NORTH MAHARASHTRA UNIVERSITY,

JALGAON

(NAAC Re-Accredited)

SYLLABUS FOR

S.Y.B.Sc.

BOTANY

FACULTY OF SCIENCE

(With Effect From June, 2013)

NORTH MAHARASHTRA UNIVERSITY, JALGAON

Syllabus For S. Y. B. Sc. Botany

BOT. 231: PAPER-I: MORPHOLOGY AND TAXONOMY OF ANGIOSPERMS
SEMESTER - I (Total Periods 60)

AIMS & OBJECTIVES:

1. To study vegetative and floral plant parts, besides their modifications and functions.
2. To study ground plan of Angiospermic flowers.
3. To know functions of taxonomy and categories of classification.
4. To study Bentham and Hooker's system of plant classification in detail.
5. To study plant families covering different groups.

Part –I : Morphology of Angiosperms

Chapter-1: Introduction (Lecture 01)

1.1 Definition and Scope

Chapter-2: Root (Lectures 03,Marks 02)

2.1 Definition, General characters and Functions of Root

2.2 Types of root system – Tap root and adventitious root system

Chapter-3: Stem (Lectures 03,Marks 02)

3.1 Definition, General characters and Functions of Stem

3.2 Types of Stem – Herbaceous and woody

Chapter-4: Leaf (Lectures 06,Marks 03)

4.1 Definition, Parts of typical leaf and functions of Leaf

4.2 Phyllotaxy: (a) Alternate (b) Opposite (c) Whorled

4.3 Types of leaf: Simple and Compound (subtypes expected)

4.4 Venation: Types of venation

Chapter-5: Inflorescence (Lectures 06,Marks 04)

5.1 Definition

5.2 Types of inflorescence: (a) Racemose and its types (b) Cymose and its types

Chapter-6: Flower (Lectures 10,Marks 06)

6.1 Definition and parts of typical flower

6.2 Types of flower: a) Hypogynous b) Epigynous c) Perigynous

6.3 Types of calyx: Deciduous and persistent

6.4 Corolla: Types of Corolla

6.5 Aestivation: Types of aestivation

6.6 Androecium:

a) Anther filament relationship: Basifixed, Dorsifixed and Versatile

b) Cohesion and adhesion of stamens

6.7 Gynoecium:

a) Apocarpus, Syncarpus.

b) Ovary: Superior and inferior

c) Types of placentation

Chapter–7: Fruit (Lectures 07,Marks 05)

7.1 Definition

7.2 Types of fruits:

A) Simple

i) Dry: Dehiscent:(i) Capsule, (ii) Follicle, (iii) Legume; Indehiscent:(e.g. Caryopsis)

ii) Fleshy: Drupe

B) Aggregate:Etaerio of berries

C) Composite:Sorosis

Part -II:Taxonomy of Angiosperms

Chapter-8: Taxonomy (Lectures 03,Marks 02)

8.1 Definition

8.2 Functions of Taxonomy :a) Identification b) Classification c) Nomenclature

8.3 Distinguishing features of Angiosperms

Chapter-9: Classification (Lectures 04,Marks 02)

9.1 Categories of Classification: Major and minor categories

9.2 Binomial Nomenclature

9.3 Types of Classification: a) Artificial b) Natural c) Phylogenetic

Chapter–10: System of Classification (Lectures 05,Marks 04)

10.1 Outline of Bentham and Hooker's system of classification up to series

10.2 Salient features, merits and demerits

Chapter–11: Study of Families (Lectures 12,Marks 10)

11.1 Study of the following plant families w.r.t. systematic position, morphological, distinguishing characters and economic importance:

1. Malvaceae 2. Papilionaceae (Fabaceae)
3. Rubiaceae 4.Solanaceae
5. Euphorbiaceae 6. Cannaceae

Reference Books:

Ganguly, H.C. & K. S. Das (1986) College Botany Vol.-.I (6th Edition), New Centra Book Agency, Calcutta, India.

Ganguly, H.C., K.S.Das and C.T.Datta (1968) College Botany Vol.I , New Central Book Agency, Calcutta, India.

Kumar, N.C.(1992) An Introduction to Taxonomy of Angiosperm. Himalaya Publishing House, Bombay, India.

Lawrence G.H.M. (1951) Taxonomy of Vascular plants. Macmillan, New York,USA.

Naik, V.N. (1984) Taxonomy of Angiosperms. Tata McGraw-Hill Publishing Company Ltd. New Delhi, India.

Pandey, B.P.(1997) Taxonomy of Angiosperms. S. Chand & Company Ltd., New Delhi, India.

Sharma, O.P. (1997) Plant Taxonomy. Tata McGraw-Hill Publishing Co. Ltd. New Dehli, India.

Shivarajan, V.V. (1984) Introduction to Principles of Plant Taxonomy. Oxford & IBH Publishing Co. New Delhi, India.

Singh, V. and D.K. Jain (1992) Taxonomy of Angiosprms.Rastogi Publication, Meerut, India.

Subramanyam, N.S. (1997) Modern Plant Taxonomy.Vikas Publishing house, New Delhi, India.

Susilkumar Mukerjee (1984) College Botany Vol III Published by J.N. Sen. B.S.I.New Central Book Agency Calcutta.

Vashistha, P.C. (1992) Taxonomy of Angiosperms. R. Chand & Co. Publishers, New Delhi, India.

BOT. 241: PAPER-I: PLANT ANATOMY

SEMESTER - II (Total Periods 60)

AIMS & OBJECTIVES:

1. To know scope and importance of anatomy
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.

Chapter-1: **Introduction** (Lectures 02)

1.1 Definition, Scope and Importance

Chapter-2: **Plant Tissues** (Lectures 06,Marks 06)

2.1 Definition and types

2.2 Meristematic tissue and types

2.3 Permanent tissue and types:(a) simple (b) complex

Chapter-3: **Concept of Tissue System** (Lectures 18,Marks 18)

3.1 Epidermal Tissue System:

A. Definition, Structure and Function.

B. Cutinisation, Lignifications, Suberisation, Silicification.

C. Types of Epidermal Appendages:

a) Unicellular and Multicellular Trichomes.

b) Glandular and non-glandular Trichomes.

c) Stellate, Dendroid Trichomes and peltate scales.

D. Types of Stomata:

i. Ranunculaceous (Anomocytic)

ii. Cruciferous (Anisocytic)

iii. Rubiaceous (Paracytic)

iv. Caryophyllaceous (Diacytic)

v. Graminaceous.

3.2 Study of Mechanical Tissue System Based on Principles.

a. Inflexibility b. Inextensibility

c. Incompressibility d. Shearing stresses

3.3 Secretory Tissue Systems:

a. Digestive glands b. Nectaries

c. Resin ducts d. Laticiferous ducts

e. Hydathodes f. Oil ducts.

Chapter-4: **Primary Structure of Dicotyledonous (e.g. Sunflower)**

(Lectures 07,Marks 04)

4.1 Root

4.2 Stem

4.3 Leaf

Chapter-5: **Primary Structure of Monocotyledonous (e.g. Maize)**

(Lectures 07,Marks 04)

5.1 Root

5.2 Stem

5.3 Leaf

Chapter-6: Comparative Anatomical Study of Dicotyledonous and Monocotyledonous (Lectures 06,Marks 03)

6.1 Root

6.2 Stem

6.3 Leaf

Chapter-7: **Secondary Growth** (Lectures 10,Marks 05)

7.1 Secondary growth in Dicot. Stem e.g.Sunflower.

7.2 Secondary growth in Dicot. Root e.g Sunflower.

7.3 Secondary growth in Monocot. Stem e.g. *Dracaena*.

Reference Books:

Chandurkar, P.J. (1971) Plant Anatomy(3rd Ed.), Oxford and IBH Publishing Co. New Delhi & Bombay, India.

Cutter, E. G. (1971) Plant Anatomy: Experiment and Interpretation Part-II, Organ. Edward Arnold, London, UK.

Daubenmire, R.F. (1974) Plants and Environment,(3rd Ed.) John Wiley & Sons, New York.

David W. Hall and Jason H. Byrd (2012) Forensic Botany – A Practical Guide, Willey – Blackwell.

Eames, A.J. and L.H. McDaniels(1947) An Introduction to Plant Anatomy, (2nd Ed.). McGraw Hill Co. New York, USA.

Esau, K. (1977) Anatomy of Seed Plants (2nd Ed.).John Wiley, New York.

Fahn, A. (1982) Plant Anatomy (3rd Ed.)Pergman Press, Oxford & New York.

Ferguson (2010) Careers in focus: Forensics. Infobase Publishing, New York, USA.

Metcalfe, C.R. and L. Chalk (1950) Anatomy of Dicotyledons. Vol. I-II, Clarendon Press, Oxford.

Pandey, B.P. (1954) Plant Anatomy. S. Chand &Co. (P.)Ltd. New Delhi, India.

Singh, V. Panda, P.C. and D.K. Jain (1998) Anatomy of Seed Plants. Rastogi Publications, Meerut, India.

Subrahmanyam, N. S. (1997) Modern Plant Taxonomy. Vikas Publishing House P. (Ltd.) New Delhi, India.

Tayal, M.S. (1994) Plant Anatomy. Rastogi Publications, Meerut, India.

Vasistha, P.C. (1986) Plant Anatomy. Pradeep Publications, Jalandhar, India.

BOT. 232: PAPER-II: PLANT PHYSIOLOGY

SEMESTER - I (Total Periods 60)

AIMS & OBJECTIVES:

1. To know importance and scope of plant physiology.
2. To study plants and plant cells in relation to water.
3. To study the process of photosynthesis in higher plants with particular emphasis on light and dark reactions, C_3 and C_4 pathways.
4. To study respiration in higher plants with particular emphasis on aerobic and anaerobic respiration.
5. To study movement of sap and absorption of water in plant body.
6. To study the plant movements.

Chapter-1: Introduction (Lectures 02)

1.1 Definition, Scope and Importance

Chapter-2: Plant and Water Relations (Lectures 10,Marks 06)

2.1 Diffusion: Definition, Mechanism of diffusion with suitable example, Graham's Law of diffusion, role of diffusion in plant life and diffusion pressure

2.2 Osmosis: Definition, Types of solution: Hypotonic, Isotonic and Hypertonic, Permeability of membranes, mechanism of osmosis with suitable Osmometer, exo and endosomosis, Plasmolysis and De-Plasmolysis, OP, WP, TP, DPD and its relationship.

2.3 Imbibitions: Definition, Phenomenon of imbibitions, Imbibitions Pressure

Chapter-3: Water Absorption (Lectures 07,Marks 04)

3.1 Importance of water

3.2 Physical and chemical properties of water

3.3. Concept of active and passive absorption

3.4. Osmotic and non-osmotic theory

3.5. Factors affecting water absorption: External and Internal.

Chapter-4: Salt Absorption (Lectures 05,Marks 03)

4.1. Importance of nutrients

4.2 Theories:

(a) Ion exchange:

(i) Contact exchange, (ii) Carbonic acid exchange

(b) Carrier concept: Bennet and Clerk's Theory

4.3 Factors affecting Salt Absorption

Chapter-5: Ascent of Sap (Lectures 03,Marks 02)

5.1 Paths of Solutes

5.2 Theories: (a) Pulsating theory (b) Dixon and Jolly's Theory

Chapter-6: Transpiration (Lectures 08,Marks 06)

6.1 Definition

6.2 Magnitude

6.3 Types of transpiration

6.4 Structure of stomata

6.5. Mechanism of opening and closing of stomata:

(a) Steward's Theory

(b) K^+ Pump Theory

6.6 Factors affecting the rate of transpiration

6.7 Significance of transpiration

Chapter-7: Photosynthesis (Lectures 11,Marks 09)

7.1 Introduction and Definition

7.2. Photosynthetic pigments: Chlorophylls, Carotenoids, Phycobillins and their role.

Two Pigment Systems

7.3. Mechanism of Photosynthesis

(a) Light reaction: Cyclic and non-cyclic Photophosphorylation

(b) Dark Reaction: C_3 and C_4 cycle

7.4. Difference between C_3 and C_4 cycle

7.5. Factors affecting the process of photosynthesis

Chapter-8: Respiration (Lectures 11,Marks 08)

8.1 Introduction and definition

8.2. Types of Respiration: Aerobic and Anaerobic

8.3 Mechanism of Aerobic Respiration

(a) Glycolysis

(b) Kreb's Cycle

(c) ETS

8.4 Anaerobic Respiration: Alcoholic respiration

8.5 Bioillumination

8.7 Factors affecting the process

Chapter-9: Plant Movements (Lectures 03,Marks 02)

9.1 Introduction

9.2 Types:

(a) Tropic movements: Phototropic, Hydrotropic and Geotropic

(b) Tactic Movements: Phototactic, Thermotactic and Chemotactic

(c) Nastic movement: Nyctanastic, Seasmonastic and Thigmonastic

Reference Books:

Amar singh (1977) Practical Plant Physiology.Kalyani Publication, New Delhi, Ludhiyana, India.

Jain, V.K. (1997) Fundamentals of Plant Physiology.S.Chand& Company Ltd. New Delhi, India.

Kochhar, P.L. (1962) A Text Book of Plant Physiology.Atmaram& Sons, NewDelhi, India.

Kumar, A. and S.S. Purohit (1998) Plant Physiology, fundamentals and Application.AgroBotanical, Bikaner, India.

Meyer, B.S. & D.B. Anderson (1952) Plant Physiology.Affiliated East-west Press Pvt.Ltd., New Delhi, India.

Mukharji&Ghose, A.K.(1996) Plant Physiology. Tata Macgraw Hill Publishing company Ltd. New Delhi, India.

Pandey&Sinha (1999) Plant Physiology.Vikas Publishing House Pvt.Ltd. New Delhi, India.

Sarbhai, B.P.(1995) Elements of Plant Physiology. Anmol publication pvt.Ltd., NewDelhi, India.

Srivastava, H.C. (1994) Plant Physiology.Rastogy Publication, Meerut, India.

SundaraRajan (2000) College Botany (Plant Physiology and Molecular BiologyVol.IV Himalaya Publishing House, New Delhi, India.

Varma, V. (1984) Introduction to Plant Physiology.Emkay Publications, New Delhi.

Varma, V. (1995) A Text Book of Plant Physiology and Biochemistry. S.Chand & Company. New Delhi, India.

BOT. 242: PAPER-II: APPLIED BOTANY

SEMESTER - II (Total Periods 60)

AIMS & 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 mushrooms and their nutritional value.
4. To study biofertilizers, their types and cultivation methods
5. To study technique of plant tissue culture and its application.
6. To study the role plants in forensic science.

Chapter-1: Applied Botany (Lectures 02)

1.1 Introduction, Scope and Importance

Chapter-2: Fermentation Industry (Lectures 11,Marks 08)

2.1 Introduction, Definition and Types: Aerobic and Anaerobic

2.2 Microbes involved in fermentation.

2.3 Industrial production of Ethanol, Penicillin w. r. to

i) Pure culture
ii) Substrate
iii) Sterilization
iv) Fermentation
v) Recovery of end product

Chapter-3: Mushroom Cultivation (Lectures 10,Marks 08)

3.1 Introduction

3.2 Edible and Non-Edible Mushrooms

3.3 Nutritional value of Mushrooms

3.4 Important edible Mushroom used for cultivation

3.5 Spawn and spawn making

3.6 Methods of cultivation of

i) *Agaricus* (Button mushroom)
ii) *Pleurotus*(Dhingri mushroom) / *Volvariella* (Paddy straw mushroom)

Chapter-4: Organic Manures and Biofertilizers (Lectures 12,Marks 08)

4.1 Organic Manures:

a) Introduction and importance

b) Types: Compost, Farm Yard Manure and Green manure

4.2 Biofertilizers:

a) Definition and Importance

b) Types of biofertilizers

c) Methods of cultivation of

I) Blue Green Algae. (BGA)

i) Preparation of culture media- De's medium (modified)

ii) Isolation and Inoculation

iii) Mass Cultivation of BGA (G. S. Venkatraman, 1963)

iv) Utilization of BGA in Agriculture

II) *Rhizobium* Culture

i) Isolation from root nodules of Leguminous plants

ii) Pure culture (YEMA Medium)

iii) Mass production

iv) Methods of application in Agriculture

v) Agronomic importance

Chapter-5: Plant Tissue Culture (Lectures 11,Marks 08)

5.1 Introduction and Definition

5.2 Concept of Totipotency

5.3 General steps involved in Plant Tissue Culture:

i) Murashige and Skoog's (M.S). Medium: Composition and Preparation

ii) Explants

iii) Surface sterilization

iv) Inoculation

v) Incubation

vi) Callus formation

vii) Subculture

viii) Organogenesis and formation of plantlet

ix) Hardening

5.4 Application of Plant Tissue Culture in Agriculture, Horticulture and Medicine

Chapter-6: Adulteration in Plant Products (Lectures 11,Marks 06)

6.1 Introduction and Definition

6.2 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

Chapter-7: Forensic Botany (Lectures 03,Marks 02)

7.1 Introduction, Definition, Scope and Importance.

7.2 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 metel* (Datura)

Reference Books:

Atkin, F.C. (1972). Mushroom Growing Today.Faber and Faber Ltd.London, U.K.

Butcher, D. N. and Ingram D.S. (1976). Plant Tissue Culture .Edward Arnold Ltd. London , U.K.

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Kofler, L.A. and Hickey, R.J.(1954). Industrial Fermentations, Vol.I. Chemical Publishing Co. Inc. New York, USA.

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Pathak, Y. G. (1998). Mushroom Production And Processing Technology, Agribios, Jodhapur, India.

Somani, L.L., Bhandari S.C. and K. K. Vyas (1990).Biofertilizers, Scientific Publication, Jodhapur, India.

Street, H.E. (1973). Plant Tissue And Cell Cultures. Blackwell ScientificPublications, Oxford.

SubbaraoN.S. (1995). BiofertilizersIn Agriculture And forestry. Oxfordand IBH publishing Company Pvt. LTd. New Delhi.

Swaminathan M.S. (1991). Biotechnology in Agriculture, A dialogue.Mac Millan India Ltd., Madras, India.

Thomas, E. and DavayM.R. (1975). From Single Cell to Plants.Wykeham Publications London Ltd, U.K.

BOT. 203: BOTANY PRACTICAL COURSE

Based on BOT.-231, BOT.-232, BOT.-241 and BOT.- 242

Practical-1 : A) Study of Leaf Phyllotaxy

B) Study of Inflorescence

Practical-2&3 : Study of Flowers

A) Calyx: Types of calyx

B) Corolla: Forms of Corolla

C) Androecium: Adhesion and Cohesion

D) Gynoecium: Types of Placentation

E) Study of Fruits: Simple, Aggregate and Composite

Practical 5&6 : Study of any four families as per theory syllabus with respect to Morphological characters, floral formula, floral diagram and systematic position. [At least one family from Polypetalae, Gamopetalae, Monochlamydae and Monocotyledonae]

Practica l7 : To determine the DPD by using the potato tuber

Practica l8 : To determine the molar concentration of solution at which incipient Plasmolysis takes place.

Practica l9 : To determine the rate of transpiration by varying

(a) Light intensity

(b) Wind velocity

Practical 10 : To determine the rate of photosynthesis by varying

(a) Light intensity

(b) Light quality

Practical 11&12: Demonstration experiments:

(a) Osmosis by curling experiment

(b) Imbibitions pressure

(c) Thistle funnel

(d) Ringing experiment.

(e) Relative transpiration

(f) CO_2 Necessary for photosynthesis

(g) Kuhen's Tube experiment

(h) Cyclosis in *Hydrilla*

Practical 13 : To study types of vascular bundles (P.S.)

Practical 14 : Study of primary structure in stem of dicot and monocot.

i) Sunflower

ii) Maize

Practical 15 : Study of primary structure in root of dicot and monocot. (P.S.)

i) Sunflower

ii) Maize

Practical 16 : Study of secondary growth in Sunflower and *Dracaena* stem. (P.S.)

Practical 17 : Study of trichome and stomata with the help of locally available material.

Practical 18 : Study of secretory tissue and mechanical tissue system with the help of permanent slides.

Practical 19 Cultivation of *Agaricus/Pleurotus/Volvariella*

Practical 20 : Demonstration

(a) Mass culture of B.G.A. (Venkatraman)

(b) *Rhizobium* culture.

Practical 21 : Principle and working of:

i) Laminar Air flow / Inoculation chamber

ii) Autoclave

Practical 22 : Study of basic techniques of plant tissue culture

i) Preparation of explants

ii) Surface sterilization

iii) Inoculation

Practical 23 : 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. Beverage: Tea and Coffee

Practical 24 : Give botanical name and use of following plant material in forensic science

(a) *Argemone mexicana* (b) *Abrus precatorius*

(c) *Jatropha curcas* (d) *Datura metel.*

Note: P.S.: Permanent slide

N.B. 1. Visit to plant tissue culture laboratories / fermentation industry / mushroom cultivation unit / biofertilizer production unit, etc. is compulsory. Scientific report of the visit should be submitted at the time of practical examination.

2. Botanical excursion and its report is compulsory

3. Duly certified journal is compulsory at the time of practical examination

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FACULTY OF SCIENCE

SYLLABUS FOR

T.Y.B.Sc.

IN BOTANY

To Be Implemented From

Academic Year 2014-15

NORTH MAHARASHTRA UNIVERSITY, JALGAON
CLASS-T.Y.B.Sc.
SUBJECT- BOTANY
PROPOSED OUT LINE OF SYLLABUS W.E.F. JUNE-2014

SEMESTER-I

BOT. 351 Paper I	**:**	**Diversity of Lower Cryptogams**
BOT. 352 Paper II	**:**	**Taxonomy of Angiosperms**
BOT. 353 Paper III	**:**	**Genetics 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	**:**	**Gardening**
BOT.356.3	**:**	**Seed Technology**
BOT.356.4	**:**	**Ethnobotany**

SEMESTER-II

BOT. 361 Paper I	**:**	**Diversity of HigherCryptogams**
BOT. 362 Paper II	**:**	**Gymnosperms & Paleobotany**
BOT. 363 Paper III	**:**	**Plant Breeding**
BOT. 364 Paper IV	**:**	**Plant Biochemistry**
BOT. 365 Paper V	**:**	**Embryology & Palynology**
BOT. 366 Paper VI	**:**	**OPTIONAL (Only One)**
BOT. 366.1	**:**	**Botanical Techniques**
BOT. 366.2	**:**	**Pharmacognosy**
BOT. 366.3	**:**	**Plant Pathology**
BOT. 366.4	**:**	**Horticulture**

(Note: In case of optional papers, only respective number of papers should be selected for both semesters)

PRACTICAL COURSES

BOT. 301 Practical Paper I :	**(Based on Paper I & III)** **i.e. BOT-351, BOT-361, BOT-353, BOT-363.**
BOT. 302 Practical Paper II	**: (Based on Paper II & IV)** **i.e. BOT-352, BOT-362, BOT-354, BOT-364.**
BOT. 303 Practical Paper III :	**(Based on Paper V & VI)** **i.e. BOT-355, and BOT-356.1, BOT-356.2,BOT 356.3,BOT.356.4, and BOT-365, BOT-366.1, BOT-366.2, BOT-366.3and BOT.366.4**

BOT. 351 PAPER- I
DIVERSITY OF LOWER CRYPTOGAMS [60 Periods]
Semester-I

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 importance of cryptogamic plants.

