

*****
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 \( \text{pH} \) 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:**

- 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:**

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  
1:1 Introduction, Scope and importance

Chapter-2: Forensic Science  
2.1 Introduction, Definition, Scope and Importance
2.2 Role of following plants in Forensic Botany
   a) Cannabis sativa (Jute)
   b) Jatropha curcas (Chandrajoyot)
   c) Argemone mexicana (Yellow poppy)
   d) Abrus precatorius (Gunj)
   e) Datura metal (Datura)

Chapter-3: Herbal Cosmetics  
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

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

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

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 / Subabul

6.5 Social forestry: A tool of integrated rural development.

Chapter-7: Plant Tissue Culture

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

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**

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**


Prakashan, Nadiad


11. M. Sitaram Rao. Social Forestry

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:

(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:

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:

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:

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:

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:

9.1. Introduction
9.2. Principle and Working of spectrophotometer
9.3. Application of spectrophotometer

Chapter 11. General principles of Biophysical Chemistry Instruments

10.1 pH Meter
10.2 Centrifuge

REFERENCE BOOKS:

BOTANICAL TECHNIQUES:
6. L. R. Patki, B. L. Bhalchandra, I. H. Jeevaji forwarded by Dr. (Mrs) V. M. Sapkal. An introduction to microtechniques. S. Chand & Co. Ltd., New Delhi.

----------XXXX----------
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:

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:

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:

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**

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:

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.

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

REFERENCE BOOK:

   New Delhi


5. Iyengar, M.A. Study of Crude drugs, Manipal Power Press, Manipal.


   Delh.

    and Hyderabad


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:

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:

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

Chapter 6. Budding:

6.1 Definition
6.2 Methods of budding
   a) ‘T’ Shape budding
   b) Patch budding

Chapter 7. Special Practices in Horticulture

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
Chapter 10. Preservation of Fruits and Vegetables:

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

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
REFERENCE BOOKS:

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:

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:

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) Pathogenicity xi) Etiology xii) Incubation period
   xiii) Disease cycle xiv) Symptoms xv) Epidemiology

Chapter 3: Study of diseases:

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 inoculums, 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

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

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


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

REFERENCE BOOKS


5. B. P. Pandey Plant Pathology, S. Chand & Co. Ltd. Ramnagar New Delhi 110055
7. G. Rangaswami (1973) Diseases of Crop plants in India Prentice Hall of India. PVT. Ltd, New Delhi, India
12. E. J. Butler (1973) Fungi and Diseases in Plants Thacker Spink & Co. Culcutta, India
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)
  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)
  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
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) Protandary------------------------(Maize )
  (ii) protogyny------------------------ (Pearl millet)
- Unisexuality  
  (i) Monoecious------------------------( Maize, Pumpkins)
  (ii) Dioecious------------------------ (Hemp, Asparagus)
- Self incompatibility------------------------(Radish, Cabbage)


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.
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)

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 college/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.

81 | Page
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) Argemone mexicana          (b) Abrus precatorius
   (c) Jatropha curcas            (d) Datura metel.
### EQUIVALENCE OF PAPERS

#### SEM – I

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

#### SEM – II

<table>
<thead>
<tr>
<th>Paper</th>
<th>Code</th>
<th>Title of New Paper (To be implemented from June 2017)</th>
<th>Paper</th>
<th>Code</th>
<th>Title of old Paper</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>BOT. 361</td>
<td>Gymnosperms &amp; Paleobotany</td>
<td>I</td>
<td>BOT. 361</td>
<td>Diversity of Higher Cryptogams</td>
</tr>
<tr>
<td>II</td>
<td>BOT. 362</td>
<td>Anatomy and Embryology</td>
<td>II</td>
<td>BOT. 362</td>
<td>Gymnosperms &amp; Paleobotany</td>
</tr>
<tr>
<td>III</td>
<td>BOT. 363</td>
<td>Genetics, Plant Breeding and Evolution</td>
<td>III</td>
<td>BOT. 363</td>
<td>Plant Breeding</td>
</tr>
<tr>
<td>IV</td>
<td>BOT. 364</td>
<td>Plant Biochemistry</td>
<td>IV</td>
<td>BOT. 364</td>
<td>Plant Biochemistry</td>
</tr>
<tr>
<td>V</td>
<td>BOT. 365</td>
<td>Applied Botany</td>
<td>V</td>
<td>BOT. 365</td>
<td>Embryology &amp; Palynology</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Optional Paper [Any one]</td>
<td></td>
<td></td>
<td>Optional Paper [Any one]</td>
</tr>
<tr>
<td>VI</td>
<td>BOT. 366.1</td>
<td>Botanical Techniques</td>
<td>VI</td>
<td>BOT. 366.1</td>
<td>Botanical Techniques</td>
</tr>
<tr>
<td>VI</td>
<td>BOT. 366.2</td>
<td>Medico-botany and Pharmacognosy</td>
<td>VI</td>
<td>BOT. 366.2</td>
<td>Pharmacognosy</td>
</tr>
<tr>
<td>----</td>
<td>------------</td>
<td>---------------------------------</td>
<td>----</td>
<td>------------</td>
<td>----------------</td>
</tr>
<tr>
<td>VI</td>
<td>BOT. 366.3</td>
<td>Horticulture</td>
<td>VI</td>
<td>BOT. 366.4</td>
<td>Horticulture</td>
</tr>
<tr>
<td>VI</td>
<td>BOT. 366.4</td>
<td>Plant Protection</td>
<td>VI</td>
<td>BOT. 366.3</td>
<td>Plant Pathology</td>
</tr>
</tbody>
</table>