ALGAE (30 Periods)

Chapter 1. Introduction To Algae: **05**

1.1 Definition and aspects of diversity of Algae and its importance.
1.2 General characters of algae.
1.3 Classification of algae up to classes with reasons as per G. M. Smith (1955) giving at least two examples from each class.
1.4 Life cycle patterns: Haplontic, Diplontic and Diplohaplontic.
1.5 Alternation of generations.
1.6 Similarities and differences related to fungi.
1.7 Prokaryotic and Eukaryoticcells of Algae.
1.8 Contribution of Indian Phycologists:
i) Prof. M. O. P. Iyengar
ii) Ella Gonzalves

Chapter 2. Range of ThallusStructure in Algae: **03**

2.1 Unicellular thallus
2.2 Colonial thallus
2.3 Filamentous thallus
2.4 Siphonaceous thallus
2.5 Pseudoparenchymatous
a) Uni-axial thallus
b) Multi-axial thallus
2.6 Parenchymatous thallus

Chapter 3.Origin and Evolution of Sex in Algae **04**

3.1 Definition and methods of reproduction in Algae.
3.2 Origin of sex i.e. origin of gametes
3.3 Evidences for zoosporic origin of gametes.
3.4 Evolution of sex.

Chapter 4. Life Cycle of *Chara* with respect to: **05**

4.1. Systematic position with reasons.
4.2. Occurrence
4.3. Structure of thallus

4.4. Reproduction
a) Vegetative reproduction
b) Sexual reproduction
4.5. Structure and development of sex organs
a) Nucule
b) Globule
4.6. Fertilization and germination of zygote.

Chapter 5. Life Cycle of *Ectocarpus* with respect to: **04**

5.1 Systematic position with reasons
5.2 Occurrence
5.3 Structure of thallus
5.4 Reproduction.
a) Asexual reproduction
b) Sexual reproduction in *Ectocarpussiliculosus.*

Chapter 6. Life Cycle of *Batrachospermum* with respect to: **05**

6.1. Systematic position with reasons
6.2. Occurrence
6.3. Structure of thallus
6.4. Reproduction
a) Asexual reproduction
b) Sexual reproduction
6.5. Structure of sex organs
6.6. Fertilization
6.7. Post-fertilization changes
6.8. Germination of oospores

Chapter 7. Economic importance of Algae: **04**

7.1. Role of algae in relation to:
a) Agriculture
b) Food
c) Fodder
d) Industry: Agar, Alginates and Carragenins
e) Sewage disposal: by oxidation method
f) Origin of Petroleum and gas.
g) Medicines
7.2. Recent trends in algal biotechnology in relation to Single Cell Protein (SCP)

FUNGI (30 Periods)

Chapter 8.An introduction to the Fungi. **04**

8.1. General characters of fungi.
8.2. Classification of fungi up to classes giving reasons as per Ainsworth (1973).
8.3. Contribution of following Mycologists.
i) Prof. E. J. Buttler
ii) Prof. C. V. Subramanian.

Chapter 9. Study of Myxomycotina with respect to: **03**

9.1. Thallus structure
9.2. Types of plasmodia
9.3. Nutrition
9.4. Reproduction
  a) Vegetative and Asexual
  b) Sexual
9.5. Schematic representation of life cycle of *Stemonitis*.

Chapter 10. Life Cycle of *Albugo* with respect to: **04**

10.1 Systematic position with reasons
10.2 Habit and Habitat
10.3 Structure of mycelium.
10.4 Reproduction
  a) Asexual
  b) Sexual
10.5 Schematic representation of life cycle of *Albugo*

Chapter11. Life Cycle of *Penicillium* with respect to: **05**

11.1 Systematic position with reasons.
11.2 Habit and Habitat
11.3 Structure of mycelium
11.4 Reproduction
  a) Asexual
  b) Sexual
11.5 Schematic representation of life cycle of *Penicillium*
11.6 Economic importance of *Penicillium.*

Chapter 12. Life Cycle of *Pucciniagraminis-tritici* with respect to: **06**

12.1. Systematic position with reasons.
12.2 Five spore stages: Spermatia, Aeciospores, Urediospores, Teleutospores andBasidiospores
12.3. Schematic representation of life cycle of *Pucciniagraminis-tritici*
12.4. Control and forecasting measures
12.5. Wheat rust problem in India.

Chapter 13. Study of Deuteromycotina with respect to: **03**

13.1. Salient features
13.2. Reproduction and fruiting bodies

Chapter 14. Study of Lichens: **02**

14.1. General characters,
14.2. Types
14.3. Importance.

Chapter 15. Economic Importance of Fungi: **03**

15.1. Role of fungi in relation to:
15.2 Medicine
15.3 Food and fodder.
15.4 Soil fertility

15.5 Plant pathology
15.6 Mycoses
15.7 Biodeterioration
15.8 Fermentation Industry

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BOT.352:PAPER-II
TAXONOMY OF ANGIOSPERMS[60 Periods]
Semester-I

AIMS and OBJECTIVES:

1. To study origin of Angiosperms with respect to Age and Probable ancestors.
2. To study Pre-Darwinian and Post- Darwinian systems of Classification.
3. To study various Angiospermic Families emphasizing their morphology, Biology, Phylogeny and interrelationship.
4. To study functions and Botanical features of Botanical gardens.
5. To know role of Anatomy, Embryology and Palynology in Taxonomy.

Chapter1.SystemsofPlantClassification 10

1.1 ConceptofPre-Darwinian
- i) System based on habit
- ii) Sexual system
- iii) System based on forms -relationship

1.2 Post-Darwiniansystems
- i) Theory of evolution
- ii) School of thoughts
- a) Rannelian School: Hutchinson'ssystem. (Outline merits and demerits)
- b) Englerian School: Engler and Prantl's system(Outline merits and demerits)

1.3 Comparisonbetween Engler&Prantl'sandHutchinson'ssystem

Chapter2.StudyofAngiospermicFamilies 30

2.1 (SensuBenthamandHooker'ssystemofclassification)
Studyof followingfamilies w.r.t geographicaldistribution, vegetative andfloralcharacters,distinguishingfeatures,floralformula,andeconomicimportance.

1. Annonaceae
2. Crucifereae [Brassicaceae]
3. Tiliaceae
4. Rutaceae
5. Caesalpinaceae
6. Mimoceae
7. Myrtaceae
8. Cucurbitaceae
9. Compositeae[Aseraceae]
10. Sapotaceae
11. Asclepiadaceae
12. Convolvulaceae
13. Acanthaceae

14. Labiate (Lamiaceae)
15. Nyctaginaceae
16. Casuarianaceae
17. Orchidaceae
18. Amaryllidaceae
19. Scitaminae: Musaceae
20. Graminae (Poaceae)

2.2. Points of Biological and Morphological interest**.**

1) Asclepiadaceae
2) Convolvulaceae
3) Casuarinaceae
4) Orchidaceae

Chapter3.Origin of Angiosperms: 08

3.1 Time , Place and origin of angiosperms

3.2 Probable ancestors of angiosperms

a) Pteridospermales
b) Bennettitales
c) Gnetales

Chapter4.BotanicalGardens: 05

4.l. DefinitionandfunctionsofBotanicalgardens

4.2. Botanicalfeaturesofthefollowing:

a)NationalBotanicalgarden–Lucknow.
b)IndianBotanicalgarden– Kolkata.
c)RoyalBotanicalgarden- Kew(England)

Chapter5.Herbarium: 05

5. l. Definitionandfunctions

5.2. Herbarium techniques

Chapter6ModernTrendsinTaxonomy: 05

6.1 Roleoffollowing:

a) Cytology(number and morphology of chromosomes)
b) Anatomy (stomata, trichomes andxylem elements)
c) Palynology (number and types of aperture , exine stratification)

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BOT. 353: PAPER- III
GENETICS AND MOLECULAR BIOLOGY [60 Periods]
Semester-I

AIMS and OBJECTIVES:

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 study the scope and importance of molecular biology.
5. To study the biochemical nature of nucleic acids, their role in living systems, experimental evidences to prove DNA as a genetic material.
6. To understand the process of synthesis of proteinsand role of genetic code inpolypeptide formation.
7. To study the concept of gene, its classical nature, comparison with modern approach.
8. To understand organization of nucleic acids in prokaryotes and eukaryotes.

GENETICS(30 Periods)

Chapter 1. Mendelian Genetics: **07**

- 1.1 Historical background.
- 1.2 Mendel's work -Monohybrid and Dihybrid Ratio
- 1.3 Mendel's Laws:
  - a) Law of dominance
  - b) Law of segregation.
  - c) Law of independent assortment.
- 1.4 Deviation from Mendel's laws (Neo-Mendelism):
  - a) Duplicate dominant gene (15:1)
  - b) Duplicate gene with cumulative effect(9:6:1 ratio)
  - c) Epistasis (13:3 ratio).

Chapter 2. Multiple Alleles: **03**

- 2.1 Concept, characters and examples.
- 2.2 Multiple alleles in blood groups in human being.
- 2.3 Sterility genes in *Nicotiana.*

Chapter 3. Linkage and Crossing over: **06**

- 3.1 Concept and history of linkage
- 3.2 Detection of linkage from F_2 data
- 3.3 Process of crossing over
- 3.4 Types of crossing over :single, double and multiple
- 3.5 Chromosome mapping by three point test cross

Chapter 4. Population Genetics: **06**

- 4.1 Hardy-Weinberg's law of genetic equilibrium.
- 4.2 Factors affecting the equilibrium in population.
  - i) Migration
  - ii) Mutation
  - iii) Selection
  - iii) Genetic drift

Chapter 5. Chromosomal aberrations and mutations: **08**

5.1 Structural changes in chromosomes – Addition, deletion, duplication,inversion andtranslocation

5.2 Numerical changes in chromosomes – Euploidy, Aneuploidy.

5.3 Gene mutations- concept, mutagens- U.V., I. R. and chemical.

MOLECULAR BIOLOGY (30 Periods)

Chapter 6.Introduction to molecular biology. **05**

6.1. Historical background.

6.2. Scope and importance.

6.3 Concept of Cell cycleand types of cell division

Chapter 7. Nucleic Acids: **10**

7.1. Evidences for DNA as a genetic material - Griffith's and Avery'sexperiments (Transformation).

7.2. Molecular Model of DNA (Watson and Crick's Model)

7.3. Forms of DNA : A-DNA, B-DNA and Z-DNA

7.4. Types of DNA replication-: Conservative, Dispersive andSemi conservative

7.4 Meselson and Stahl's experiment.

7.5. Mechanism of DNA replication: Initiation of replication, replication fork, RNA- primer, Semi-discontinuous replication, Okazaki fragment, enzyme involved in replication.

7.6 Types of RNA: r-RNA, m-RNA, t-RNA, clover leaf model.

Chapter 8. Genetic Code and Protein Synthesis: **07**

8.1. Concept of genetic code.

8.2. Properties of genetic code.

8.3. Components involved in protein synthesis.

8.4. Central dogma of molecular biology.

8.5. Mechanism of protein synthesis.

a) Transcription

b) Translation

Chapter 9. Modern Concept of Gene: **04**

9.1 Introduction

9.2 Exon, intron, splicing of transcripts

9.3 Concept of citron, recon, muton and replicon

9.4 Current concept of gene and pseudo-gene.

Chapter 10. Gene Regulation in Prokaryotes: **04**

10.1 Operon concept.

10.2 Inducible operon – Lac operon.

10.3 Repressible operon- Tryptophan operon.

REFFERENCE BOOKS:

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BOT. 354 PAPER-IV
ADVANCED PLANT PHYSIOLOGY [60 Periods]
Semester-I

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 fat metabolism under primary metabolism of plants.

Chapter 1. Mineral Nutrition and Absorption of Minerals: 12

1.1 General role of mineral elements in plants, Micro and Macroelements:

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.

Chapter 2. Plant Growth and Development: 13

2.1. Introduction, Definitions of growth, Development and Differentiation.

2.2. Introduction and roles of following phytohormones.

a) Auxins
b) Gibberellins
c) Cytokinins
d) Ethylene
e) Abscisic Acid.

2.3. Factors affecting growth.

Chapter 3. Physiology of Flowering: 10

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. Fat Metabolism : 08

4.1. Introduction
4.2. Synthesis of fatty acids
4.3 α and β-oxidation
4.4. Relevance of fat metabolism in germination.

Chapter 5. Nitrogen Metabolism: 10

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

Chapter-6. Photorespiration: 07

6.1 Introduction
6.2 Metabolism of Photorespiration
6.3 The photorespiratory cycle.
6.4 Significance of Photorespiration
6.5 Differences between dark respiration and photorespiration

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BOT:-355 :PAPER-V.
PLANT ECOLOGY AND PHYTOGEOGRAPHY [60 Periods]
Semester-I

AIM AND BJECTIVES:

1: To know scope and importance of the discipline.
2: To study the ecological techniques.
3: To know about plant communities.
4: To know about conservation of natural resources, Energy and Pollution.
5: To study botanical regions of India.
6: To study vegetation types of Maharashtra.

PLANT ECOLOGY (50 Periods)

Chapter 1Introduction: **02**

Definition, scope and importance of ecology, Branches of ecology

Chapter 2Phytosociology: **05**

2.1 Introduction,definition
2.2 Qualitative characters-
Physiognomy,Phenology,Periodicity,AspectionandStratification.
2.3 Sampling techniques of population:
i)Quadrat method-:a) List b) List count c) Chart.
ii) Point method.
2.4 Quantitative characters-:
a) Frequency b)Density c) Abundance.
2.5 Raunkiaer`s law of frequency and Frequency diagram.

Chapter 3 Community dynamics: **06**

3.1 Succession: Definition, Causes,and , types.
3.2 Evolution of plant communities.
3.3 Process ofSuccession:Xerosere, Hydrosere. Climax concept:
Monoclimax,Polyclimax,
3.4 EcologicalNiche.

Chapter 4Ecological adaptations: **05**

Adaptation to water-:Hydrophytes, Xerophytes, Mesophytes and Amphibiousplants withRespect to peculiar characters with examples.

Chapter 5Ecosystems: **06**

5.1 Concept and kind (Natural and Manmade).
5.2 Components of natural ecosystem.
5.3 Natural-Pond ecosystemand Manmade-crop land ecosystem.
5.4 Food Chain, Food webs, andHomeostasis.
5.5 Ecological pyramids and Energy relations.
5.6 Effect of man on naturalEcosystem.

Chapter 6Natural Resources and their conservation. **05**

6.1 Introduction
6.2 Types of natural resources
6.3 Concept and necessity of conservation.
6.4 Biodiversity. In-situ and Ex-situ conservation.

Chapter 7-Energy Conservation. **07**

7.1 Sources of energy :Conventional and Non-conventional energy
7.2 Conventional sources of energy:
- a) coal
- b) oil
- c) natural gas
- d) thermal power
- e) firewood
- f) hydropower
- g) Nuclear power

7.3 Non-conventional sources of energy :
- a) solar energy
- b) wind energy
- c) Tidal energy
- d) Biomass based energy

7.4 Prospective alternatives for energy:
- a) Petro plants,
- b) Biogas.

Chapter 8Pollution **05**

8.1 Concept and definition
8.2 Kinds and causes of pollution
8.3 Study of air, water, soil pollutionWith reference to causes, hazards andremedial measures.
8.4 Green house gasses andGreen house effect.

Chapter 9Biogeochemical cycles. **04**

9.1 Elements and their distribution
9.2 The cycling process
9.3 Biogeochemicalcycles:Characteristic features of biogeochemical cycles.
9.4 Types:
a) Gaseous nutrient cycles-Carbon,Oxygen and Nitrogen cycle.
b) Sedimentarynutrient cycle.

Chapter10 Bioremediation: **05**

10.1 Introduction needand scope of bioremediation
10.2 Phytoremediation:-
- a) Recovery of heavy metals from soil.
- b) Reclamation of industrial waste andmunicipal waste water.

PHYTOGEOGRAPHY(10 Periods)

Chapter11 Phytogeography: **04**

11.1 Main Botanical Regions of India.

11.2 Detailedstudyof vegetation types in Maharashtra.

Chapter12EcologicalIndicators: **03**

12.1 Introduction

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

Chapter13 Endemism. **02**

Causes and Types,

Chapter 14Biogeography. **01**

Dispersal: Barriers andmeans of dispersal.

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BOT.- 356.1 PAPER-VI [OPTIONAL PEPR-I]
PLANT BIOTECHNOLOGY [60 periods]
Semester-I

AIMS AND OBJECTIVE :

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. Introduction **02**

1.1. Definition, Scope and importance.
1.2. Biotechnology in India.

Chapter 2.Equipments: Structure, Principle, Working and Uses of the following: **06**

2.1 Autoclave
2.2 Laminar Air FlowCabinet
2.3 pH Meter
2.4 Centrifuge
2.5 Spectrophotometer
2.6 Hot air oven.

Chapter 3. Plant Tissue Culture: **06**

3.1 Significance and scope of plant tissue culture.
3.2 Differentiation andtotipotency in plants.
3.3 Nutritional Media-tissue nutrition. Conventional and liquid media.
3.4 Preparatory steps for tissue culture-selection of explants and sterilization.
3.5 *In situ* transfer of tissue and maintenance of plants.

Chapter 4. Types of Culture-Tools and Techniques: **06**

4.1 Tissue culture of specialized plant materials (Anthers, Pollens, Protoplast, and somatic hybridization, Embryo and Endosperm culture).
4.2. Indirect organogenesis- Callus culture, types and morphological nature of callus.
4.3. Micro propagation
4.4. Advantage, limitations and application of micro propagation.
4.5. Germplasm conservation and cryopreservation
4.6**.** Production of synthetic and artificial seeds.

Chapter 5 . Commercial production o banana/ sugarcane by micro propagation/tissueculture **08**

5. 1 Selection of mother plant
5.2 Initiation

5.3 Multiplication
5.4 Elongation and rooting
5.5 Primary and secondary hardening
5.6 Marketing

Chapter 6. Fermentation Technology: 08

6.1. Principles of microbial growth.- Batch culture, continuous culture,synchronous culture
6.2. Microbes involved, substrates, Fermentation process, optimum conditions,product recovery, flow sheet and uses of the following:
a) Citric Acid
b) Vinegar
c) Antibiotics- Penicillin
d) Vitamins (B-complex)

Chapter 7. Biomass and Bioenergy: 08

7.1 Biomass as a source of energy
7.2 Composition of Biomass
7.3 Biomass conversion into energy
a. Non-biological methods- Pyrolysis, Gassification,Liquification.
b. Biological methods- Aerobic and anaerobic digestion.
7.4 Biogas production
7.5 Biofuels
7.6 Petrocrops

Chapter 8. Single cell Protein (SCP): 06

8.1 Microorganisms used in SCP
8.2 Production of SCP, *Spirulina* and Yeast
8.3 Nutritional value of SCP
8.4 Advantages of SCP

Chapter 9. Genetic Engineering: 10

9.1 History and development of genetic engineering- milestone.
9.2 Restriction endonucleases. – Types, naming systems, mode of action.
9.3 Vectors for gene cloning- Types, plasmids, cosmids, Bacteriophages.
9.4 *Agrobacterium tumefeciens* vectors (Octopine and Nopalin Plasmids)
9.5 Gene cloning in prokaryotes- out line, procedure.
9.6 Isolation of gene of interest.
9.7 Insertion of isolated gene into the vector.
9.8 Transformation.
9.9 Selection of transformed cell.

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BOT. 356.2: PAPER VI [OPTIONAL PAPER-II]

GARDENING[60 periods]

Semester-I

AIMS and OBJECTIVES:

1. To know the concept of garden.
2. To study the different characters of garden.
3. To know about regular activities in gardening.
4. To study the different ornamental garden plants.
5. To study about the techniques of Pot culture, Bonsai, Topiary, Lawn, Rockery.

GARDENING

Chapter 1. Introduction: **05**

- 1.1 Definition of garden and gardening
- 1.2 Importance of garden
  - a) Aesthetic
  - b) Academic
  - c) Economic
- 1.3 Types of Garden:
  - a) Formal garden
  - b) Informal garden
  - c) Botanical garden
  - d) Special types of garden :
    - i) Vertical Garden
    - ii) Bog or Marsh Garden
    - iii) Roof garden

Chapter 2. Planning of Gardens: **07**

- 2.1. Consideration of following in planning:
  Originality in planning, variety and surprise, color scheme, fragrance,privacy, comfort and flexibility.
- 2.2. Study of physical, structural and biological features of the gardens such as
  - a) Fences
  - b) Hedges and borders
  - c) Paths and avenues
  - d) Arches and Pergolas
  - e) Water garden
  - f) Rockery
  - g) Lawns
  - h) Green house

Chapter 3. Soil Management: **07**

- 3.1 Soil: Nature and types
- 3.2 Manures:

a) Bulky organic manures-Compost and composting, Vermi-compost,Green manures, Farm Yard Manure (FYM)
b) Concentrated organic manures-Liquid manures

3.3 Fertilizers (N, P, K)
3.4 Agrochemicals: Insecticides, Pesticides and Fungicides
3.5 Irrigation techniques

Chapter 4. Garden Tools and Implements: **03**

4.1 Implements: Sickle, Trowel, Rake, Hoe, Secateurs, Prunning sheers,Grafting and budding knife.
4.2 Uses and maintenance of following:
a) Budding and grafting knife
b) Mower
c) Sprayer

Chapter 5. Indoor Gardening: **03**

5.1 House plants for indoor gardening and characters of indoor plants.
5.2 Selection of house plant and popular indoor plants.
5.3 Maintenance of indoor plants.
5.4 Hanging baskets

Chapter 6. Pot Culture: **03**

6.1 Containers
6.2 Selection of plants
6.3 Potting and repotting
6.4 Maintenance and importance

Chapter 7. Bonsai Technique: **04**

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

Chapter 8. Study of Ornamental Plants: **09**

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

Chapter 9. Topiary: **03**

9.1 Introduction
9.2 Selection of plants
9.3 Methods / Training
9.4 Importance

Chapter 10. Lawns: **04**

10.1 Preparation of soil
10.2 Selection of grasses

10.3 Planting methods
10.4 Maintenance and after care
10.5 Importance.

Chapter 11. Garden Operations: **05**

11.1 Preparation and importance of seed beds and seed pans
11.2 Collection and sowing of seeds
11.3 Seedling transplantation
11.4 Transplantation of large tree
11.5 Preparation of pits
11.6 Pruning and Mulching

Chapter 12. General account of pests and diseases in garden plants with respect to Pathogen , host, symptoms, damage and control**.** **02**

Chapter 13. Floriculture Industries (Dry flowers): **05**

13.1 Introduction
13.2 Indian market of Dry flowers
13.3 Selection of Materials
13.4 Techniques of drying
i) Air drying (in shade)
ii) Sun drying
iii) Press drying
iv) Oven drying
v) Micro-wave oven drying
13.5 Dried plant products in Indian market
13.6 Storage and care.

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BOT. 356.3: PAPER-VI (OPTIONAL PAPER-III)

SEED TECHNOLOGY(60Periods:)

Semester- I

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.

Chapter 1. Seed: **04**

1.1. Definition
1.2. Development of seed
1.3. Functions of parts of seed

Chapter 2. Seed Technology: **04**

2.1. Definition
2.2. Role and goals of seed technology in crop production

Chapter 3. Seed Dormancy: **04**

3.1. Causes of seed dormancy.
3.2. Methods of breaking the seed dormancy

Chapter 4. Principles of Quality Seed Production: **04**

4.1. Stage of Seed Multiplication
4.2. Seed purity, Genetic purity.

Chapter 5. Methods of certified seed production: **04**

5.1. Isolation
5.2. Seed inspection
5.3. Rouging

Chapter 6. Types of cultivars (variety): **04**

Composite, synthetic, Hybrid, Role of producer,
Seed production agencies.

Chapter 7. Harvesting-: Drying, Processing, seed sampling: **02**

Chapter 8. Seed testing: **04**

8.1 Physical purity.
8.2 Genetic purity
8.3 Seed viability and vigour test

Chapter 9. Seed Law and Seed Certification: **03**

Seed certification agency - Structure, role and duties.

Chapter 10. Seed Deterioration: **02**
Causes and remedial measures.

Chapter 11. Seed storage, pest and diseases of seed, seed aging: **01**

Chapter 12.Marketing agencies, planning and economics of seed production: **02**

Chapter 13. Seed processing and packing: **04**

SEED PATHOLOGY

Chapter 14.Seed pathology: **03**
14.1 Introduction
14.2 Significance of seed borne diseases.

Chapter 15. Types of micro-organism associated with seeds and diseases caused by them: **04**

Chapter 16. Location of seed borne inoculum and seed infection: **04**
16.1 Factors affecting the seed infection
16.2 Longevity of seed borne diseases.

Chapter 17. Control of seed borne pathogens: **03**

Chapter 18. Quarantine and post-entry quarantine: **04**

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1. Agrawal R. L. (1980) Seed Technology, Oxford and IBH Publication Co. New Delhi, India.
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BOT. 356.4: PAPER-VI (OPTIONAL PAPER-IV)
ETHNOBOTANY [60 Periods]
Semester-I

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: 04

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: 04

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: 04

1. Pawara
2. Bhil
3. Kokani
4. Thakur
5. Katkari

Chapter 4. Study of Ethnobotany of plants from Indian region used against: 20

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) Eye complaints: Improving eye sight and curing diseases.
g) Healing wound: Cuts, Bruises, Sprains, Fracture.
h) Skin diseases: Boils, Burns, Sores, Piles,
i) Urinary diseases
j) Diabetes

k) Antifertility agents
l) Contraceptives
m) Antivenom

Chapter 5. Veterinary Diseases: **04**

5.1. Diarrhoea and Dysentery
5.2. Foot and Mouth disease
5.3. Maggot's infected sores
5.4. Yoke galls
5.5. Bone fracture

Chapter 6. Monographic Studies: **04**

Monographic studies based on Individual plant and tribe:

a) *Madhuca longifolia* (Mahua)
b) Ethnobotany of Mikirs of India.

Chapter 7. Ethnobotany of North Maharashtra: **05**

w.r.t. Botanical Soures and administration

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

Chapter8. Abstract Relationship: w.r.t. plant/parts used, family, people/tribe concerned with themes and quotations of the following: **05**

A. a. Folksongs
b. Folk proverbs
c. Plants motifs
B. a. Sacred plants
b. Sacred groves with special reference to Maharashtra
c. Plants used to in festivals

Chapter 9. Plants and parts used for following purposes **05**

9.1. House construction:
a) Doors and Windows
b) Walls
c) Roofs
d) Thatching
e) Furniture
9.2. Basketry
9.3. Toys
9.4. Musical instruments
9.5. Agricultural implements
9.6. Fencing
9.7. Fibers

Chapter 10. Beyond inventorying: **05**

10.1. Indigenous Biotechnology:
a) Ranu tablet
b) Leather technology in relation to reptile skin technology

10.2. Jaggery extraction
10.3. Biodiversity acts, Bioprospecting and Ethnobotany
10.4. Kitchen gardens

REFERENCE BOOKS :

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2. Jain, S.K. (Ed) (1995) A Manual of Ethnobotany (IInd Ed.) Scientific Publishers, Jodhpur, India.
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BOT. 361: PAPER-I

DIVERSITY OF HIGHER CRYPTOGAMS (60 Periods)

Semester-II

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 importance of cryptogamic plants.

BRYOPHYTES (30 Periods)

Chapter 1.Introduction: **06**

1.1. General characters of Bryophyta
1.2. Classification of Bryophyta up to classes giving reasons with at least two examples of each class as per G. M. Smith (1955).
1.3. Alternation of generation in Bryophytes.
1.4. Contribution of Indian Bryologists.
   a) Prof. Shiv Ram Kashyap
   b) Prof. B. P. Pandey

Chapter 2. Life History of *Marchantia* with respect to: **06**

2.1. Systematic position, habit and habitat
2.2. External and internal morphology of gametophytes.
2.3. Reproduction-Vegetative and sexual.
2.4. Structure of sex organs.
2.5. Fertilization,
2.6. Structure and development of sporophyte,
2.7. Dehiscence of capsule and dispersal of spores,
2.8. Structure and germination of spores

Chapter 3. Life History of *Anthoceros* with respect to: **06**

3.1. Systematic position, habit and habitat
3.2. External and internal morphology of gametophytes.
3.3. Reproduction-Vegetative and sexual.
3.4. Position and Structure of sex organs.
3.5. Fertilization,
3.6. Structure and development of sporophyte,
3.7. Dehiscence of capsule and dispersal of spores,
3.8. Structure and germination of spores
3.9. Evolutionary features of sporangium is to be emphasized.

Chapter 4. Life History of *Polytrichum* with respect to: **06**

4.1. Systematic position, habit and habitat
4.2. External and internal morphology of gametophytes.
4.3. Reproduction-Vegetative and sexual
4.4. Position and structure of sex organs.

4.5. Fertilization,
4.6. Structure of sporophyte,
4.7. Dehiscence of capsule and dispersal of spores,
4.8. Structure and germination of spores

Chapter 5.Economic importance of Bryophytes: **02**

Chapter 6. General topics **04**

6.1. Evolution of Bryophytic Gametophytes according to Regressive and Progressivetheories.
6.2 Evolution of Bryophytic sporophytes according to the Theory of sterilization and Theory of reduction.

PTERIDOPHYTES (30 Periods)

Chapter 7. Introduction: **06**

7.1. General characters of Pteridophytes.
7.2. Classification of Pteridophytes upto classes giving reasons with at least two examples of each class according to Prof G. M. Smith.
7.3. Contribution of Indian Pteridologists.
  a) S. S. Bir / Sporne K. R.
  b) N. S. Parihar

Chapter 8. Life History of *Psilotum* with respect to: **06**

8.1. Systematic position,
8.2. Habit and habitat
8.3. External morphology of sporophyte
8 4. Internal morphology of sporophyte
8.5. Reproduction, vegetative and asexual
8.6. Morphological nature of synangium.
8.7. Dehiscence of synangia
8.8. Structure and germination of spores,
8.9. Structure of mature gametophyte (Prothallus),
8.10. Structure of mature male and female sex organ.
8.11. Fertilization.
8.12. Development and structure of embryo.
8.13. Alternation of generation.

Chapter 9. Life History of *Lycopodium* with respect to: **06**

9.1. Systematic position,
9.2. Habit and habitat
9.3. External morphology of sporophyte.
9.4. Internal morphology of sporophyte.
9.5. Reproduction. –Vegetative and Asexual
9.6. Position and structure and dehiscence of sporangium.
9.7. Structure and germination of spores.
9.8. Structure of gametophyte
9.9. Structure of mature sex organs.
9.10. Fertilization.

9.11. Development and structure of embryo.
9.12. Protocorm and its morphological nature
9.13. Alternation of generation.

Chapter 10. Life History of *Marsilea* with respect to: 06

10.1. Systematic position,
10.2. Habit and habitat
10.3. External andinternal morphology of sporophyte,
10.4. Reproduction,
10.5. External and internal morphology of sporocarp,
10.6. Morphological nature and dehiscence of the sporocarp.
10.7. Structure of microspore and megaspore.
10.8. Structure of male and female gametophytes
10.9. Fertilization
10.10. Development and structure of embryo,
10.11. Alternation of generation,

Chapter 11.Economic importance of Pteridophytes: 02

Chapter 12. General topics: 04

12.1. Stellar Evolution in pteridophytes
  a) Concept,
  b) Types – (i) Protostele, (ii) Siphonostele, (iii) Solenostele
  c) Evolution of steles.
12.2. Heterospory and seed habit in pteridophyta.

REFFERENCE BOOKS:

BRYOPHYTES and PTERIDOPHYTES

1. Ganguli, H.G. and A.K.Kar (2001) College Botany Vol. 11 Books and Allied Press, Ltd.Kolkata, India
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BOT. 362 Paper II
Gymnosperms and Paleobotany [60 periods]
Semester-II

AIMS AND OBJECTIVES:

1. To study Gymnosperms with respect to distinguishing characters, comparison with Angiosperms, 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 (35 Periods)

Chapter 1. Introduction: **07**

1.1. Distinguishing features of the group.
1.2. Comparison of Gymnosperms with Angiosperms.
1.3. Economic importance of Gymnosperms.
1.4 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
2.9. Seed: structure and germination
2.10. Alternation of generation

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 generation.
3.11. Resemblance with Angiosperms.

PALEOBOTANY (25 Periods)

Chapter 4. Introduction **03**

4.1 Definition and scope of Paleobotany
4.2 Contribution of Birbal Sahani in Paleobotany.

Chapter 5. Fossils: **10**

5.1 Definition
5.2 Fossilization process
5.3 Condition favorable for fossilization.
5.4. Geological time scale.
Eras, Periods, Epochs, general and nomenclature of fossils.
Major plant fossils located in India.
5.5. Types of fossils: Impression, Compression, Petrifaction,
Cast, Coal ball, Amber

Chapter 6. Study of the following fossil groups w.r.t morphology and structure:12

6.1. Psilopsida- *Rhynia*
6.2. Lycopsida: i) *Lepidodendron* ii) *Lepidostrobus*
6.3. Sphenopsida: i) *Calamites* ii) *Annularia*
6.4. Pteridopsperm: *Lyginopteris oldhamia* (stem)
6.5. Bennettitales: *Cycadeoidea* (flower)
6.6. Angiosperm- Petrified wood (dicot), *Rhizopalmoxylan*

REFFERENCE BOOKS:

GYMNOSPERMS:

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2. Datta, S. C. (1998) Systematic Botany. 4th edition, New Age International Pvt. Ltd. New Delhi. India
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9. Norman, F. Hughes 1976 Paleobotany of Angiosperms origin, Cambridge University Press, Cambridge, London, U.K.

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BOT.363 PAPER- III
PLANT BREEDING [60 Periods]

AIMS AND OBJECTIVES:

1. To introduce the student with science of plant breeding
2. To introduce the student with branch of plant breeding for the survival of human being from starvation.
3. To study the techniques of production of new superior crop verities.

Chapter 1.Introduction: **02**

1.1 Definition, Principles, aims, objectives, scope and importance.

Chapter 2. Mode of Reproduction in Relation to Breeding Methods: **03**

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

Chapter 3. Variation: **04**

3.1 Definition, measurement
3.2 Types and causes of variation.

Chapter 4.Crop improvement Methods. **03**

4.1 Plant introduction and acclimatization
4.2 Selection
4.3 Hybridization
4.4 Mutation breeding

Chapter 5. Introduction: **04**

5.1 Plant Introduction centers of origin of crop plants and Acclimatization purposes.
5.2 Functions of plant introduction agencies.
5.3 Procedure, Purpose, Merits and Demerits of Introduction

Chapter6. Selection: **06**

6.1 Definition, Procedure, Merits and Demerits of the following.
a) Mass Selection
b) Pure line Selection
c) Recurrent Selection
d) Clonal Selection

Chapter 7. Hybridization: **07**

7.1 Definition and Types of Hybridization
7.2 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

Chapter 8. Male Sterility **3**

8.1 Genetic male sterility
8.2 Cytoplasmic male sterility
8.3 Genetic Cytoplasmic male sterility
8.4 Use of male sterility in hybrid seed production

Chapter 9.Methods of Hybridization : **10**

9.1 Improvement in Self and Cross Pollinated Crops through Hybridization
9.2 Procedure Merits and Demerits of the Following Methods
a) Pedigree method
b) Bulk method
c) Back cross method
d) Single cross
e) Double cross
f) Synthetic cross

Chapter 10. Heterosis: **03**

10.1 Definition and History.
10.2 Effects of Hybrid Vigor.
10.3 Causes of Heterosis.
10.4 Utilization and Limitations.

Chapter 11. Mutation Breeding: **05**

11.1 Definition and Types of Mutation.
11.2 Classification of Mutagens.
11.3 Processes of Mutation, Gama Garden.
11.4 Application of Mutation Breeding.
11.5 Merits and demerits.

Chapter 12.Polyploidy. **03**

12.1 Role of Polyploidy in crop evolution. E.g. Wheat,*Raphano brassica*, Nicotiana.
12.2 Utilization of Allopolyploidy in Plant Breeding.
12.3 Utilization of Autopolyploidy in Plant Breeding.

Chapter 13. Breeding for Disease and Insect Resistance. **04**

13.1 Mechanism of disease development.
13.2 Nature of disease resistance.
13.3 Causes of disease resistance.
13.4 Sources of disease resistance.
13.5 Merits and demerits.

Chapter 14. Improved Seed Production and Certification **03**

14.1 Importance of quality seed in agriculture
14.2 Plant variety testing
14.3 Seed quality control
14.4 Seed certification- purpose and minimum standards

REFERENCE BOOKS:

1. Agrawal, R.L. (1998) Fundamentals of Plant Breeding and Hybrid seed production. Oxford and IBH Publishing Co. New Delhi, India.
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3. Breeding Crops Plants by Hayes H.K., Shree Publishers.
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12. Singh, B. D. (2006) Plant Breeding: Principles and Methods. Kalyani Publishers, New Delhi.
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BOT.- 364 PAPER- IV

PLANT BIOCHEMISTRY [Periods 60]

Semester-II

AIMS and OBJECTIVE:
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

Chapter-1.Biochemistry: **04**

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

Chapter-2 – Biomolecules **12**

2.1 Carbohydrates: Definition classification and biological importance's of carbohydrates.
- a) Mono-, di- and tri- saccharides of biological importance.
- b) Polysaccharides and mucopolysaccharide of biological importance

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 with physiological importance

2.3 Amino acids, peptides and proteins: Definition. Classification and properties of amino Kids, essential and nonessential amino acids with physiological importance.
- a) Peptides - Definition of peptide bond Structure and function of peptides of biological significance
- b) Proteins - Classification, physico-chemical properties, structure [primary and secondary]

Chapter-3. Plant Secondary Metabolites: **14**

Definition, characteristics (source, structure, general properties,) of:-

a) Tannins	b) Lignin	c) Phenolics
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 Biophysicochemical Techniques: 14

5.1 Principle and application of ultra filtration, Vacuum evaporator, distillation assembly and soxhlet apparatus

5.2 Spectrophotometer and colorimeter: Beer's and Lambert's law and its significance.

a) Principle and working of a simple colorimeter.

b) Principle and application of UV-VIS spectrophotometry.

5.3 **Isotopes in Biochemistry:** Measurement of radioactivity: principle and application, Auto radiography, Application of radioisotopes in biochemistry.

5.4 Electrophoresis: Principle, types and applications

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

Chapter-6 .Biosensors: 10

6.1 Concept of biosensors, biochips,biofilms and biosurfactents

6.2 Types of biosensors- conventional and microbial.

6.3 Environmental, medical and industrial applications of biosensors

REFERENCE BOOKS:

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2. Rastogi, S.C (1993), Biochemistry –., Wiely Eastern ltd, Pune Second Edition.
3. Stryer Lubert Biochemistry –, W.H. freeman and co , New York , fourth edition.
4. Agrawal G.R and Agrawal R.A., Krishna (1998-99)Text book of biochemistry – Prakashan media (p) ltd, Meerat
5. Satyanaragana U., (2004)Biochemistry- book and allied pub. ltd, kolkato, , second edition.
6. Jain J.L., Jain Sanjay., Jain Nitin (2005)Fundamentals of biochemistry –., S. Chand and company ltd, New Delhi, First multi colour edition
7. Nelson,D.L. and M.M.Cox (2005),Lehninger's Principle of Biochemistry, Publisher David N.Nelson, Michael Cox, edition fourth.
8. Agraval, (19989-1999), textbook of Biochemistry, Krishna Pakashan, edition tenth.
9. Satyanarayana, U.and U.Chakrapani (2006), textbook of Biochemistry, third edition
10. Price,N.C. and Stevens (2000) Fundamentals of Enzymology, edition
11. Frifielder, .D, W.(1983) Physical biochemistry- H.Freeman and Co. New York,
12. Holmes and H.Peck Analytical biochemistry-, academic press, New York.
13. Wilson and Goulding Biophysical technique-, ELBS edition, latest edition.
14. Upadhyaya and Upadhyaya and Nath Biophysical chemistry (principle and technique) – Himalaya Pub. Nagpur, latest edition.

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BOT. 365: PAPER-V

EMBRYOLOGY AND PALYNOLOGY[60 Periods]

AIMS and OBJECTIVES:

1. To know scope and importance of Embryology and palynology.
2. To study structure and development in microsporangium and megasporangium.
3. To study microsporogenesis and megasporogenesis.
4. To study male and female gametophytes.
5. To study fertilization, endosperm ,embryo formation and polyembryony.
6. To study structure of pollen morphology and aerobiology
7. To study interdisciplinary approaches of palynology

EMBRYOLOGY (40 Periods)

Chapter 1. Definition and Scope: **01**

Chapter 2. Microsporangium: **05**

Structure of tetrasporangiate anther, anther wall, tapetum, tapetum types, sporogenous tissue.

Chapter 3. Microsporogenesis and Development of Male Gametophyte: **06**

3.1 Microsporogenesis- Meiosis in spore mother cells, Cytokinesis (Successive and Simultaneous type), Types of pollen tetrad.

3.2 Structure and development of male gametophyte

Chapter 4. Megasporangium (Ovule): **09**

4.1 Structure andTypes of Ovules- Orthotropous, Anatropous, Amphitropous, Campylotropous, Circinotropous.

4.2 Megasporogenesis and Development of Female Gametophyte (Embryo Sac):

a. Megasporogenesis
b. Deveopment of female gametophyte (Embryo sac): Structure of typical (8 nucleated) embryo sac, Types of embryo sac- monosporic *(Polygonum)*, bisporic (*Allium)*and tetrasporic (*Peperomia)*

Chapter-5. Pollination: **02**

5.1 Introduction , Definition

5.2 Pollination through various agencies:

a) Anemophily
b) Entamophily
c) Hydrophily
d) Ornithophily
e) Cheiropterophily

Chapter 6. Fertilization: **05**

6.1 Entry of Pollen tube into the Ovule: Porogamy,Chalazogamyand Mesogamy

6.2 Discharge of pollen tube contents in embryo sac, fusion of gametes-syngamy and triple fusion.
6.3 Significance of double fertilization.

Chapter 7. Polyembryony: 04
7.1 Definition
7.2 Causes of Polyembryony
7.3 Classification of Polyembryony

Chapter 8. Endosperm: 02
8.1 Types- Nuclear, Cellular, Helobial.
8.2 Ruminate endosperm

Chapter 9.Embryo:
9.1 Embryo development in dicot- *Capsella bursa- pastoris* in monocot- *Sagittaria***04**

Chapter 10. Role of Embryology in Taxonomy: 02

PALYNOLOGY (20 Periods)

Chapter 11. Introduction : **02**
Definition, Scope and Importance of Palynology

Chapter 12. PollenMorphology: 05
12.1 Structure of Microspore/ Pollen
12.2 Polarity,Symmetry,Shape and Size of Pollen
12.3 Apertures Types-a-Simple b- Compound
12.4 NPC Classification
12.5 Pollenwall Features- Sporoderm Stratification and Sculpturing

Chapter 13.Pollen Viability and Storage: 04
13.1 Pollen viability,factors affecting viability
a) Pollen Cytology
b) Humidity,Temp.
13.2 Pollen storage- Short and Long term storage
13.3 Significance of storage of Pollen grains

Chapter 14.Aerobiology and Pollen Allergy : 05
14.1. Aeropalynological Survey in India and Abroad
14.2. Determination and quantification of aeroallergens:
a) Sampling methods
b)Gravity sedimentation method
c) Filtration
d) Precipitation

Chapter 15. Interdisciplinary Approaches of Palynology 04
15.1 Mellistopalynology
15.2 Forensic palynology
15.3 Paleopalynology

15.4 Palynotaxonomy
15.5 Aerobiology and Pollen Allergy

REFERENCE BOOKS:
EMBRYOLOGY AND PALYNOLOGY

1. Bhattacharya, Kashinath,Manas Ranjan Majumdar and Swati Gupta Bhattacharya(2006) A Text Book Of Palynology, New Central Book Agency (P) Ltd. Kolkata.
2. Bhojawani, S.S. and S.P. Bhatnagar (2011) The Embryology of Angiosperms,Vikas Publication House (P) Ltd., New Delhi, India
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8. Pandey, B.P (2009) A Text Book of Botany Angiosperms, S.Chand and Company Ltd. New Delhi, India
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11. Shivanna, K. R. and Johri B.M. (1985) The Angiosperm Pollen : Structure and Function, Wiley Eastern Ltd., New York, USA
12. Pandey S. N. and A Chadha (2006 Reprint) Plant Anatomy and Embryology, VikasPublishing House Pvt Ltd.New Delhi.

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BOT. 366.1: PAPER- VI (OPTIONAL-I)

BOTANICAL TECHNIQUES [60 Periods]

Semester – II

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.

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

Chapter 2. Stains and staining: 08

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 3. Study of Different Instruments: 10

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

Chapter 4 Microtomy: 08

(A) Killing and Fixing of Material.

a) Collection of material.
b) Types of Fixative
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 5. 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 emersion.

5.5 Measurements.

Chapter 6. Culture Techniques: 10

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 7. 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 8.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 9. Spectrophotometry: 02

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

Chapter 10. General principles of Biophysical Chemistry Instruments 04

10.1 pH Meter
10.2 Centrifuge

REFFERENCE BOOKS:

BOTANICAL TECHNIQUES:

1. Aneja, K,R. (1996) Experiments in Microbiology, Plant Patholc Tissue Culture and Mushroom Cultivation (IInd Ed,) Wishwa Prakasn New Delhi, India.
2. Dwivedi, J.N. and R.B.Singh (1990). Essentials of Plant Techniques ,ScientificPublishers, Jodhpur, India
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7. V. K. Sharma.(1991) – Techniques in microscopy and cell Biology, Tata Mc Graw HillPublishing Co. Ltd. New Delhi.
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9. Sadasivan, Manicum "Biochemical analysis" New age Publication, New Delhi.
10. De Robertis and De Robertis 2005 (8^{th} Edition), Cell and Molecular Biology.
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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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BOT. 366.2 PAPER-VI (OPTIONAL-II)

PHARMACOGNOSY [60Periods]

AIMS AND OBJECTIVES:

1. To know history, scope and importance of Pharmacognosy.
2. To study classification, cultivation, collection and processing of plant drugs.
3. To study morphology, botanical and chemical characterization and analytical methods of crude drugs.
4. To prepare Ayurvedic recipes.
5. To make student aware about biopiracy and legislation about medicinal Plants.

Chapter 1. Introduction of Pharmacognosy: **08**

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

Chapter 2. Classification of Plant Drugs: **08**

- 2.1 Taxonomical, morphological, chemical, therapeutic and alphabetical
- 2.2 Chemical nature of crude drug:
- 3.3 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: **08**

- 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 aduleration and types of adulterants
5.2 Methods of drug evaluations in brief
a. Morphological
b. Microscopic
c. Chemical
d. Physical
e. Biological

Chapter 6. Preparation of following Ayurvedic medicines with respect to Botanical source, part used and method of preparation : 06

6.1 Triphala churna
6.2 Sukhsarak Vatti (triphala+sonamukhi+Jire+Ajwon)
6.3 Kumariasav
6.4 Arjunarishtha (Aristha)
6.5 Maka Telam (*Eclipta Alba*)

Chapter 7. Botanical source, distribution, botanical characterization of drug constituents and uses of the following drugs: 10

7.1 Root drug:
a) *Asparagus racemosus* (Shatavari)
b) *Withania somnifera* (Ashwagandha)
7.2 Rhizome:
a) *Zingiber officinale* (Adrak)
b) *Curcuma domestica* (Halad)
7.3 Stem bark drug:
a) *Holarrhena pubescens* (Dudh kuda)
b) *Teminalia arjuna* (Arjun sadada)
7.4 Stem drug:
a) *Tinospora cordifolia* (Gulvel)
b) *Acacia Catechu* (Black Catechu)
7.5 Leaf drug:
a) *Adathoda zeylanica* (Adulsa)
b) *Lawsonia inermis* (Hena)
7.6 Fruit drug:
a) *Terminalia bellerica* (Behada)
b) *Terminalia chebula* (Hirda)
7.7 Entire plant:
a) *Ocimum sanctum* (Tulasi)
b) *Mentha spicata* (Pudina)

Chapter 8.Drug Ethics: 04

8.1 Biopiracy of medicinal plants from India
8.2 Drug legislation and patenting

REFERENCE BOOK:

1. Jeffery, B. and Harborn. Photochemical Methods: A guide to Modern Techniques of Plant analysis. Springer, 1998.
2. Khandelwal, K.R. Practical Pharmacognocy, Pragati Books Pvt. Ltd.

3. Kokate, C.K. Purohit A.P. and GokhaleS.B. Pharmacognocy (degree), Nirali Prakashan.
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7. Daniel, M. Chemotaxonomy –
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BOT. 366.3: PAPER- VI: [Optional paper-III]

PLANT PATHOLOGY [60 Periods]

AIMS AND OBJECTIVES:

1. To know scope and importance of plant pathology.
2. To know the terminologies in plant pathology
3. To study the causes of plant diseases.
4. To study the control measures of plant diseases

Chapter 1. Introduction: **04**

1.1. Scope and importance, historical account of plant pathology.

1.2. Work of the following pathologists:

a)	Theophrastus	b)	Prevost
c)	De-Bary	d)	Butler
e)	Mundkur,	f)	K.C.Mehta

Chapter 2. Terminology: - Define following: **03**

Disease, Pathogen, Host, Parasite, Pathogenecity, Immune, Inoculum, Innoculum Potential, Penetration, Infection, Systemic infection, Pathogenecity, Pathogenesis, Etiology, Incubation period , Disease cycle, Symptoms, Epidemology.

Chapter 3.Causes of Plant diseases: Introduction: **05**

3.1. Animate causes - A brief survey of diseases caused by the following organisms with examples of each- Bacteria, Viruses, Fungi, Nematodes and Mycoplasma.

3.2. Inanimate causes - A brief survey of diseases caused by:

a) Adverse climatic conditions such as high and low temperature
b) Unfavorable intensity of light
c) Excess water.
d) Deficiency and excess of minerals.
e) Chemical injuries caused by atmospheric pollutants,
f) Faulty applications of fungicides insecticides, and weedicides

Chapter 4. Inoculum dispersal: Introduction and definition: **04**

4.1. Active or Autonomous dispersal-Soil, Seeds, Plants.

4.2. Passive dispersal-

a)	Wind	b)	Water
c)	Insects	d)	Fungi
e)	Nematodes	f)	birds
g)	mammals	h)	man

Chapter 5. Development of Diseases (Pathogenesis): **04**

Introduction, inoculum potential

a). Landing of inoculum on the host,

b). Penetration: modes of penetration of viruses, bacteria, fungi and nematodes.

c) Mechanism of penetration.

I) Indirect penetration:

i) Through wounds

ii) Through natural openings – stomata, hydathodes and lenticels

II) Direct penetration-

i) Break down of structural barriers

ii) Break down of chemical barriers.

Chapter 6. General Principles of Disease Control: 13

6.1. Preventive therapy:

a) Avoidance of the pathogen
b) Exclusion of inoculum
c) Eradication
d) Protection
e) Disease resistance

6.2. Curative therapy

6.3. Mechanical control-

a) Choice of geographic area
b) Selection of field
c) Proper time of sowing
d) use of disease escaping variety
e) Selection of seed planting stock
f) high budding.

6.4. Control through cultural practices:

a) Crop rotation
b) Mixed cropping
c) Removal and destruction of diseased plants and plant organs.
d) Rouging
e) Destruction of alternate and collateral host.

6.5. Field sanitation :

a) Destruction of crop residue
b) Deep ploughing
c) Improved soil drainage system
d) Flooding and fallowing
e) Depth of sowing of seeds
f) Heat and uses of chemicals

Chapter 7. Legal control: 02

7.1 Introduction
7.2 Plant Quarantine - Definition, limitations and importance
7.3 Plant Quarantine Organization in India.

Chapter 8. Biological Control: 02

8.1 Introduction, definition, biocidaland biostatic control
8.2 Methods:

a) Organic amendment of soil with organic matter

b) Predaceous fungi method.

8.3 Mechanism: a) Exploitation b) Antibiosis c) Competition

Chapter 9. Chemical Control: **10**

9.1. Introduction, importanceand different types

9.2. Classification of chemicals according to their:

a) Mode of action: eradicants, protectants, chemotherapeutants.

b) Nature of pathogen against which used.

9.3. Chemicals used in plant diseases control, mode of action and uses :

a) Sulphur:

i. Inorganic-Sulphur powder, Wettablesulphurand Lime sulphur.

ii. Organic- Dithiocarbamates

b) Copper : Bordeaux mixture. Burgundy mixture, Copper oxychloride

c) Mercury :

i. Inorganic-Mercuric choride-($HgCl_2$), Mercurous Chloride(Hg_2Cl_2)

ii. Organic - Ceresan, Agrosan, Aresan

d) Heterocyclic nitrogen compounds: i. Captan. ii. Glyodin

e) Antibiotics: Introduction, definition, mode of action.
i. Streptomycin, ii. Tetracycline iii. Griseofulvin

Chapter 10. Control Through Disease Resistance : **03**

10.1 Use of resistant varieties, difference between disease escape, disease tolerance and disease resistance.

10.2. Development of resistant varieties:

a) Selection b) Hybridization c) Mutation

Chapter 11. Study of following diseases with respect to causal organism, symptoms and control measures; **10**

Animate Diseases:

a) Viral diseases: TMV/PXV

b) Bacterial diseases: Citrus canker

c) Fungal diseases:

i. Damping of seedling

ii. Powdery mildew of Teak/ Sisoo /Grapes

iii. Downy mildew of bajara (Green year disease of bajara)

iv. Ergot of bajara

v. Loose smut of wheat

vi. Tikka disease of groundnut

vii. Red rot of sugarcane

d) Mycoplasma diseases: Little leaf of brinjal

e) Nematodal diseases: Root knot of vegetables.

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BOT. 366.4 Paper VI :[Optional Paper-IV]

HORTICULTURE[60 Periods]

AIMS AND OBJECTIVES:

1. To know horticulture, its scope, importance and its disciplines.
2. To know the horticultural zones of India and Maharashtra
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 poly-houses in horticulture.
6. To study production technology, harvesting 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: **05**

- 1.1 Historical background
- 1.2 Definition, scope and importance
- 1.3 Horticultural zones of India and Maharashtra
- 1.4 Export and import potential of horticultural crops.
- 1.5 Different disciplines of horticulture
  - a) Pomology,
  - b) Olericulture
  - c) floricutlre
  - d) ornamental horticulture
  - e) Landscap horticulture

Chapter 2. Propagation of Horticultural Plants: **03**

- 2.1 Sexual propagation: Advantages and disadvantages
- 2.2 Asexual propagation:
  - i) Methods in brief
  - ii) Advantages and disadvantages

Chapter 3. Cutting: **03**

- 3.1 Definition
- 3.2 Methods of cutting:
  - i) Stem cutting: Softwood cutting, Hardwood cutting
  - ii) Leaf cutting
  - iii) Root cutting

Chapter 4. Layering: **03**

- 4.1 Definition
- 4.2 Methods of layering:
  - i) Simple layering
  - ii) Compound layering
  - iii) Serpentine layering
  - iv) Air-layering or Gootee

Chapter 5. Grafting: **03**

- 5.1 Definition
- 5.2 Methods of grafting:
  - i) Whip grafting
  - ii) Wedge grafting

iii) Tongue grafting

Chapter 6. Budding: **03**

6.1 Definition

6.2 Methods of budding

i) 'T' Shape budding

ii) Patch budding

Chapter 7. Training and Pruning of Plants: **05**

7.1 Definition

7.2 Difference between training and pruning

7.3 Objectives of training and pruning

7.4 Advantages of training and pruning

Chapter 8. Bahar Treatment: **03**

8.1 Definition, importance and principles

8.2 Types of Bahar (Methods not expected)

i) Ambe Bahar

ii) Mrig Bahar

iii) Hasth Bahar

Chapter 9. Production technology of some important horticultural Crops w.r.t: **09**

Commercial varieties, climate, soil, cultivation practices, pest and disease management, nutrition and water requirement, harvesting, processing, extraction of active ingredients, marketing:

a) Grapes

b) Tomato

Chapter 10. Preservation of Fruits and Vegetables: **15**

10.1 Introduction, importance and scope 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, Onions, 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, salts, vinegar or preservation by food additives i.e. chemical preservatives: citric acid, potassium metabisulphite, sodium benzoate, sulphur dioxide

ii) Drying, Dehydration and concentration of fruits and vegetables

iii) Ionizing radiations

10.3 Preparation of preserved products

a) Mix fruit jam

b) Wood apple or guava jelly

c) Lemon/ Orange squash

d) Tomato ketchup

e) Ready to serve (RTS)

f) Fruit syrup (sharbat)

g) Candy

Chapter 11:- Polyhouse and green hose technology with reference to Ornamental Horticulture **08**

11.1. Scope and Importance

11.2. Types of structure

a) Greenhouse
b) Conservatory
c) Polyhouse
d) Glass house
e) Plastic tunnel.

11.3. Constraction of Various structure – materials, requirements and cost.

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PRACTICAL PAPER-I [BOT. 301]

Based on BOT.-351, BOT.-353 BOT.361 and BOT.-363

LOWER CRYPTOGAMS

1. Study of life cycle of *Chara.*
2. Study of life cycle of *Ectocarpus.*
3. Study of life cycle of *Batrachospermum*.
4.&5 Study of range of thallus structure in algae with the help of materials or permanent slides:
   a) Unicellular thallus-*Chlamydomonas*, *Chlorella*.
   b) Colonial thallus –*Pandorina, Eudorina, Volvox. Hydrodictyon*
   c) Filamentous thallus - *Pithophora, Chaetophora, Coleochaetae, Stigeoclonium*, *Drapanaldia, Fritscheilla and Oedogonium.*
   d) Siphonaceous thallus -*Vaucheria. Caulerpa*
   e) Pseudoparenchymatous (Uniaxial/Multiaxial) thallus – *Batrachospermum, Polysiphonia*.
   f) Parenchymatous thallus -*Ulva, Enteromorpha*
6. Study of life cycle of *Albugo*
7. Study of life cycle of *Penicillium* sp.
   a) Mycelial structure
   b) Conidial phase
   c) Cleistothecium (P.S.)
8. Study of life cycle of *Puccinia graminis-tritici*: All stages.
9. Study of Myxomycetes-: *Stemonitis*
   Deuteromycetes – *Cercospora/ Alternaria* andLichens :any one form

[GENETICS AND MOLECULAR BIOLOGY]

10 A] Mitosis :squash technique. [any suitable material- root tips]
   B] Meiosis: Smear technique [Flower buds]
   C] Polytene chromosome [P.S.]
11 Isolation of DNA from suitable plant material
12 Solving of problems on monohybrid and dihybrid cross.

[HIGHER CRYPTOGAMS]

13. Study of life cycle of *Marchantia.*
14. Study of life cycle of *Anthoceros*.
15 . Study of life cycle of *Polytrichum*.
16 . Study of life cycle of *Psilotum* (P.S. and Specimens)
17 . Study of life cycle of *Lycopodium*.
18&19 Study of life cycle of *Marsilea*.
20. Study of types of Steles in Pteridophytes-P.S.

[**PLANT BREEDING]**

21. Floral biology in Self Pollinated and Cross Pollinated Species.

(i) Factors promoting self pollination(By demonstration Flower/Photograph)
   - Bisexuality (Hermaphroditism)---------- (Wheat, Rice)
   - Cleistogamy----------(Wheat, Rice)
   - Homogamy----------(Tomato, Lady's finger)

(ii) 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)

22 Techniques of Hybridization in Self Pollinated and Cross Pollinated Crops.

23 Estimation of heterosis (i) Standard heterosis
(ii) Mid- Parent heterosis
(iii) Useful or Economic heterosis

24 Pollen viability test by (i) Aceto-Carmine method
(ii) Sugar solution method

Note: Study tour is compulsory. Students are expected to submit detailedscientific tour report. (Algae, Fungi, Bryophyta and Pteridophyta).

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PRACTICALPAPER –II [BOT-302]

Based on BOT.-352, BOT.- 354, BOT.- 362, BOT.-364

[ANGIOSPERM TAXONOMY]

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

6 Identification of genera and species by using any plant flora

7 Prepare an artificial key (indented or bracketed) based on vegetative and floral characters

[ADVANCE PLANT PHYSIOLOGY]

8 Qualitative assessment of microelements in plant ash (P, K, Mg, Mn, Ca, Na,)

9&10 Separation of amino acids from germinating seeds by ascending paper chromatography.

11 Study of lipase activity in germinating seeds.

12 Effect of hormone on germinating seeds.

[GYMNOSPERMS]

13&14 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 (stained preparation)
iv) Morphology of male cone – L. S. Permanent slide
v) Morphology of female cone – L. S. Permanent slide
vi) study of pollen grains.
vii) V. S. of mature ovule(Permanent slide)

15&16 Study of *Gnetum* with the help of Permanent slide/ specimen.

i) External morphology
ii) T. S. of stem
iii) T. S. of leaf
iv) Secondary growth in the stem of *Gnetum ula*
v) Morphology of male cone – L. S.
vi) Morphology of female cone – L. S.
vii) V. S. of mature ovule

[PALEOBOTANY]

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

18&19 Study of the following with the help of slides and/ or specimens.

i) *Rhynia* ii) *Lepidodendron*
iii) *Lepidostrobus* iv) *Calamites*
v) *Annularia* vi) *Lyginopteris*
vii) *Cycadeoidea* viii) *Rhizopalmoxylon*

[BIOCHEMISTRY]

20 Biochemical tests for:
a) Carbohydrate b) Proteins c) lipids

21 Bichemical tests for
a) Tanins b) Alkaloids c) Phenols

22 To study the enzyme activity [amylase]

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

24 Isolation of lipids from oil seeds by using soxhlet apparatus.

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PRACTICAL PAPER-III [BOT.-303]

Based on BOT.- 355, BOT.- 356.1/BOT.- 356.2/BOT.- 356.3 / BOT.- 356.4 BOT.- 365, BOT.- 366.1/BOT.- 366.2/BOT.- 366.3 / BOT.- 366.4

PLANT ECOLOGY AND PHYTOGEOGRAPHY

1. To determine the minimum size of the quadrate by 'species area curve method'.
2. To study the vegetation by list count quadrate method. Calculate the frequency classes and plot a graph.
3. Study of soil with reference to soil texture, water holding capacity, pH, and test for carbonate, nitrate, and sulphate.
4. 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

5&6. Measurement of water .quality based on hardness. Dissolved oxygen, free CO_2, Chloride, total alkanity.

BOT. 316.1 :(PLANT BIOTECHNOLOGY)

7. Principle, Working and uses of following equipments:
   - a) Autoclave
   - b) Laminar air flow
   - c) pH meter
8. Principle, Working and uses of following equipments:
   - a) Centrifuge
   - b) Spectrophotometer
   - c) Hot air oven
9. Preparation of M.S. medium
10. Embryo Culture of Maize
11. Citric acid Fermentation and Bioassay
12. Observation ,studyand importance of following.
    - i) Spirulina
    - ii) Rhizobium
    - iii) Azatobacter
    - iv) Jatropha

BOT. 316.2: (GARDENING)

7. Techniques of pot culture.
8. Observation, listing and uses of various garden tools, manures and fertilizers.
9. Preparation and aftercare of a Bonsai.
10. Study of different indoor plants and preparation of hanging basket.
11. Study of different ornamental plants such as annuals, shrubs, climbers, Palms, cycads, ferns, ornamental grasses and Bamboos(two examples of each) with respect to Botanical name, ornamental value and place of choice.
12. 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) Hanging basket
   ii) Bonsai
   iii) Potted-indoor plan

BOT. 326.3 : SEED TECHNOLOGY andSEED PATHOLOGY

7. Physical purity test
8. Germination test (Maize and Ground nut)
9. Seed moisture test.
10. Seed viability test. (Tetrazolium test andferric chloride for legume seeds)
11. Detection of seed microflora.
12. Seed processing, grading, packing.

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

BOT.356.4 : (ETHNOBOTANY)

7to12 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:
   i. Tubers.
      a) *Dioscorea bulbifera* (Kadu Kand)
      b) *Pueraria tuberosa* (Bhui kohala)
   ii. Leaves .
      a) *Chenopodium murale* (Chil)
      b) *Amaranthus spinosa* (Kateri Matla)
      c) *Amaranthus viridis* (Matla)
      d) *Rivea hypocrateriformis* (Phangola)
   iii. Fruits :
      a) *Diospyros melanoxylon* (Tembrun)
      b) *Morinda pubescens* (Al, Ali)
      c) *Meyna laxiflora* (Aliv)
   iv Seeds:
      a) *Indigofera glandulosa* (Zhunja)
      b) *Sterculia urens* (Kadai)
      c) *Holoptelea integrifolia* (Papada)

B) Beverages. Flowers:
   Madhuca longifoia (Mahu)

C) Oil yielding : Seeds :
   Madhuca longifoia (Mahu, Tolambi)

D) Fiber yielding :Stem :
   Helicteris isora (Murud Sheng)

E) Bidi Wraper : 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)

G) Gum yielding:
a) *Anogeiossus latifolia* (Dhawada)
b) *Sterculia urens* (Kadai)

H) Fish Poison: Stem Bark:
a) *Holoptelea integrifolia* (Papada)
b) *Lannea coromandelica* (Modhal)

I) Cloth washing: Fruits :
a) *Balanites aegyptiaca* (Hingenbet)

J) Ethnomedicine
i. Anti-dysentery
a) Fruit - *Helicteris isora* (Murud Sheng)
b) Fruit - *Cassia fistula* (Bahava)
c) Stem Bark - *Holarrhena pubescens* (Kuda)
ii. Skin diseases
a) Seed oil - *Psoralea corylifolia* (Bavachi)
b) Fruit - *Pongamia pinnata* (Karanj)
c) Stem Bark -*Azadirachta indica* (Neem)
iii. Bronchitis and Asthma:
a) Leaves - *Achyranthus aspera* (Aghada)
b) Fruit - *Solanum virginianum* (Bhuiringni)
c) Fruit - *Terminalia bellerica* (Behada)
iv. Rheumatism
a) Leaves – *Vitex negundo* (Nirgudi)
b) Leaves - *Cassia auriculata*(Awali)
c) Stem Bark -*Azadirachta indica* (Neem)
v. Tonic in Anaemic condition :
a)Stem - *Tinospora cordifolia* (Gulvel)
b)Root tuber - *Chlorophytum borivilianum* (Safed Musali)
c) Root tuber - *Asparagus racemosus* (Shatavari)
vi. Miscellaneous: Household utensils:
a) Fruit - *Lagenaria siceraria* (Dhudhi)

K) Musical Instruments:
a) Stem - *Bambusa arundinacea* (Bamboo) or *Bambusa vulgaris* (Kath-Bamboo)

EMBRYOLOGY AND PALYNOLOGY

13. Study of Microsporangium (P.S.)
14. Study of different types of ovules (P.S.)
15. Study of different types of pollen grains with help of Chitaley technique (Any suitable materials)
16. Study of germination of pollen grains (Any two suitable materials)
17. Mounting of embryo stages (Any locally available material)

BOT. 366.1: BOTANICAL TECHNIQUES:

18. Study of botatnical instruments (Any four) as per theory.
19to21 Microtomy of any suitable material.
22 Maceration of vascular tissues.
23-24 Calibration of microscope and measurement of spore.

BOT. 326.2 :PHARMACOGNOSY:

5&6 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)
c. Gulvel (Tinospoa cordifolia)

7 and 8. Preliminary photochemical screening for the powder drug of following (any three)

a. Root – Shatavari (*Asparagus racemosus*)
b. Rhizome- Adruk (*Zizngiber officinalis*)
c. Fruit- Beheda (*Terminalia belerica*)
d. Leaf – Adulsa (*Adathoda zeylenica*)
e. Bark – Dudhkuda (*Holarrhelaena pubscens*)

8 and10 Preparation of following drug (any two)

a. Triphala Churna
b. Sukhsarakwati
c. Kumari asav
d. Arjunarisht
e. Maka telum

BOT. 326.3 : (PLANT PROTECTION)

25-29 Study of the following plant diseases with reference to the causal organism,symptoms, nature of damage and control measures

1. Tobacco mosaic virus
2. Yellow vein mosaic of papaya
3. Citrus canker.
4. Powdery mildew.
5. Whip smut of sugarcane
6. Tikka disease of groundnut
7. Red rot of sugarcane
8. Root knot of vegetables.

30. Preparation of Bordeaux mixture/Burgundy's mixture and application on diseasedplant and observation of its effects.

BOT.326.4 :HORTICULTURE

18. Study of Garden Tools and Equipments
19. Study of Propagation- i) Media ii) Containers iii) Potting Iv) Reportting
20. Study of Propagation merthods by
    a. Cutting
    b. Layering
21. Study Propagation methods by
    a. Budding
    b. Grafting
22. to 24 Preparation and Preserved food products
    a. Mix fruit jam
    b. Wood apple or Guava jelly
    c. Lemon / Orrgange Squash
    d. Tomato Ketchup
    e. Reedy to serve – R.T. S./ Juices.

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Note: Students of T. Y. B. Sc. Class after completion of their graduation degree in Botany may get jobs in following industries and departments/ sectors

1. Seed production companies
2. Research laboratories related with biological sciences
3. NEERI, NCL, NIO, DRDO
4. Oil seed companies
5. Sugarcane, Cotton and textile industries
6. Forensic laboratories
7. NBPGR [National bureau of plant genetic recourses]
8. BSI [Botanical survey of India]
9. Museum and Herbarium Curator
10. Paleobotanical institutes
11. R & D Department of various NGO's
12. Department of Forest and Environments
13. Biofertilizer companies
14. Gardening and Horticulture agencies
15. SelfEmployment: Garden landscaping, bonsai flowers arrangement nursery development, event management.
16. Food and food preservation industries.
17. Plant tissue culture industries
18. Herbal cosmetic industries
19. Mushroom industries
20. Perfumeries
21. Fermentation industries
22. Social forestry
23. West land developments department
24. Pharmaceutical and Antibiotic industries
25. Production of bioenergy and Petrocrops development.

EQUIVALANCEOF PAPERS

SEMESTER-I

Paper	*Code*	*New*	*Paper*	*Code*	*Old*
I	BOT.351	Diversity of Lower Cryptogams	I	BOT.351	Cryptogams-I
II	BOT.352	Taxonomy of Angiosperms	II	BOT.352	Angiosperms Taxonomy
III	BOT.353	Genetics and Molecular Biology	III	BOT.353	Genetics and Plant Breeding
IV	BOT.354	Advanced Plant Physiology	IV	BOT.354	Molecular Biology
V	BOT.355	Plant Ecology and Phytogeography	V	BOT.355	Plant Ecology and Phytogeography
VI.	Optional [Anyone]		VI.	Optional [only one] Respective No. of Paper	
VI (a)	BOT.356.1	PlantBiotechnology	VI (a)	BOT.356.1	Gardening
VI.(b)	BOT.356.2	Gardening	VI.(b)	BOT.356.2	Botanical Techniques
VI(c)	BOT.356.3	Seed Technology	VI(c)	BOT.356.3	Plant Biotechnology
VI(d)	BOT.356.4	Ethnobotany			

SEMESTER-II

Paper	*Code*	*New*	*Paper*	*Code*	*Old*
I	BOT.361	Diversity of Higher Cryptogames	I	BOT.361	Cryptogams-II
II	BOT.362	Gymnosperms and Paleobotany	II	BOT.362	Gymnosperms and Paleobotany
III	BOT.363	Plant Breeding	III	BOT.363	Plant Physiology
IV	BOT.364	Plant Biochemistry	V	BOT.365	Plant Protection
V	BOT.365	Embryology and Palynology	IV	BOT.364	Plant Anatomy Embryology and Palynology
VI.	Optional [Anyone]		VI.	Optional [only one] Respective No. of Paper	
VI (a)	BOT.366.1	Botanical Techniques	VI (a)	BOT.366.1	Ethnobotany
VI.(b)	BOT.366.2	Pharmacognosy	VI.(b)	BOT.366.2	Pharmacognosy and Medicobotany
VI(c)	BOT.366.3	Plant pathology	VI(c)	BOT.366.3	Seed Technology and Seed pathology
VI(d)	BOT.366.4	Horticulture			

NORTH MAHARASHTRA UNIVERSITY,

JALGAON

(NAAC Re-Accredited)

"A" Grade

FACULTY OF SCIENCE

SYLLABUS FOR

F.Y.B.Sc. (BOTANY)

To Be Implemented From

Academic Year 2015-16

SEMESTER- I

PAPER-I

BOT:111 Bacteria, Viruses and Algae

PAPER-II

BOT:112 Plants for Human Welfare

PRACTICAL COURSE BOT:113

BASED ON BOT. 111, BOT.112

SEMESTER - II

PAPER-I

BOT:121 Fungi, Lichens and Plant Pathology.

PAPER-II

BOT: 122 Industrial Botany

PRACTICAL COURSE BOT: 123

BASED ON BOT.121, BOT.122

SEMESTER-I

F.Y.B.Sc. BOTANY

PAPER-I BOT.111. BACTERIA, VIRUSES AND ALGAE

(Total Lectures : 48)

OBJECTIVES

i. To study the diversity among Bacteria, Viruses and Algae.
ii. To study systematic, morphology and structure, of Bacteria, Viruses and Algae.
iii. To study the life cycle pattern of Bacteria, Viruses and Algae.
iv. To study the useful and harmful activities of Bacteria, Viruses and Algae .

Chapter-1. Bacteria **12L**

1.1 Introduction and General Characters.

1.2 Classification of Bacteria on the basis of morphology

1.3 Nutrition- Autotrophic and Heterotrophic

1.4 Structure of Bacterial Cell

1.5 Gram positive and Gram negative Bacteria

1.6 Reproduction - Asexual and Sexual (Conjugation)

1.7 Economic Importance of Bacteria - useful and harmful activities

1.8 Study of Bacterial diseases w.r.t. causal organism, symptoms and control measures of

i) Citrus canker ii) Black arm of Cotton

Chapter-2. Viruses **12L**

2.1 Introduction and Discovery of Viruses.

2.2 The Nature of Viruses. (living & nonliving)

2.3 Ultra structure and chemical composition

2.4 Types of viruses on the basis of shapes

2.5 Bacteriophages

2.6 Reproduction of Bacteriophages- Lytic cycle and Lysogenic cycle

2.7 Study of viral diseases w.r.t. causal organism, symptoms and control measures of

i) Yellow vein mosaic disease of Lady's finger ii) Leaf curl of Tomato

Chapter- 3 Algae **10L**

3.1 Introduction and General Characters of algae

3.2 Thallus structure of algae

3.3 Reproduction- Vegetative, asexual and sexual

3.4 Economic importance of algae in

i. Agriculture ii. Industries iii. Medicine

iv. Energy Production

Chapter-4 Classification of algae **4 L**

4.1 Classification of algae according to G. M. Smith (1955) up classes with reasons giving at least two examples from each class.

Chapter-5 Study of life cycle of S*pirogyra* **5 L**

5.1 Systematic position

5.2 Thallus structure

5.3 Reproduction: Vegetative and Sexual (conjugation)

Chapter-6 Study of life cycle of *Sargassum* **5 L**

6.1 Systematic position

6.2 Thallus structure (external & internal)

6.3 Reproduction: Vegetative and Sexual.

6.4 Structure of male and female conceptacles.

6.5 Alternation of Generations

Reference Books:

Agrwal, S. B. and Srivastav (1985)Modern Text Book of Botany Vol. I Algae, Fungi, Bacteria Viruses and Lichen, Universial Publication, Agra.

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SEMESTER-I

F.Y.B.Sc. BOTANY

PAPER-II BOT. 112. PLANTS FOR HUMAN WELFARE

(Total Lectures : 48)

OBJECTIVES :

1) To know the role plants in human welfare.
2) To acquaint students with various plants of economic use
3) To know importance of plants & plant products
4) To study chemical contents of the plant products
5) To know about utility of plant resources

Chapter-1: Introduction plants for human welfare **4L**

1.1 Introduction, scope & importance
1.2 Plants of plant products in human welfare as food, fodder, Fibers, medicines oils, spices, condiments and non alcoholic beverages.
1.3 Vavilov's concept of origin of cultivated plants.
1.4 Green revolution in India.

Chapter-2: Food plants **10 L**

2.1 Cereals- Botanical source, centre of origin, chemical contents and uses of

i) Wheat ii) Rice

2.2. Pulses-Botanical source, centre of origin, chemical, contents and uses of

i) Pigeon pea ii)Chick pea

2.3. Vegetables -Botanical source, centre of origin, chemical contents and uses of

i) Spinach ii) Brinjal

2.4. Fruits -Botanical source, centre of origin, chemical contents and uses of

i) Banana ii) Guava

2.5. Fodder -Botanical source, centre of origin, chemical contents and uses of

i) Lucerne, ii) Berseem

Chapter-3 Spices & Condiments **4L**

3.1. Definition and importance

3.2 Botanical source chemical contents, plant parts used and uses of

i) Capsicum ii) Coriander iii) Cardamom iv) Cinnamon

Chapter-4 Oils & Fibres **4L**

4.1 Oils- Definition, characteristics, botanical source, parts used, chemical contents and uses of i) Groundnut oil ii) Castor oil.

4.2 Fibres- Occurrence, structure, classification of fibres, important sources and uses of i) Cotton ii) Coir.

Chapter-5: Non alcoholic beverages **3 L**

5.1 Botanical source, active principles and uses of i) Tea ii) Coffee.

Chapter-6 Medicinal plants **10L**

6.1 Introduction

Botanical source, characteristics of plants, active principles, plant parts used and uses of

i) Hirda ii) Behada iii) Amla iv) Aloe v) Neem vi) Adulsa

Chapter-7 Timber **6L**

7.1. Introduction

7.2 Botanical source, characteristics and uses of i) Teak Ii) Shisam

Chapter-8 Bio-energy **7 L**

8.1. Introduction Definition and scope.

8.2. Energy plantation concept, important characteristics and sources of bio-energy

i) Jatropha ii) Karanj

Reference Book:

Aiyer, A.K.Y.N. (1954) Field Crops In India. The Bangalore Printing & Publishing Company Bangalore.

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Sambamurthy, A.V.S.S.And Subramanyam, N.S.(1989).A Textbook of Economic Botany , Wiley Eastern Ltd. New Delhi.

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SEMESTER-II

F.Y.B.Sc. BOTANY

PAPER-I BOT.121. FUNGI, LICHENS AND PLANT PATHOLOGY

(Total Lectures : 48)

OBJECTIVES

i. To Study the Biodiversity of Fungi

ii. To know the Economic Importance of Fungi

iii. To study the features of Lichens

iv. To know the terminologies in plant pathology

v. To know the scope and importance of Plant Pathology

vi. To study the control measures of plant diseases

Chapter - 1 Fungi **4L**

1.1 Distinguishing characters

1.2 Occurrence

1.3 Structure of thallus

1.4 Nutrition

1.5 Reproduction - Vegetative, Asexual and Sexual

Chapter – 2 Classification of fungi according to G. M.Smith (1955) up to classes with reasons giving at least two examples from each class **4L**

Chapter-3 Study of life cycle of *Rhizopus* **5L**

3.1 Systematic position

3.2 Occurrence

3.3 Thallus structure

3.4 Reproduction-Asexual and Sexual

Chapter-4 Study of life cycle of *Agaricus* **6L**

4.1 Systematic position

4.2 Occurrence

4.3 External and internal morphology of sporophore/ Basidiocarp

4.4 Reproduction

Chapter-5 Economic importance of fungi **5L**

i) Agriculture

ii) Industries

iii) Food

iv) Medicine

v) Deterioration

Chapter 6- Lichens **6L**

6.1 Definition, Habit and Habitat

6.2 Occurrence

6.3 Types of Lichens

6.4 Thallus structure

6.5 Ecological and Economic importance of Lichens

Chapter 7- Plant Pathology **5L**

7.1-Definitions,Scope & Importance of Plant Pathology

7.2-Causes of Diseases

a) Abiotic-moisture, temperature, pH, mineral deficiency

b)Biotic-bacteria, viruses, mycoplasma, fungi, nematodes.

Chapter 8-Concept of disease **5L**

8.1-Classification of plant diseases

8.2- Definition and terminology in plant pathology

i) Causal organism ii) Parasite iii) Pathogen iv) Inoculum v) Penetration

vi) Infection vii) Incubation period viii) Disease Cycle

8.3- General Symptoms of Diseases caused by bacteria, viruses and fungi

Chapter 9- Study of Plant Diseases w.r.t. causal organism, symptoms and control measures of **4L**

9.1- Bacterial disease- Canker of Mango

9.2- Viral disease- Leaf curl of Papaya

9.3 –Mycoplasma disease- Little leaf of Brinjal

9.4-Nematodal disease- Root knot of vegetables

Chapter10- Study of Plant Diseases w.r.t.causal organism, symptoms and control measures of following fungal diseases **4L**

i) White rust of Crucifers ii) Powdery mildew of Teak iii)) Smut of Jawar

iv) Tikka disease of Groundnut

Reference Books:

Alexopolus, C. J. , Mims, C. W. and Blackwel (1999). Intriductory Mycology. JohnWiely & Sons. Inc. U. K.

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SEMESTER-II

F.Y.B.Sc. BOTANY

PAPER-II BOT.122. INDUSTRIAL BOTANY

(Total Lectures: 48)

OBJECTIVES:

1) To provide thorough knowledge about various plant groups from primitive to highly evolved plants
2) To make the students aware of applications of different plants in various industries
3) To highlight the potential of these studies to become an entrepreneur
4) To equip the students with skills related to laboratory as well as industries based studies
5) To make the students aware about conservation and sustainable use of plants
6) To create foundation for further studies in Botany
7) To address the socio-economical challenges related to plant sciences
8) To facilitate students for taking up and shaping a successful career in Botany

1. **Introduction to Industrial Botany** **2L**

1.1 Concept, Scope and Importance of Industrial Botany.

2 Organic manure and Biofertilizer Industry **10L**

2.1 Organic Manures

i) Introduction and importance
ii) Types: Compost, Farm Yard Manure and Green manure

2.2 Biofertilizers

i) Definition and Importance
ii) Types of biofertilizers
iii) Methods of cultivation of

A) Blue Green Algae. (BGA)

a) Preparation of culture media- De's medium (modified)
b) Isolation and Inoculation
c) Mass Cultivation of BGA (G. S. Venkatraman, 1963)
d) Utilization of BGA in Agriculture

B *Rhizobium* Culture

a) Isolation from root nodules of Leguminous plants
b) Pure culture (YEMA Medium)

c) Mass production
d) Methods of application in Agriculture
e) Agronomic importance

3 Fermentation Industry **8L**

3.1 Introduction, Definition and Types: Aerobic and Anaerobic
3.2 Microbes involved in fermentation.
3.3 Industrial production of Ethanol and Penicillin w. r. to
i) Pure culture
ii) Substrate
iii) Sterilization
iv) Fermentation
a) Recovery of end product

4 Mushroom Industry **8L**

4.1 Introduction
4.2 Edible and Non-Edible Mushrooms
4.3 Nutritional value of Mushrooms
4.4 Important edible Mushroom used for cultivation
4.5 Spawn and spawn making
4.6 Methods of cultivation of
i) *Agaricus* (Button mushroom)
ii) *Pleurotus* (Dhingri Mushoom)
i ii) *Volvariella* (Paddy straw mushroom)

5. Rubber Industry **6L**

5.1 Source of raw material and properties

5.2 Manufacture of para rubber

5.3 Uses of rubber

6 Bio-pesticide Industry **6L**

6.1 Concept of bio-control; Integrated Pest Management (IPM).

6.2 Importance of bio pesticides.

6.3 Source and uses of Azadirectin as bio-pesticide

6.4 Commercial significance.

7. Fruit Processing Industry **8L**

7.1 Fruit processing, Concept and need

7.2 Cold Storage

7.3. Types of fruit processing [Canned fruits, dried fruit chips, fruit pulp, squash, jam, jelly, pickle and ketchups.]

Reference Book:

Atkin, F.C. (1972). Mushroom Growing Today.Faber and Faber Ltd.London, U.K.

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A.C. Gaur. Biofertilizers in Sustainable Agriculture. IARI, New Delhi

PRACTICAL COURSE

Objectives

1) To study the morphological diversity among Bacteria , Viruses, Algae and Fungi
2) To observe vegetative and reproductive parts of various life forms of Bacteria ,Viruses, Algae and Fungi
3) To detect chemical contents in various plant products of economic use
4) To study botanical source/s, characteristics and utilities of Plants/ plant products
5) To know the industrial applications of various plants and plant products
6) To visit nearby locality to observe algal and fungal diversity as well as plant diseases occur in nature and make a report of it
6) To visit either of the industries and prepare a scientific report

Note-

1) A botanical excursion to study plant diversity and visit to any one industry as per syllabus is compulsory
2) Scientific report of the visit/s should be submitted at the time of practical examination.
3) Duly certified journal is compulsory at the time of practical examination

Practical BOT:113 (Semester I)
(Based on BOT: 111 and BOT: 112)

Practical 1 Gram staining of Bacteria (Root nodules, Sugercane juice, curd)

Practical 2 Study of Bacterial Disease w.r.t. Causal organism, Symptoms and control measures of i) Citrus Canker ii) Black arm of Cotton

Practical 3 Study of viral diseases w.r.t. Causal organism and Symptoms

i) Yellow vein leaf mosaic disease in Lady's finger

ii) Leaf curl of Tomato

Practical 4 Study of Algal diversity w.r.t Systematic position and morphology of following

i) *Zygnema ii) Euglena iii)* Desmids *iv) Vaucheria v) Ectocarpus vi) Nostoc vii) Batrachospermm*

Practical 5 Study of Life cycle f *Spirogyra*

i. Thallus Structure

ii. Reproduction (Conjugation) (p.s.)

Practical 6 Study of Life cycle of *Sargassum*

i. External & Internal morphology

ii. T.S. of Male & Female Conceptacles (p.s)

Practical 7 Botanical source, chemical contents and uses of

i) Wheat ii) Rice iii) Chickpea iv) Pigeon pea

Practical 8 Botanical source, chemical contents and uses of

(I)-i) Spinach ii) Brinjal iii) Banana iv) Guava

(II) i) Lucerne ii) Berseem

Practical 9 Botanical source, plant part used, active principle and uses of

i) Capsicum ii) Coriander iii) Cardamom iv) Cinnamon

Practical 10 I) Botanical source, plant part used, chemical contents and uses of

i) Ground nut oil ii) Castor oil

II) Botanical source, plant part used and uses of i) Cotton ii) Coir.

Practical 11 Botanical source, plant part used and uses of 1) Tea ii) Coffee iii)Teak iv) Shisam

Practical 12

I) Botanical source family, plant Part used active principle and uses of following medicinal plantsi) Hirda ii) Behada iii) Amla iv) Aloe v) Neem vi) Adulsa

II) Botanical source, plant part used and uses following Petro-crops

i) *Jatropha* ii) Karanj.

Practical- BOT 123 (Semester II)

(Based on BOT:121 and BOT:122)

Practical 1 Study of fungal diversity w.r.t Systematic position and morphology of following

i*) Stemonitis ii) Achlya iii) Morchella iv) Puccinia v) Alternaria*

Practical 2 Study of life cycle of *Rhizopus*

i) Mounting of sporangia

ii) Zygospore (p.s.)

Practical 3 Study of life cycle of *Agaricus*

i) External morphology of sporophore / basidiocarp ii)

Internal morphology of sporophore / basidiocarp (p.s.)

Practical 4 Study of Lichens

i) Different types- Crustose, Foliose and Fruticose

ii) Internal morphology of Lichen thallus and apothecia (p.s.)

Practical 5 Study of plant diseases (Specimen or Photographs)w.r.t. causal organisms,

symptoms and control measure of

i) Viral- Leaf curl of Papaya

ii) Bacterial -Canker of Mango

iii) Mycoplasma- Little leaf of Brinjal

iv) Nematodal- Root knot of vegetables

Practical 6 Study of plant diseases (Specimens or Photographs) w.r.t. causal organisms, symptoms and control measure of :

i) White rust of crucifers

i) Powdery mildew of Teak

iii) Smut of Jowar

iv) Tikka disease of Groundnut

Practicals based on BOT 122

Practical 7 Demonstration of
i) Mass culture of B.G.A. (Venkatraman)
ii) *Rhizobium* culture.

Practical 8 Cultivation of *Agaricus/Pleurotus/Volvariella*

Practical 9 Identify the botanical source, plant part used and uses of rubber

Practical 10 Preparation of biopesticide Azadirectin

Practical 11 Demonstration of Jam/ Squash

Practical 12 Demonstration of Jelly/ Ketchup

Scope:

1. Entrepreneurships regarding plant based industries
2. Job opportunities in following industries like Biofertilizer industry, mushroom industry, biopesticide industry, fermentation industry, food industry, Pharmaceutical industry, unconventional energy industry and Pollution control board etc.

Equivalent Theory & Practical Courses

Class : F.Y.B.Sc.

Subject : Botany

Papers	New course (To be implemented from June 2015)	Old courses
I BOT.111	Bacteria, Viruses and Algae	BOT.111 Lower Cryptogams
II BOT.112	Plants for Human Welfare	BOT.121 Cell Biology
I BOT.121	Fungi, Lichens and Plant Pathology	BOT.112 Higher Cryptogams
I BOT.122	Industrial Botany	BOT.122 Economic Botany
Practical BOT103 (Old Course)	Based on BOT.111, 112, 121 and 122	Practical Based onBOT.111, 112, 121 and 122

NORTH MAHARASHTRA UNIVERSITY,

JALGAON

(NAAC Re-Accredited)
"A" Grade

FACULTY OF SCIENCE

SYLLABUS FOR

S.Y.B.Sc. (BOTANY)

To Be Implemented From

Academic Year 2016-17

SEMESTER- I

PAPER-I

BOT.-231: Bryophytes and Pteridophytes

PAPER-II

BOT.-232: Morphology of Angiosperms

PAPER-III PRACTICAL COURSE

BOT. 233: Practicals Based on BOT.-231 and BOT.-232

SEMESTER - II

PAPER-I

BOT.-241:Plant Physiology

PAPER-II

BOT.-242: Taxonomy of Angiosperms

PAPER-III PRACTICAL COURSE

BOT.-243 Practicals based on BOT.-241 and BOT.- 242

Semester-I

Paper-I :BOT.-231: Bryophytes and Pteridophytes [60 Lectures]

Objectives:

1. *To study the morphological diversity of Bryophytes and Pteridophytes.*
2. *To study economic importance of the Bryophytes and Pteridophytes.*
3. *To study the evolution of Bryophytes and Pteridophytes.*

Chapter-1: Introduction to Bryophytes **06**

1.1 General Characters of Bryophytes
1.2 Economic Importance of Bryophytes
1.3 Alternation of Generation

Chapter-2: Classification of Bryophytes with reasons up to classes with example of each class according to G. M. Smith (1955) **04**

Chapter-3: Study of Life Cycle of *Riccia* **10**

3.1 Classification with reasons
3.2 Occurrence
3.3 External and Internal morphology of Gametophyte.
3.4 Reproduction: a) Vegetative b) Sexual
3.5 Structure of sex organs (Development not expected)
3.6 Fertilization
3.7 Structure of sporophyte (Development is not expected)
3.8 Structure and Germination of spore

Chapter-4: Study of Life Cycle of *Funaria* **10**

4.1 Classification with reasons
4.2 Occurrence
4.3 External and Internal morphology of Gametophyte.
4.4 Reproduction: a) Vegetative b) Sexual
4.5 Position & structure of sex organs (Development not expected)
4.6 Fertilization
4.7 Structure of sporophyte (Development is not expected)
4.8 Dehiscence of capsule, Structure and Germination of spore

Chapter-5: Introduction to Pteridophytes **06**

5.1 General Characters of Pteridophytes
5.2 Economic Importance of Pteridophytes
5.3 Alternation of generation

Chapter-6: Classification of Pteridophytes up to classes giving reasons with at least two examples of each class according to G.M. Smith. **04**

Chapter-7: Study of Life Cycle of *Selaginella* **10**

7.1 Classification with reasons
7.2 Occurrence
7.3 External morphology of sporophyte
7.4 Internal morphology of sporophyte
7.5 Reproduction:a) Vegetative b) Sexual
7.6 Structure of strobilus (Cone)
7.7 Structure of Microspores and Megaspores
7.8 Germination of Micro and Megaspores
7.9 Structure of male gametophyte with sex organ and female gametophyte
7.10 Fertilization

Chapter-8: Study of Life Cycle of*Adiantum* w.r.t. **10**

8.1Classification with reasons
8.2 Occurrence
8.3 External morphology of sporophytes
8.4 Internal morphology of sporophytes
8.5 Reproduction a) Vegetative b) sexual
8.6 Structure of sorus, sporangium.
8.7 Structure and germination of spore
8.8 Structure of gametophyte with sex organs
8.9 Fertilization
8.10 Structure of embryo

References:

1. Campbell H. D., 1940. The Evolution of land plants (Embryophyta). University of Press, Stanford.
2. Chopra R. N. and P. K. Kumar. 1988. Biology of Bryophytes. Wiley Eastern Ltd. New Delhi.
3. Gangulee Das and Dutta. College Botany Vol.1, Central Book Depot. Culcutta.
4. Parihar N. S. An Introduction to Bryophyta Central Book Depot, Allahabad 1965.
5. Shaw, J. A. and Goffinet B., 2000, Bryophyte Biology, Cambridge University Press.
6. Smith G. M. 1938, Cryptogamic Botany Vol. II. Bryophytes and Pteridophytes. McGraw Hill Book Company, Landon.
7. Sporne K. R, 1967. The Morphology of Bryophytes. Hutchinson University Library, Landon.
8. Vasishta B. R. Bryophyta. S. Chand and Co. New Delhi.
9. Watson E.V. 1971, The Structure and Life of Bryophytes. Hutchinson Univerisity Library Landon.
10. Gangulee, H. C. and Kar, A. K. College Botany Vol.II, New Central Book Agency, Culcutta.
11. Chandra S. & Srivastava M. 2003, Pteridology in New Millenium, Khuwer Academic Publishers.
12. Eames, A. J. 1979, Morphology of Vascular Plants, Lower group. Wiley International edition, New Delhi.
13. Parihar N. S. 1977, Biology and Morphology of Pteridophytes, Central Book Depot, Allahabad.
14. Rashid A. 1976, An Introduction to Pteridophyta, Vikas Publ. Co. New Delhi.
15. Sporne, K. R. 1967, Morphology of Pteridophytes- Hutchinson University Library Landon
16. Vasishta B.R. 1993, Pteridophyta, S. Chand and Co. New Delhi.

SEM-I

Paper-II -BOT.-232: Morphology of Angiosperms [60 Lectures]

Objectives:

1. *To study the habit of the angiosperm plant body.*
2. *To study the vegetative characteristics of the plant.*
3. *To study the reproductive characteristics of the plant.*
4. *To study the plant morphology.*

Chapter-1: Introduction **02**

1.1 Definition, scope and importance of morphology

Chapter-2: Study of Root. **06**

2.1 Definition

2.2 General characters of and functions of root.

2.3 Types of roots:

A] Tap Root System

B] Adventitious roots system.

2.4 Modifications of root.

A] Modifications for storage: conical, napiform, fusiform tuberous, moniliform, fasciculated roots

B] Modification for support: Prop and Stilt root

C] Modification for assimilation: Epiphytic root, Assimilatory roots

D] Modification for breathing: Pneumatophores

E] Modification for absorption: Parasitic roots

Chapter-3: Study of Stem **08**

2.1 Definition

2.2 General Characters and functions of stem

2.3 Types of stem –Weak, strong.

2.4. Modification of stem:

A] Underground Modification: Rhizome, Tuber, Bulb, Corm,

B] Sub aerial Modifications: Runner, Stolon, Offset, Sucker.

C] Aerial Modification: Phylloclade, Cladode, Tendrils and spines.

Chapter-4: Study of Leaf **10**

1.1 Definition

1.2 Parts of Typical leaf

1.3 Stipules and its types- Free lateral, Adnate, Interpetiolar, Intra-petiolar, Ochreate and Foliaceous.

1.4 Types of leaf- a) Simple b) Compound and its subtypes.

1.5 Venation and its types.

1.6 Phyllotaxy and its types.

1.7 Modification of leaf- Spines, Tendril, Pitcher.

Chapter-5: Study of Inflorescence **08**

5.1. Definition and parts of inflorescence

5.2. Types of Inflorescence

A] Racemose inflorescence and its types:

B] Cymose inflorescence and its types:

I] Solitary

II] Uniparous

III] Biparous

IV] Multiparous

C] Special types of inflorescence:

I] Cyathium

II] Verticillaster

III] Hypanthodium

Chapter-6: Study of Flower **16**

6.1 Definition

6.2 Parts of typical flower

6.3 Types of flower: a) Hypogynous b) Epigynous c) Perigynous

6.4 Calyx: Types of Calyx – Caducous and persistent

6.5 Corolla: Types of Corolla- a) Polypetalous regular and irregular b) Gamopetalous regular and irregular.

6.6 Perianth: Polyphyllous and Gamophyllous.

6.6Aestivation: Types of aestivation

6.7 Androecium:

A] Anther filament attachment: Basifixed, Dorsifixed, Adnate, Versatile.

B] Cohesion and Adhesion of stamens

C] Modifications- Petaloid stamens, Pollinia.

6.8 Gynoecium

A] Types of style – Terminal, Lateral, and Gynobasic.

B] Types of Stigma – Capitate, Bifid, Trifid, Discoid, Feathery.

C] Types of ovary based on number of carpel

D] Apocarpus, Syncarpus.

E] Ovary: Superior, Inferior and half superior.

F] Types of placentation

Chapter-7: Study of Fruit **10**

7.1. Definition

7.2. Types of fruits

A] Simple fruits I] Dry Fruits

a) Dehiscent – Legume, Follicle, Capsule [loculicidal, septicidal, septifragal]

b) Schizocarpic- Lomentum, Cremocarp.

c) Indehiscent – Caryopsis, Achene, Cypsella.

II] Fleshy Fruits – Drupe, Berry, Hesperidium.

B] Aggregate Fruits – Etaerio of berries, Etaerio of follicles, Etaerio of Achenes.

C] Composite fruits: Sorosis, Syconus.

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Semester- I

BOT. 233: BOTANY PRACTICAL COURSE

Based on BOT.-231 and BOT.-232

Practical based on BOT.-231

Practical -1: Study of diversity of Bryophytes w.r.t systematic position and morphology:

A] *Marchantia* B] *Anthoceros* C] *Sphagnum*

Practical -2: Study of life cycle of *Riccia*

2.1 Classification with reasons

2.2 External morphology of gametophyte

2.2 V. S. of thallus

2.3 V. S. of thallus passing through sex organs (P. S.)

2.4 V. S. of sporophyte (P.S.)

Practical-3: Study of Life cycle of *Funaria*

3.1 Classification with reasons

3.2 External morphology of gametophyte

3.3 T. S. of axis

3.4 V. S. of antheridial head (P. S.)

3.5 V. S. of archegonial head (P. S.)

3.6 V. S. of sporophyte (P.S.)

3.7 Mounting of spores & peristomial teeth.

Practical -4: Study of diversity of Pteridophytes w.r.t systematic position and morphology:

A] *Psilotum* B] *Lycopodium* C] *Equisetum* D) *Marsilea*

Practical-5: Study of Life cycle of *Selaginella*

5.1 Classification with reasons

5.2 External morphology of sporophyte

5.3 T. S. of Stem

5.4 V. S. strobilus (P. S.)

5.5 Mounting of spores & ligules

Practical -6: Study of Life cycle of *Adiantum*

6.1Classification with reasons

6.2 External morphology of sporophyte

6.3 T. S. of Rachis

6.4 V. S. of Sorus (P. S.)

6.5 Mounting of spores

Practicals Based on BOT.-232

Practical-7: Morphology of root and stem modification as per theory**.**

Practical-8: Morphology of Leaf a) Phyllotaxy b) Modifications as per theory.

Practical-9: Study of types of Inflorescence

Practical-10: Study of Flower morphology

A) Calyx: Types of calyx

B) Corolla: Forms of Corolla

C) Types of aestivation

Practical-11: Study of Flower morphology

A) Androecium: Adhesion and Cohesion

B) Gynoecium: Types of Placentation

Practical -12: Study fruit Morphology: as per theory

A] Simple Fruits

B] Aggregate fruits

C] Composite fruits

Semester-II

Paper I -BOT.-241: Plant Physiology

AIMS & OBJECTIVES:

1. *To know importance and scope of plant physiology.*
2. *To study plants and plant cells in relation to water.*
3. *To study the process of photosynthesis in higher plants with particular emphasis on light and dark reactions, C3 and C4 pathways.*
4. *To study respiration in higher plants with particular emphasis on aerobic and anaerobic respiration.*
5. *To study movement of sap and absorption of water in plant body.*
6. *To study the plant movements.*

Chapter-1: Introduction: 02

1.1 Introduction, scope and Importance

Chapter-2: Plant cell and water relation: 10

2.1 Properties of water: physical and chemical

2.2 Diffusion: Definition, mechanism of Diffusion with suitable example, Diffusion Pressure, Graham's Law of Diffusion and significance of Diffusion

2.3Osmosis**:**Introduction Definition, mechanism of osmosis with suitable osmometer, Osmotic pressure, Wall pressure and Turgor pressure, DPD and its relationship with OP, TP,WP, Type of solution-Isotonic, hypotonic and hypertonic solution.
Types of osmosis-endo and exosmosis, Plasmolysis and deplasmolysis significance.

2.4. Imbibition: definition, mechanism, Imbibition pressure, Importance of imbibition

Chapter-3: Absorption of water 07

3.1. Introduction

3.2. Importance of water in plant

3.3. Mechanism of water absorption: Active and Passive Absorption. Theories of active absorption-
Osmotic theory and Non Osmotic theory, Mechanism of Passive Absorption, factors affecting the process.

Chapter-4: Ascent of sap 08

4.1 Introduction, Definition

4.2 Path of solute

4.3 Mechanism of ascent of sap

Theories: a) Vital theories- Pulsating theory, Relay pump theory
b) Root pressure theory
c) Physical theory-Dixon and Jolly's Theory.

Chapter 5: Transpiration 08

5.1 Introduction, Definition

5.2 Types of transpiration

5.3 Structure of stomata

5.4 Mechanism of opening and closing of stomata.

5.5 Theories of transpiration: a) Stewards theory b) K^+ Pump theory

5.6 Significance of transpiration.

5.7 Factors affecting transpiration

Chapter-6: Photosynthesis 11

6.1 Introduction and Definition

6.2 Photosynthetic pigments: Chlorophylls, Carotenoids, Phycobillins and their role.

6.3 Red drop and Emmerson effect, Two Pigment System

6.3 Mechanism of Photosynthesis

(a) Light reaction: Cyclic and Non-cyclic Photophosphorylation

(b) Dark Reaction: C3 and C4 cycle

6.4. Difference between C3 and C4 cycle

6.5. Factors affecting the process of photosynthesis

Chapter-7: Respiration 11

7.1 Introduction and definition

7.2 Types of Respiration: Aerobic and Anaerobic

7.3 Respiratory quotient

7.4 Mechanism of Aerobic Respiration:

(a) Glycolysis

(b) Kreb's Cycle

(c) ETS

7.5 Anaerobic Respiration: Alcoholic respiration

7.6 Bioillumination

7.7 Factors affecting the process of Respiration

Chapter-8: Plant Movements 03

8.1 Introduction

8.2 Types:

(a) Tropic movements: Phototropic, Hydrotropic and Geotropic

(b) Tactic Movements: Phototactic, Thermotactic and Chemotactic

(c) Nastic movement: Nyctanastic, Seasmonastic and Thigmonastic

Reference Books:

1. Amar singh (1977) Practical Plant Physiology. Kalyani Publication, New Delhi, Ludhiyana, India.
2. Jain, V.K. (1997) Fundamentals of Plant Physiology. S.Chand& Company Ltd. New Delhi, India.
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5. Meyer, B.S. & D.B. Anderson (1952) Plant Physiology.Affiliated East-west Press Pvt.Ltd., New Delhi, India.
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12. Varma, V. (1995) A Text Book of Plant Physiology and Biochemistry. S. Chand & Company. New Delhi, India.

Semester-II,

Paper-II -BOT.-242 Taxonomy of Angiosperms

Aims and Objectives:

1. *To study the diversity of angiosperms.*
2. *To study the comparative account among the families of angiosperms.*
3. *To study the economic importance of the angiosperm plants.*
4. *To study the distinguishing features of angiosperm families.*

Chapter-1: Taxonomy: **05**

1.1 Definition, objectives and importance of taxonomy

1.2 Distinguishing features of angiosperms

1.3 Functions of Taxonomy: Identification, Classification and Nomenclature.

Chapter-2: Classification: **05**

2.1 Criteria used for the classification

2.2 Types of classification a) Artificial b) Natural c) Phylogenetic classification

2.3 Binomial Nomenclature.

Chapter-3: Systems of classification: **05**

3.1. Introduction

3.2 Outline of Bentham and Hooker's system of classification up to series

3.3 Merits and Demerits of classification

Chapter-4: Study of plant families **35**

Study of following families with respect to the Systematic position, Morphological characters, floral formula and floral diagram, Distinguishing features, Economic importance,

1] Malvaceae	2] Papilionaceae [Fabaceae]	3]Acanthaceae
4] Solanaceae	5] Nyctaginaceae	6] Euphorbiaceae
7] Cannaceae	8] Liliaceae	

Chapter-5: Botanic Gardens **06**

5.1 Definition

5.2 Functions of Botanical Garden

5.3 Types of Garden: Formal and In-formal

5.4 Salient features of a] Indian Botanical Garden, Kolkata
b] National Botanic Garden, Lucknow
c] Royal Botanic Garden, Kew (England)

Chapter-6: Herbarium Technique **04**

a. Definition
b. Techniques of Herbarium
Collection, Pressing and Drying, Poisoning, Mounting and Labelling.

Reference Books:

1. Ganguly, H.C. & K. S. Das (1986) College Botany Vol.-.I (6th Edition), New CentraBookAgency, Calcutta, India.
2. Ganguly, H.C., K.S.Das and C.T.Datta (1968) College Botany Vol.I , New Central BookAgency, Calcutta, India.
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BOT.-243 Botany Practical based on BOT.-241 and BOT.- 242

Practical Based on BOT.- 241

Practical 1: To determine the DPD by using the potato tuber

Practical 2: To determine the rate of transpiration by varying

(a) Light intensity

(b) Wind velocity

Practical 3: To determine the rate of photosynthesis by varying

(a) Light intensity

(b) Light quality

Practical 4. Determination of RQ using Ganong's respirometer

Practical 5&6: Demonstration experiments:

(a) Osmosis by curling experiment

(b) Imbibition pressure

(c) Thistle funnel

(d) Ringing experiment.

(e) Relative transpiration

(f) CO2 Necessary for photosynthesis

(g) Kuhen's Tube experiment

(h) Cyclosis in *Hydrilla*

Practical Based on BOT.- 242

Practical-7 to 10: Study of Plant families w.r.t Systematic position, Morphological characters, floral formula and floral diagram of any six families according to the syllabus. [At least one family from each class: Polypetalae, Gamopetalae, Apetalae and Monocotyledonae)

Practical-11: Preparation of artificial key based on vegetative or/and reproductive characters.

Practical-12: Demonstration of Herbarium Technique

a) Drying and Pressing

b) Poisoning

Equivalence: Theory and Practicals

Class: S. Y. B. Sc.

Subject : Botany

Paper	Old Course (W.E.F. From 2013-14)	Paper	New Courses (to be implemented from June 2016
BOT.-231	Morphology and Taxonomy of Angiosperms	BOT.-232	Morphology of Angiosperms
BOT.-232	Plant Physiology	BOT.-241	Plant Physiology
SEM-II			
BOT.-241	Plant Anatomy	BOT.-242	Taxonomy of Angiosperms
BOT.-242	Applied Botany	BOT.-231	Bryophytes and Pteridophytes
PRACTICAL			
BOT:203	Based on BOT.-231, BOT.-232, BOT.-241 and BOT.- 242	BOT:233	Based on BOT.231, BOT.-232,
		BOT: 243	Based On BOT.-241 and BOT.- 242

NORTH MAHARASHTRA UNIVERSITY, JALGAON

(NAAC Re-Accredited)

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 andBOT. 353.

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

i.e. BOT. 352and 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. 354and 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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9. Kumar H.D. and H. N. Singh (1976) A Text Book of Algae. Affiliated East West Press Ltd., New Delhi, India
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12. Pandey, S.N., Trivedi, P. S. and S P. Misra (1995) A Text Book of Algae, Vikas Pub. House Pvt. Ltd. New Delhi, India.
13. Parihar, N.S. (1991) An Introduction to Embryophyta, Vol.1 Bryophyta. Central Book Depot, Allahabad, India
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15. Puri, P. (1985) Bryophyta A Broad Perspective, Atma Ram and Sons, New Delhi, India. House. Pvt Ltd. New Delhi.
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17. Sharma, O.P (1990) Text Book of Algae. Tata McGraw Hill Pub. Co. Ltd, New Delhi, India.
18. Sharma, O.P.-Fungi. Tata McGraw Hill Pub. Co. Ltd, New Delhi, India.
19. Singh, Pande and Jain. (2004). Text book of Botany, Diversity of Microbes and Cryptogams, Rastogi Publications, Gangotri, Shivaji Road, Meerut
20. Smith G.M (1955) Cryptogamic Botany Vol. I: Algae and Fungi. McGraw-Hill Book Co New York, U.S.A.
21. Sporne K.R. 1991. The Morphology of Pteridophytes, B. I. Publishing Pvt. Ltd. Bombay.
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24. Vashishta, P.C. (2010). Botany for Degree Students -Bryophyta. S. Chand and Co. Ltd. New Delhi, India.

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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. 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) Orchidaceae2) 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 cytoplasmicmatrix.

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 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 **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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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 inphotoperiodism

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 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

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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, Aspection 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 NINOand 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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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 tobiotechnology.
3. To acquaint with the importance of interdisciplinary approaches ofBiotechnology.
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 Jatropa)

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.GadiaLohar

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 ofchoice 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) Cycadsv) 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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1. S.C.DEY (2013) Indoor Gardening. Agrobios, Jodhpur, India.

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3. Bose, T.K. and Mukharjee D. (1997) Gardening in India.

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7. I. Parey Lancaster (1997) Gardening in India. Oxford and I.B.H. Publishing Co. Pvt. Ltd. New Delhi.

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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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1. **Agrawal R. L. (1980)** Seed Technology, Oxford and IBH Publication Co. New Delhi,India.
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):

a) Unicellular thallus-*Chlamydomonas*, *Chlorella*.

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

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

d) Siphonaceousthallus -*Vaucheria. Caulerpa*

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

f) Parenchymatousthallus -*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

Practical1.Preparation of fixative and stains (Acetocarmine or suitable cytological stain)

Practical2. Study of Mitosis techniques (Root tip of onion or any suitable material)

Practical3.Study of Meiosis techniques (PS)

Practical4.Study of polytene chromosome from Chironomus larvae

Practical5. Isolation of DNA from any plant material (e.g. Cauliflower, Banana etc.) or any suitable plant material

Practical6.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.

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.

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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 quadrate 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)

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

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NORTH MAHARASHTRA UNIVERSITY,

JALGAON

(NAAC Re-Accredited)

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.

4.3Contribution 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, Petrifaction, 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. 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)*Enigmocarpon*

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PALEOBOTANY:

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2. Swarge K. R. (1966) Indian fossil Pteridophytes, CSIR New Delhi. India.
3. Stewart Wilson. N. (1983). Paleobotany and evolution of plants, Cambridge University Press.
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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, 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: *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. Ruminate 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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11. Pandey, S.N. and A. Chadha (2006) Plant Anatomy and Embryology, Vikas Publishing House Pvt. Ltd. New Delhi, India
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16. Singh,V., P.C.Pandey & D.K. Jain(1998) Embryology of Angiosperm , Rastogi Publications ,Meerut, India
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18. Singh, Sanjay Kumar (2005) A Text Book of Plant Anatomy, Campus Books International, New Delhi, India
19. Singh, S. K. and Semma Srivastava (2011) Anatomy of Angiosperm, Campus Books International, New Delhi, India
20. Singh, Sanjay Kumar (2014) Embryology of Angiosperm, Campus Books International, New Delhi, India

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 verities.
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 F_1 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

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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: principleand application, Application of radioisotopes inbiochemistry.

5.4 Electrophoresis: Principle, types and applications

5.5 Centrifugation: Principle and theory of RCF andapplications 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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2. Rastogi, S.C (1993), Biochemistry –,Wiely Eastern ltd, Pune Second Edition.

3. StryerLubert Biochemistry –, W.H. freeman and co , New York , fourth edition.

4. Agrawal G.R and Agrawal R.A., Krishna (1998-99)Text book of biochemistry –Prakashan media (p) ltd, Meerat

5. Satyanarayana U., (2004) Biochemistry- book and allied pub. ltd, kolkata, , second edition.

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7. Nelson, D.L. and M.M.Cox (2005),Lehninger's Principle of Biochemistry, Publisher David N.Nelson, Michael Cox, edition fourth.

8. Agraval, (19989-1999), textbook of Biochemistry, Krishna Prakashan, edition tenth.

9. Satyanarayana, U. and U.Chakrapani (2006), textbook of Biochemistry, third edition

10. Price,N.C. and Stevens (2000) Fundamentals of Enzymology, edition

11. Frifielder, .D, W.(1983) Physical biochemistry- H.Freeman and Co. New York,

12. Holmes and H.Peck Analytical biochemistry-, academic press, New York.

13. Wilson and Goulding Biophysical technique-, ELBS edition, latest edition.

14. Upadhyaya and Upadhyaya and Nath, Biophysical chemistry (principle and technique) – Himalaya Pub. Nagpur, latest edition.

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)**

6.1Introduction, 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

6.5Social 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

1. Dubey, R.C., 2005 A Text book of Biotechnology S.Chand& Co, New Delhi.

2. Vayas, S.C, Vayas, S. and Modi, H.A. 1998 Bio-fertilizers and organic Farming Akta

Prakashan, Nadiad

3. Jogdand, S.N. (2001) Advances in Biotechnology. Himalaya Publishing house, Mumbai, India.

4. S.K. Jain, Manual of Ethno botany, Scientific Publishers, Jodhpur, 1995.

5. S.K. Jain (ed.) Glimpses of Indian. Ethnobotny, Oxford and I B H, New Delhi – 1981

6. Dubey, R.C. and D, K.Maheshwari, 2007. A textbook of Microbiology, S.Chand and Company, New Delhi.

7. Girdharilal, Siddappa, G.S. & Tandon, G.L. (1998). Preservation of Fruits Ana Vegetables, ICSR, New Delhi, India..

8. Bose, T. (1996) Fruits- Tropical & subtropical, Nayaprokash, Calcutta.

9. Casida, L.E. (1991). Industrial Microbiology, Wiley Eastern Ltd. New Delhi, India.

10. S.N. Negi. Hand book of Social Forestry

11 M. Sitaram Rao . Social Forestry

12. Thankamma (1975). Food, drugs & cosmatics. A consumer guide, The Mac Millan company of India Ltd. Delhi, Mumbai.

Semester – VI

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

REFFERENCE BOOKS:

BOTANICAL TECHNIQUES:

1. Aneja, K,R. (1996) Experiments **in** Microbiology, Plant Patholc Tissue Culture and Mushroom Cultivation (IInd Ed,) Wishwa Prakashan New Delhi, India.
2. Dwivedi,J.N. and R.B.Singh (1990). Essentials of Plant Techniques ,Scientific Publishers, Jodhpur, India
3. Modi, H.A. (1996) Elementaiy Microbiology Vol.V. Ekta Prakashan, Ahmadabad.
4. Starrier, R.Y. Ingrahaan, J.L., Whalis, M.L. and P.andPainter (1993) GeneralMicrobiology (5th Ed) The Macmillan Press Ltd, London, u.x.
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6. L. R. Patki , B. L. Bhalchandra, 1. H. Jeevaji forwarded by Dr. (Mrs) V. M. Sapkal. An introduction to microtechniques. S. Chand & Co. Ltd., New Delhi.
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10. De Robertis and De Robertis 2005 (8th Edition), Cell and Molecular Biology.
11. Krishnamurthy K. V. (1988) Methods in Plant Histochemistry.
12. Powar C.B 2005 (3rdEdition) "Cell Biology" , Himalaya Publication, Mumbai.
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)

REFERENCE BOOK:

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

2. Jeffery, B. and Harborn. Photochemical Methods: A guide to Modern Techniques of

Plant analysis. Springer, 1998.

3. Khandelwal, K.R. Practical Pharmacognosy, Pragati Books Pvt. Ltd.

4. Kokate, C.K. Purohit A.P. and GokhaleS.B. Pharmacognosy (degree), Nirali Prakashan, Mumbai.

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

6. Iyengar, M.A. Pharmacognosy Lab. Manipal Power Press, Manipal.

7. Rangari, V.D. A Textbook of Pharmacognosy and Photochemistry. Vol-I and II

8. Wallis, T.E. Textbook of Pharmacognosy. J.A, Churchill Ltd. London

9. Kumar N. C. : An Introduction to Medical Botany and Pharmacognosy, Emkay Publications, New Delh.

10. Pullaiah T. and P. Suresh Narayana, Textbook of Pharmacognosy Vol. 1, Ikon Books, New Delhi and Hyderabad

11. Bhattacharjee S. K. (1998) Handbook of Medicinal Plants. Pointer Publishers, Jaipur. India.

12. Kaushik Purushottam and Dhiman. A.K (2000). Medicinal Plants and Raw Drugs of India, Bishen Singh Mahendra Pal Singh. Dehradun. India

13. Klianna, Girija (1993) All About Herbal Remedies. Vikas Publishing House (P.) Ltd., New Delhi. India.

14. Kunan, J.C. (1999) Plants Thai Heal. Oriental Watchman Publishing House, Pune. India

15. Shah, C.B. and Quadri IS (1990) Text Book of Pharmacognosy. B.S. Singh Prakashaa Ahmedabad, India.

16. Thakur, R.S., Pun, H S. and Husain, A. (1989). Major Medicinal Plants of India. Central Institute of Medicinal and Aromatic Plants, CS1R. Lucknow, India.

17. Trease, G.E. and Evans, W.C. (1978). Pharmacognosy (iith Ed.) Bailliene Tindall. London U.K

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 metabi-sulphate, 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) Epidemology

Chapter 3 : Study of diseases: 10

3.1 : Inanimate diseases :

i) Diseases caused due to nutritional difficiencies 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 theropy -
i) Avoidance of pathogen , ii) Exclusion of the inoculums, iii) Eradication , iv) Protection v) Disease resistanc
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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NORTH MAHARSHTRA UNIVERSITY, JALGAON

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) *Lepidostrobu*s
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) Protandary----------(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 injecter 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) *Argemone mexicana*
(b) Abrus precatorius
(c) Jatropha curcas
(d) Datura metal.

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

NORTH MAHARASHTRA UNIVERSITY, JALGAON

Faculty of Science & Technology

SYLLABUS FOR CORE SUBJECT (D.S.C.): BOTANY

As Per The U. G. C. Guidelines

Based on
Choice Based Credit System (CBCS)

F. Y. B. Sc. BOTANY SEMESTER-WISE SYLLABUS
(Theory and Practical)

Semester-I:

Bot. 101: Microbial Diversity, Algae & Fungi
Bot. 102: Plant Taxonomy
Bot. 103: Practical Based on Bot. 101 & 102

Semester-II:

Bot. 201: Diversity of Archegoniates
Bot. 202: Plant Ecology
Bot. 203: Practical Based on Bot. 201& 202

W. E. F. June, 2018

Year-I: Core Subject (DSC)
Structure of F. Y. B.Sc. under CBCS
w.e.f. June 2018

Year	Semester	Paper	Code	Title	Marks	Credits
I	I	I	Bot.101	Microbial Diversity, Algae & Fungi	60: 40	2
		II	Bot.102	Plant Taxonomy	60: 40	2
		III	Bot.103	Practical (LAB – I)	60: 40	2
	II	I	Bot.201	Diversity of Archegoniates	60: 40	2
		II	Bot.202	Plant Ecology	60: 40	2
		III	Bot.203	Practical (LAB – II)	60: 40	2

NORTH MAHARASHTRA UNIVERSITY, JALGAON
Syllabus of F.Y.B.Sc. Botany w.e.f. June, 2018
Semester –I
Paper-I
Bot. 101: Microbial Diversity, Algae & Fungi Total: 30 L

Aims and Objectives:

1. To study the diversity among Microbes.
2. To study systematic, morphology and structure of Bacteria, Viruses, Algae and Fungi.
3. To study the life cycle pattern of Bacteria, Viruses, Algae and Fungi.
4. To study the useful and harmful activities of Bacteria, Viruses, Algae and Fungi.

Unit 1: Microbes **2L**

1.1:Introducdtion and main groups of microbes : Prions, Viroids, Viruses, Rickettsias, mycoplasmas , Bacteria,cyanobacteria .

1.2: Classification of microorganisms – R.H.Whittaker's (1969) five kingdom concept.

Unit 2: Viruses **7L**

2.1 Introduction, Discovery and Characteristics of Viruses.

2.2 General morphology of viruses: Helical, Polyhedral, Enveloped and Complex viruses.

2.3 Nature of viruses (living and nonliving)

2.4 Ultra structure of viruses

2.5 DNAVirus (T-Phase)and RNA Virus(TMV)

2.6 Reproduction of Bacteriophase : Lytic and Lysogenic cycle.

2.7 Economic importance

2.8Plant diseases caused by viruses w.r.t. symptoms, causal organism and control measures of

i. Yellow vein mosaic disease of Lady's finger

ii. Leaf curl of Tomato

Unit 3: Bacteria **7L**

3.1 Introduction, discovery and General Characters.

3.2 Classification of Bacteria on the basis of morphology.

3.3Structureof Bacterial Cell

3.4 Gram positive and Gram negative Bacteria

3.5 Reproduction - Asexual and Sexual (Conjugation)

3.6 Economic Importance of Bacteria - useful and harmful activities

3.7Study of Bacterial diseases w.r.t. causal organism, symptoms and control measures of

i) Citrus canker

ii) Black arm of Cotton

Unit 4: Algae **7L**

4.1 Introduction, definition and General Characters of algae
4.2 Habitats of algae: Aquatic, Terrestrial and algae unusual habitats
4.3Thallus structure in algae.
4.4 Reproduction: Vegetative, Asexual and Sexual
4.5Classification of algae according to G. M. Smith (1955) up to classes with reasonsgiving at least two examples from each class.
4.6 Economic importance of algae
i. Agricultureii. Industries iii. Medicineiv. Energy Production
4.7 Study of life cycle w.r.t. Systematic position, thallus structure and Reproductionof ***Nostoc,***and***Spirogyra.***

Unit 5: Fungi **7L**

5.1 Introduction, definitionand General Characters
5.2 Thallus structure and mode of nutrition
5.3Classification of Fungi , according to G.M. Smith upto classes with reasonsselecting at least two example of each class.
5.3 Economic importance of Fungi (Agriculture, Industries, Food & Medicine)
5.4 Study of life cycle w. r. t. Systematic position thallus structurereproduction*of Rhizopus,* and *Agaricus.*
5.5 Lichens: Definition, Characters, Types - Crustose, Foliose,Fruticose and economics importance.
5.6 Definition , General account, significance of Mycorrhiza , Types : Ecto and Endomycorrhiza.

Note: Student activates like seminars, quiz, debate, assignments, field work, study Project & models etc. are part of curriculum for all units in all papers.

Reference Books:

1. Agrwal, S. B. and Srivastav (1985)Modern Text Book of Botany Vol. I Algae, Fungi, Bacteria Viruses and Lichen, Universial Publication, Agra.
2. Biswas, S. B. and AmitaBiswas (1986 Ed.)An Introduction to Viruses, Vikas Publishing House (P) Ltd. New Delhi.
3. Vashita, B.R. (2010) S. A Text Book of Algae Chand and Company (P.)Ltd New Delhi.
4. Vashita ,B.R. (2010) S. A Text Book of Fungi Chand and Company (P.)Ltd New Delhi.
5. Sarabhai, B. P. &Arora C.K. (1995) . A Text Book of Algae Anmol Publication, New Delhi.
6. Salle, A.J. (1974) Fundamental Principles of Bacteriology (TMH Ed.) New Delhi.
7. Gangulee, H.C. and Kar, A.K.(1998) College Botany Vol. II New Central Book Agency, Kolkota.
8. Pandey B. P. (2014) College Botany Volume 1S. Chand publications, New Delhi.
9. Pandey, S. N. and Trivedi (1997) A Text Book of Botany Vol. I Vikas Publishing House, New Delhi.
10. Sharma, P D. (1998) A Text Book of Fungi Rastogi Publication, Meerut.
11.Sharma, P D. (2009) A Text Book of Algae Tata McGraw Hill Publication, New Delhi.

Paper II
Bot. 102: Plant Taxonomy

Total: 30L

Aims and Objectives:

1. To study the diversity of angiosperms.
2. To study the comparative account among the families of angiosperms.
3. To study the economic importance of the angiospermic plants.
4. To study the distinguishing features of angiosperm families.

Unit 1: Introduction (3 L)

1.1 Definition, Scope and Importance

1.2 Functions of Taxonomy

- 1.2.1 Identification
- 1.2.2 Nomenclature
- 1.2.3 Classification

Unit 2: Taxonomic hierarchy (5 L)

2.1 Principles (I to IV) & Rules (ICN)

2.2 Ranks of Classification: Major Categories

2.3 Binomial Nomenclature

2.4 Author Citation & Rejection of names.

Unit 3: Systems of Classification (5 L)

3.1 Types of Classification.

- 3.1.1 Artificial
- 3.1.2 Natural
- 3.1.3 Phylogenetic

3.2 Outline of Bentham & Hooker's system of classification up to series.

3.3 Merits and Demerits

Unit 4: **Study of Plant Families w.r.t. systematic position, general characters, distinguishing characters and economic importance.** (6 L)

4.1 Malvaceae

4.2 Solanaceae

4.3 Euphorbiaceae

4.4 Cannaceae

Unit 5: Herbarium (3 L)

5.1 Definition, Techniques and Functions.

5.2 Importance of Herbaria.

Unit 6: Botanical Gardens (3 L)

6.1 Definition and Functions.

6.2 Special Features of Following:

- 6.2.1 Indian Botanical Garden, Kolkata.
- 6.2.2 Royal Botanical Garden, Kew, England.

Unit 7: Numerical Taxonomy (2 L)

7.1 Definition & Application

Unit 8: Modern Trends in Taxonomy (3 L)

8.1 Taxonomic evidences from:

8.1.1 Palynology

8.1.2 Cytology

8.1.3 Phytochemistry

Reference Books:

1. Ganguly, H.C. & K. S. Das (1986) College Botany Vol.-.I (6th Edition), New CentralBookAgency, Calcutta, India.
2. Ganguly, H.C., K.S.Das and C.T.Datta (1968) College Botany Vol.I , New Central BookAgency, Calcutta, India.
3. Kumar, N.C.(1992) An Introduction to Taxonomy of Angiosperm. Himalaya PublishingHouse, Bombay, India.
4. Lawrence G.H.M. (1951) Taxonomy of Vascular plants. Macmillan, New York,USA.
5. Naik, V.N. (1984) Taxonomy of Angiosperms. Tata McGraw-Hill Publishing Company Ltd, New Delhi, India.
6. Pandey, B.P.(1997) Taxonomy of Angiosperms. S. Chand & Company Ltd., New Delhi,India.
7. Sharma, O.P. (1997) Plant Taxonomy. Tata McGraw-Hill Publishing Co. Ltd. New Delhi,India.
8. Shivarajan, V.V. (1984) Introduction to Principles of Plant Taxonomy. Oxford &IBHPublishing Co. New Delhi, India.
9. Singh, V. and Jain,D.K. (1992) Taxonomy of Angiosperms.Rastogi Publication, Meerut,India.
10. Subramanyam, N.S. (1997) Modern Plant Taxonomy.Vikas Publishing house, New Delhi,India.
11. MukerjeeSusilkumar(1984) College Botany Vol III Published by J.N. Sen. B.S.I.NewCentral Book Agency Calcutta.
12. Vashistha, P.C. (1992) Taxonomy of Angiosperms. R. Chand & Co. Publishers, New Delhi,India.

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Paper III
Bot. 103: Practical
(Based on Bot.101 and Bot.102)

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1. Study of equipments used in Microbiology: Spirit lamp, Inoculation Loop, Hot air oven, Laminar Air Flow (LAF) and Incubator.
2. A) Study of viruses and Bacteria using Electron Photomicrographs (TMV, Bacteriophage, Cocci, Bacillus, Spirillum Bacteria)
   B) Gram staining technique.

3&4 A) Study of Plant diseases w.r.t.causal organism and symptoms of the Following:

a. Viral
   i. Yellow vein mosaic disease of Lady's finger
   ii. Leaf curl of Papaya

b. Bacteria
   i. Citrus canker
   ii. Black arm of cotton

c. Fungi
   i. Green mould of citrus fruits
   ii. Wheat rust (Specimen / Slide)

B) Study of growth forms of lichens (Crustose, Foliose and Fruticose)

C) Study of Mycorrhiza: (Ectomycorrhiza and Endomycorrhiza) by Photographs.

5, 6:Study of systematic position, vegetative and reproductive structures of the following :

A. *Nostoc*
I)Specimem of *Nostoc* Ball
II) Mounting of thallus: Colony, Trichome& filament
III) Cell structure

B. *Spirogyra*
I) Mounting of thallus (Vegetative)
II) Filament & Cell Structure
III) Congugation (P.S)

C.*Rhizopus*
I)Asexualthallus: Mycelium, Sporangia & Spores
II) Zygospore (P.S)

D.*Agaricus*
I) Specimen of full grown Mushroom
II) V. S. of gill : Mycelium, Basidia&basidiospores

7. How to Describe Angiospermic Plants.
8, 9, 10.Study of Plant families w. r. t. Systematic position, Morphological characters, Floral formula and floral diagram.
i. Malvaceae ii. Solanaceae
iii. Euphorbiaceaeiv. Cannaceae

11. Preparation of artificial key based on vegetative & reproductive characters.
12. Herbarium and its techniques.

Submission: 1. Any five wild plants herbarium/photographs..
2. Any Three Algae & Two Diseased Plant parts
3. Tour report

Note: *Short or long excursion tour and visit to any botanical garden is compulsory.*

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Semester – II
Paper I
Bot. 201: Diversity of Archegoniates

Total: 30 L

Aims and Objectives:

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

Unit 1: Introduction to Archegoniate (3L)

1.1 Diagnostic features of archegoniate and Transition to land habit
1.2 Alternation of generations.

Unit 2: Bryophytes (10L)

2.1Distinguishing features of the group
2.2 Range of thallus organization.
2.3 Classification of Bryophyta according to G. M. Smith (1955) upto classes with reasons, giving at least two examples from each class.
2.4 Study of life cycle :*Riccia*&*Funaria w.r.t* Morphology, anatomy and reproduction (Development not expected).
2.5 Economic importance of bryophytes and Ecological significance of *Sphagnum*

Unit 3: Pteridophytes (10L)

3.1 Distinguishing features of the group
3.2 Classification of Pteridophytes according to G. M. Smith (1955) upto classes with reasons, giving at least two examples from each class.
3.3 Study of ancient plant *Rhynia* w.r.t. systematic Position and Morphology.
3.4 Study of life cycle: *Selaginella*&*Adiantum*w.r.t.Morphology, anatomy and reproduction(Development not expected).
3.5 Types of Steles.
3.6 Economic importance of Pteridophytes

Unit 4: **Gymnosperms** (7L)

4.1 Introduction and distinguishing features
4.2 Classification of Gymnosperms by K.R.Sporneupto order giving reason with suitable examples.
4.3 Study of life cycle: *Cycas*and *Pinus*. w.r.t.Morphology, anatomy and reproduction (Development not expected).
4.4 Economic importance.

Reference Books:

1. Kumar, H.D. (1999). Introductory Phycology.Affiliated East-West.Press Pvt. Ltd. Delhi.2nd edition.
2. Raven, P.H., Johnson, G.B., Losos, J.B., Singer, S.R., (2005). Biology. Tata McGraw Hill, Delhi, India.

3. Vashishta, P.C., Sinha, A.K., Kumar, A., (2010). Pteridophyta, S. Chand. Delhi, India.
4. Bhatnagar, S.P. and Moitra, A. (1996). Gymnosperms. New Age International (P) Ltd Publishers, New Delhi, India.
5. Parihar, N.S. (1991). An introduction to Embryophyta. Vol. I. Bryophyta. Central Book Depot,Allahabad.

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Paper-II
Bot. 202: Plant Ecology

Total: 30 L

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.
4 To study the botanical regions of India and vegetationtypes of Maharashtra.

Unit 1: Introduction (2 L)

1.1 Definition and historical background
1.2 Scope & importance

Unit 2: Ecological factors

2.1. Abiotic factors (Humidity, light & temperature) (8 L)
2.2. Biotic factors (Symbiosis, epiphytes & parasitism)
2.3. Edaphic factors (Soil components, soil formation and soil profile)
2.4 Shelford law of tolerance
2.5 Adaptation of hydrophytes (*Hydrilla*&*Eichhornia*) and Xerophytes (*Nerium*&*Opuntia*)

Unit 3: Plant communities (5 L)

3.1 Characteristics of community
3.2 Species diversity
3.3 Growth form, Structure & dominance.
3.4 Ecological Succession: Hydrosere andXerosere

Unit 4: Ecosystem (10L)

4.1 Introduction & definition
4.2 Components of ecosystem
4.3 Types of ecosystem
a) Pond ecosystem
b) Grassland ecosystem
4.4 Food chain and food webs.
4.4 Ecologicalpyramids production and productivity.
4.5 Biogeochemical cycle: Carbon and Nitrogen

Unit 5: Phytogeography (5 L)

5.1 Basic Principles of Phytogeography
5.2Botanical regions of Inida
5.2 Vegetational types in Maharashtra
5.3Endemism: Causes and Types

Reference Books:

1) Agrawal, K. C. (1996) Environmental Biology, Agro-Botanical Publisher, Bikaner India.
2)Ambasta, R. S. (1990) Environmental and pollution, Student's friends and co.

Varanasi, India
3) Ambasta, R. S. (1988)A Text Book of Plant Ecology, Students Friends and co. Varanasi, India.
4) Dash, M. C. (1993) Fundamentals of Ecology, Tata MaGrow Hill, Publishing co. Ltd., New Delhi, India
5) Kumar, H. D. (1997) General Ecology, Vikas Publising House,(P) Ltd., New Delhi, India
6) Odum, E. P. (1996) Fundamental of Ecology, Natraj Publishers, Dehra-dun, India
7) Sharma, P. D. (2010) Ecology and Enivornment 8th ed. Rastogi Publication, Meerut, India
8) Kapur, P. and Govil, S. R. (2000) Experimental Plant Ecology. S. R. Jainfor, CBS, Publisher and Distributors, New Delhi, India.
9) Kormondy, E. J. (1996) Concepts of Ecology, 4th ed. Prentice Hall, U.S.A.
10) Mishra, R. and G.S. Puri,(2012) Indian Manual of plant Ecology. Scientific Publishers (India)
11) Moore, P. W. and S. B. Chapman (1986) Method in Plant Ecology. Blackwell Scientific Publication.
12) Kochhar, P. L. Plant Ecology, Genetic and Evolution, S. Nagin and Co. Ltd., New Delhi, India.
13) Nath, Ravindra(1992)Modern College Botany, IInd Edition, Kalyani Publisher, New Delhi, India.
14. Patil C.R.,PataskarP.G., Nagraja T.G.&Sathe S. S.(2004) Plant Physiology & Ecology, PhadakePrakashan, Kolhapur.
15. Verma, V. (1988) A Text Book of Plant Ecology, Emkay Publication, Delhi.

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Paper III
Bot. 203: Practical
(Based on Bot.201 and Bot.202)

1. **Study of *Riccia*:**Systematic Position,External &Internal morphology
   a) Mounting of rhizoids & scales
   b) T. S. of Thallus
   c) V. S. ofantheridia [P. S.]
   d) V.S.of archegonia [P.S.]
   e) V.S.of sporophyte [P.S.]
2. **Study of *Funaria*:**Systematic Position,External & Internal morphology
   a) T. S. of axis [P.S.]
   b) V.S. antheridial head [P.S.]
   c) V.S.ofarchegonial head [P.S.]
   d) V.S.of Capsule [P.S.]
3. **Study of *Selaginella*:** Systematic Position,External & Internal morphology
   a) T. S. of Stem
   b) Mounting of sporangia
   c) V. S. of Strobilus [P. S.]
4. **Study of *Adiantum*:** Systematic Position,External & Internal morphology
   a) T. S. of Rachis [P. S.]
   b) T. S. of Sorus [P. S.]
5. **Study of *Cycas*:** Systematic Position,External & Internal morphology
   a) T. S. of Rachis
   b)T. S. of leaflet
   c) Male cone microsporophyll [P. S.] OR Specimen
   d) Female cone megasporophyll [P. S.] OR Specimen
   e) V. S. of Ovule [P. S.]
6. **Study of *Pinus*:**Systematic Position,External & Internal morphology
   a) T. S. of Needle
   b) Mounting of pollen grain
   c) T. S. of Stem [P.S.]
   d) Male cone, microsporophyll [P. S.] OR Specimen
   e) Female cone, megasporophyll [P. S.] OR Specimen
   f) V. S. of Ovule [P. S.]

7.Demonstration, working and uses of the following ecological instruments.

   a) Soil thermometer
   b) Maximum and minimum thermometer
   c) Cup anemometer
   d) Hair hygrometer
   e) Rain Gauge

8. Determination of pH and analysis of two soil samples for carbonates, Nitrates &sulphates.

9. Study of morphological adaptations of hydrophytes and xerophytes (One each).

10. Study of biotic interactions with suitable example: Stem parasite , Root parasite, Epiphytes , Insectivorous plants.

11. Determinethe frequency & density of herbaceous vegetation by listcountquadratemethod.

12. Field visit.

Note*:1. Submission of any five plants from Archegoniates*

2. Tour report.

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KAVAYITRI BAHINABAI CHAUDHARI NORTH MAHARASHTRA UNIVERSITY, JALGAON

Faculty of Science and Technology

SYLLABUS FOR CORE AND SKILL ENHANCEMENT COUESES IN BOTANY

As Per U. G. C. Guidelines

Based on

Choice Based Credit System (CBCS)

S. Y. B. Sc. BOTANY SEMESTER-WISE SYLLABUS

(Theory and Practicals)

Semester-III

Bot. 301: Plant Anatomy

Bot. 302: Plant Physiology

Bot. 303: Practical Based on Bot: 301 and Bot: 302

Bot. 304: Mushroom Culture Technology

Semester-IV

Bot. 401: Plant Embryology

Bot. 402: Plant Metabolism

Bot. 403: Practical Based on Bot: 401 and Bot: 402

Bot. 404: Nursery and Gardening

w. e. f. June, 2019

KAVAYITRI BAHINABAI CHAUDHARI NORTH MAHARASHTRA UNIVERSITY, JALGAON

Structure of S.Y. B.Sc. Botany Syllabus under CBCS Pattern

w.e.f. June, 2019

Year	Sem.	Paper	Code	Title of Course	Marks		Credits
					Int.(CA)	Ext.(UA)	
II	III	I	Bot. 301	Plant Anatomy	40	60	2
		II	Bot. 302	Plant Physiology	40	60	2
		III	Bot. 303	Practical (LAB – I)	40	60	2
		IV	Bot. 304	Mushroom Culture Technology (SEC)	40	60	2
	IV	I	Bot. 401	Plant Embryology	40	60	2
		II	Bot. 402	Plant Metabolism	40	60	2
		III	Bot. 403	Practical (LAB – I)	40	60	2
		IV	Bot. 404	Nursery and Gardening (SEC)	40	60	2

KAVAYITRI BAHINABAI CHAUDHARI NORTH MAHARASHTRA UNIVERSITY, JALGAON

Syllabus of S.Y.B.Sc. Botany w.e.f. June, 2019

CBCS Pattern

Semester: III

PAPER-I

BOT. - 301: PLANT ANATOMY

Lectures: 30

AIMS AND OBJECTIVES

1. To know scope and importance of plant anatomy
2. To study various tissue systems
3. To know primary structure of dicot and monocot plants
4. To study normal secondary growth in plants and their causes
5. To study protective tissue system

Unit-1: **Introduction** **02 L**

1.1 Definition, Scope and Importance

Unit- 2: **Plant Tissues** **08 L**

2.1 Definition

2.2 Meristematic tissues: Classification based on position and origin

2.3 Tissues and it's types:

(a) Simple tissues:

i) Parenchyma: Arenchyma, Chlorenchyma and Palisade

ii) Collenchyma

iii) Sclerenchyma: Fiber and Sclereids / Stone cells

(b) Complex tissues:

i) Xylem and its elements

ii) Phloem and its elements

Unit-3: Protective Tissue System **07 L**

3.1 Epidermal Tissue System: Definition and Function

3.2. Types of Epidermal Appendages

a) Unicellular, Multicellular (Uniseriate and Multiseriate) Trichomes

b) Glandular, Non-glandular Trichomes

c) Stellate, Dendroid Trichomes and Peltate scales

3.3 Types of Stomata

i. Ranunculaceous (Anomocytic)

ii. Cruciferous (Anisocytic)

iii. Rubiaceous (Paracytic)

iv. Caryophyllaceous (Diacytic)

v. Graminaceous

Unit-4: **Primary Structure** **08 L**

4.1 Dicotyledonous (Sunflower)

i. Root

ii. Stem

iii. Leaf

4.2 Monocotyledonous (Maize)

i. Root

ii. Stem

iii. Leaf

Unit- 5: Secondary Growth **05L**

5.1 Vascular cambium- Structure and function, seasonal activity

5.2 Secondary growth in root and stem of Sunflower

5.3 Wood- Heartwood and sapwood

REFERENCES:-

1) Carlquist, S. (1961) Comparative Plant anatomy. Hold, Rinehart and Winson, New York, USA.

2) Chandurkar, P.J, (1971) Plant Anatomy (3rd Ed.), Oxford and IBH Publishing Co. New Delhi and Bombay, India.

3) Choyal Rajaram (2012) Plant Anatomy and Physiology, Sonali Publications, New Delhi, India.

4) Cutter, E. G. (1971) Plant Anatomy: Experiment and Interpretation Part-II, Organ. Edward Arnold, London, UK.

5) Das Susheela, M. (2017) A Text Book of Plant Anatomy. Dominant Publishers and Distributers Pvt. Ltd., New Delhi, India.

6) Eames, A.J. and L.H. Mc Daniels (1947) An Introduction to Plant Anatomy, (2nd Ed.).McGraw Hill Co. New York, USA.

7) Esau, K. (1977) Anatomy of Seed Plants (2nd Ed.).John Wiley, New York, USA.

8) Fahn, A. (1982) Plant Anatomy (3rd Ed.) Pergman Press, Oxford and New York. USA.

9) Grewal, R.C. (2011) Plant Anatomy. Campus Books International, New Delhi, India.

10) Mauseth, J.D. (1988) Plant Anatomy. The Benjamin/Cummings Publisher, USA.

11) Menan , A.B. (2008) Introduction to Plant Anatomy. Rajat Publications, New Delhi, India.

12) Pandey, B.P. (1954) Plant Anatomy. S. Chand and Co. (P.) Ltd. New Delhi, India.

13) Pandey, S.N. and A. Chadha (2006) Plant Anatomy and Embryology. Vikas Publishing House Pvt., Ltd., New Delhi, India.

14) Sharda, Tarun P. (2012) An Introduction to Plant Anatomy. Alfa Publications, New Delhi, India.

15) Sharma Rajani (2009) An Introduction to Plant Anatomy. Campus Books International, New Delhi, India.

16) Singh Sanjay Kumar ((2005) Text Book of Plant Anatomy. Campus Books International, New Delhi, India.

17) Singh, S. K., and Seema Srivastava (2011) Anatomy of Angiosperm. Campus Books International, New Delhi, India.

18) Singh, V., P.C. Pande and D.K. Jain (1998) Anatomy of Seed Plants. Rastogi Publications, Meerut, India.

19) Singh, V., P. C. Pande and D.K. Jain (2013) A Text Book of Botany Angiosperm. Rastogi Publications, Meerut, India.

20) Tandan Neeraj (2014) An Introduction to Plant Anatomy. Anmol Publications, Pvt., Ltd., New Delhi, India.

21) Tayal, M.S. (1994) Plant Anatomy. Rastogi Publications, Meerut, India.

22) Vashista, P.C. (1986) Plant Anatomy. Pradeep Publications, Jalandhar, India.

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PAPER – II

BOT.302: PLANT PHYSIOLOGY

Lectures: 30

AIMS AND OBJECTIVES

1. To know importance and scope of plant physiology.
2. To study plant and plant cell in relation to water.
3. To study different process in relation with structure of organism and its environment.
4. To understand mechanism of absorption of water, gases and solutes.
5. To understand growth at various level.

Unit: 1.Introduction **01 L**

1.1 Definition, scope and importance of plant physiology.

Unit: 2. Plant cell and water relation **05 L**

2.1 Diffusion, Definition, mechanism of diffusion with suitable example, Diffusion Pressure, Graham's law of diffusion and significance of diffusion.

2.2 Osmosis: Introduction, definition, mechanism of osmosis with suitable Osmometer, osmotic pressure, turgor pressure and wall pressure, DPD and its relation with OP, TP, and WP. Types of solution- Hypotonic, Hypertonic and Isotonic. Type of Osmosis- Exosmosis and Endosmosis, significance of osmosis , Plasmolysis, de-plasmolysis.

2.3 Imbibition**:** Definition, mechanism, imbibition pressure, Importance of imbibition.

Unit: 3. Absorption of water **05 L**

3.1 Importance of water.

3.2 Mechanism of water absorption.

a. Active absorption- Osmotic theory and non-osmotic theory.

b. Passive absorption.

3.3 Factors affecting water absorption.

Unit: 4. Ascent of Sap **05 L**

4.1 Introduction and definition

4.2 Theories of ascent sap.

a. Vital theories

b. Root pressure theory.

c. Physical force theories

d. Transpiration pull theory.

Unit: 5. Transpiration **05 L**

5.1 Definition, Magnitude and types of transpiration, Structure of stomata, mechanism of opening and closing of stomata.

5.2 Theories of stomatal opening and closing.

a. Theory of Starch- Glucose interconversion and stomatal opening in Succulent plants(Steward's Theory)

b. K^+ pump theory.

5.3 Factors affecting rate of transpiration.

5.4 Significance of transpiration.

Unit: - 6. Mineral nutrition and absorption of mineral salt **05 L**

6.1 Introduction, essential and non essential elements, Macro and micro nutrient elements.

6.2 Specific functions and deficiency symptoms of- Nitrogen, Sulphur, Phosphorus, Potassium, Magnesium and Boron.

6.3 Mechanism of mineral salt absorption.

a) Passive absorption- Mass flow theory, Ion exchange and Donnan's equilibrium.

b) Active absorption- Carrier concept theory- Protein lecithin as carrier.

Unit: 7 .Plant growth and Phytohormones **04 L**

7.1 Introduction, Definition of growth, Development and Differentiation

7.2 Definition of Phytohormones and role of Auxins, Gibberellins, Cytokinins, Ethylene and Abscisic acid.

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REFERENCES:-

1. Amar Singh (1977) Practical Plant Physiology. Kalyani Publication, New Delhi, Ludhiana, India.

2. Jain. V.K. (1977) Fundamentals of plant physiology. S. Chand and Company Ltd. New Delhi, India.

3. Kochhar. P. L. (1962) A Text Book of Plant Physiology, Atmaran and Sons, New Delhi, India.

4. Kumar, A. and S.S. Purohit (1998) Plant Physiology, Fundamentals and Application. Agro Botanical, Bikaner, India.

5. Meyer. B.S and D.B. Anderson (1952) Plant Physiology Affiliated East-West Press Pvt. Ltd., New Delhi, India.

6.Mukharji and Ghosh A.K. (1996) Plant Physiology. Tata McGraw-Hill Publishing company Ltd. New Delhi, India.

7.Pandey and Sinha (1999) Plant Physiology. Vikas Publishing House Pvt. Ltd. New Delhi, India.

8. Sarabhai, B.P. (1995) Elements of Plant Physiology. Anmol Publication Pvt. Ltd, New Delhi, India.

9.Srivastava. H.C (1994) Plant Physiology, Rastogi Publication, Meerut, India.

10.Sundara Rajan (2000) College Botany (Plant Physiology and Molecular Biology Vol.IV, Himalaya Publishing House, New Delhi, India.

11.Varma, V. (1984) Introduction to Plant Physiology. Emkay Publication, New Delhi, India.

12.Varma V. (1995) A Text Book of Plant Physiology and Biochemistry. S. Chand and Company. New Delhi, India.

13.Taiz, L. Zeiger E. (2010) Plant Physiology. Sinauer Associates Inc.; U.S.A. 5th edition.

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PAPER- III

BOT. 303:Practical (Based on BOT. - 301 and BOT. - 302)

Practical No.1&2

i) Study of meristem (Permanent slides/ Photographs).

ii) Study of Simple Tissues:

Parenchyma, Collenchyma and Sclerenchyma (Permanent Slides/ Photographs)

iii) Macerated xylem and phloem elements (Permanent slides/ Photographs).

iv) Study of dicot leaf(Sunflower) and monocot leaf (Maize) (permanent slides.)

Practical No: 3 and 4: Study of primary structure of dicot stem (Sunflower) and monocot stem (Maize).

Practical No.5: Study of primary structure of dicot root (Sunflower) and monocot root(Maize) (Permanent slides).

Practical No.6 and 7: Study of secondary growth structure in dicot stem and root (Sunflower)

Practical No. 8:

Study of trichomes (any three types) and stomata (any three types) with the help of locally available plant materials.

Practical No. 9: To determine DPD by using potato tuber.

Practical No.10: Determination of osmotic potential of plant cell sap by plasmolytic method.

Practical No. 11: To study the effect of two environmental factors (light and wind) on transpiration by excised twig.

Practical No.12and 13: Qualitative assessment of minerals in plant ash (any two from Macro and Micro elements)

Practical No.14. Demonstration experiments.

1. Osmosis by Curling experiment.
2. Osmosis-Thistle funnel experiment.
3. Bolting (Specimen or photograph)

Practical No.15. Demonstration experiments.

1. Suction due to transpiration.
2. Relative Transpiration.
3. Imbibition Pressure.
4. Ringing experiment.

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PAPER – IV

SKILL ENHANCEMENT COURSE (SEC)

BOT. 304: MUSHROOM CULTURE TECHNOLOGY

Lectures: 30

AIMS AND OBJECTIVES

1. To learn the history, scope and importance of mushroom technology
2. To understand nutritional and medicinal values of edible mushrooms
3. To know about the storage, marketing and various food preparations of mushrooms.
4. To understand the economics of mushroom cultivation.

Unit l: Introduction **05 L**

1.1: Scope and importance.

1.2: Nutritional and medicinal value of edible mushrooms.

1.3: Edible and non-edible mushrooms.

1.4: Morphology and distinguishing characteristics of following mushrooms:

a. Button (*Agaricus bisporus*)

b. Oyster (*Lentinus sajor-caju*, Syn. *Pleurotus sajor-caju*)

c. Paddy straw *(Volvariella volvacea*)

Unit 2: Cultivation Technology **15 L**

2.1: Mushroom farm layout and requirements

2.2. Materials for compost preparation, Different formulations, Selection of composting materials, Commonly used formulations, Synthetic compost and its advantages,

2.3: Spore culture and preparation of spawn.

2.4: Casing and its Importance, Quality parameters of casing mixture and commonly used materials for casing.

2.5: Cultivation procedure of: a. *Agaricus bisporus b. Pleurotus sajor-caju*.

Unit 3: Storage **04 L**

3.1: Short-term storage (Refrigeration - upto 24 hours)

3.2: Long term storage (canning, pickling). Drying, storage in salt solutions.

3.3: Marketing

Unit 4: Food Preparation **06 L**

4.1: Types of foods prepared from mushroom: Soup, Cutlet, Omlette, Samosa, Pickles, Curry.

4.2 Training Centres: National and Regional level.

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Semester: IV

PAPER- I

BOT. - 401: PLANT EMBRYOLOGY

Lectures: 30

AIMS AND OBJECTIVES

1. To know the scope and Importance of Embryology
2. To study structure of micro and megasporangium.
3. To study pollination, fertilization, Endosperm and Embryogeny.
4. To give exposure of techniques in embryology

Unit 1: Introduction **01L**

1.1: Definition, Scope and importance of Embryology

Unit 2: Microsporangium (Anther) **04 L**

2.1: Structure of anther- Epidermis, endothecium, middle layer sporogenious tissue and Tapetum.

2.2: Tapetum types- a) Amoeboid or plasmodia b) Secretary or glandular

2.3: Functions of Tapetum

2.4: Microsporogenesis- karyokinesis and cytokinesis (simultaneous and successive)

2.5: Structure of pollen and Male gametophyte

2.6: Types of pollen tetrad – linear, isobilateral, tetrahedral, decussate, T- shaped.

Unit 3: Megasporangium (Ovule) **05 L**

3.1: Structure of Ovule.

3.2: Types of ovule: i) Orthotropous ii) Anatropous iii) Amphitropous iv) Hemianatropous v) Compylotropous vi) Circinotropous

3.3: Types of Embryo sac. i) Monosporic (*Polygonum*) ii) Bisporic (*Allium*) iii) Tetrasporic (*Peperomia*)

Unit 4: Pollination and Fertilization **05 L**

4.1: Definition and Types of Pollination: Anemophily, Entomophily, Hydrophily

4.2: Fertilization i) Definition ii) Entry of pollen tube into ovule - Porogamy,

chalizogamy and mesogamy

iii) Process of double fertilization and tripl fusion

iv) Significance of double fertilization mechanism.

Unit 5: Endosperm **03L**

5.1: Definition.

5.2: Structure and function of endosperm.

5.3: Types of Endosperm. i) Nuclear ii) Cellular iii) Helobial.

Unit 6: Embryo **03L**

6.1: Definition

6.2: Structure of Dicot Embryo e.g. *Capsella brussa pastories* (Development not expected)

6.3: Structure of monocot embryo e.g. *Sagittaria* (Development not expected)

Unit 7: Seed structure and dispersal **06L**

7.1: Definition, structure of seed.

7.2: Appendages and dispersal mechanism of seed- Aril, Coma, Caruncle

7.3 Dispersal Mechanism:

i. By Wind - (Anemochory):

a. Winged seed and fruits b. Parachute mechanism c. Hairs

ii. By Water (Hydrochory): a. Floating devices b. Protective covering

iii. By Animal (Zoochory): a. Hooked fruits and seeds b. Sticky Fruit c. Edible fruit

Unit 8: Apomixis and polyembryony. **03L**

8.1: Apomixis: Definition and types – Non- recurrent, recurrent , adventive embryony and veg. reproduction

8.2: Polyembryony: Definition

8.3 Types of polyembryony: i. Simple ii. Cleavage iii Rosette

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PAPER- II

BOT.-: 402 PLANT METABOLISM

Lectures 30

AIMS AND OBJECTIVES

1. To know the scope and importance of plant metabolism.
2. To study the properties, mechanism and classification of enzymes.
3. To study the process of photosynthesis in higher plants, C3, C4 and CAM pathways.
4. To study respiration in higher plants.

Unit 1: Introduction **02 L**

1.1: Definition

1.2: Plant cell as organic Laboratory

1.3: Anabolism and catabolism

Unit 2: **Enzymes** **04 L**

2.1: Definition, Structure and properties.

2.2: Classification of enzymes

2.3: Mode of enzyme action: Lock and key Model, Induced fit model

Unit 3: **Photosynthesis** **11 L**

3.1: Definition, photosynthetic apparatus (Structure of Chloroplast)

3.2: Role of photosynthetic pigments: Chlorophyll (Chl- a, Chl- b), Carotenoids and Phycobillins

3.3: Photosystem I and II

3.4: Mechanism

a : Light Reaction: Cyclic and Non Cyclic Photophosphorylation.

b : Dark Reaction: C3, C4 and CAM pathways.

3.6: Photorespiration: Definition, Sites and Mechanism of photorespiration.

3.7: Factor affecting the process of photosynthesis.

Unit 4: Respiration **07 L**

4.1: Introduction, Definition and Types of respiration.

4.2: Mechanism of Aerobic respiration.

a) Glycolysis.

b) Kreb's cycle.

c) Electron Transfer System (ETS)

4.3 Mechanism of Anaerobic respiration: Alcoholic Fermentation

4.4 Factor affecting the process of respiration.

Unit 5: Nitrogen metabolism **06 L**

5.1: Introduction.

5.2: Types of Nitrogen fixation.

5.3: Biological nitrogen fixation.

5.4: Nitrate and ammonia assimilation.

5.5: Importance

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PAPER- III

BOT.403: Practical (Based on BOT. - 401 and BOT. - 402)

Practical No.1: Study of the following with the help of P.S. / photographs.

i) T.S. of microsporangium (Anther)

ii) Tapetum – a) Amoeboid b) Secretory

Practical No 2: Study of types of ovules with the help of P.S. / Photographs as per theory.

Practical No 3: Study of different kinds of embryo sac with the help of P.S / Photographs

i) Monosporic - *Polygonum*

ii) Bisporic - *Allium*

iii) Tetrasporic - *Peperomia*

Practical No 4: Mounting of embryos from suitable seeds (*Cucumis / Cymopsis / Citrus*).

Practical No 5: Study of structure of dicot and monocot seed

Practical No 6 and 7: Study of seed dispersal mechanism.

i: Winged – *Moringa, Hiptage*

ii: Parachute – Pappus (*Tridax*)

iii: Hair – *Calatropis*

iv: Floating – Coconut

v: Animal – *Xanthium, Achyranthes*

vi: Sticky – *Plumbago / Cleome / Boerrhaavia*

Practical No 8 and 9: Study the activity of catalase and study the effect of pH and enzyme concentration.

Practical No 10 and 11: To study the effect of light intensity and bicarbonate concentration on O_2 evolution in photosynthesis.

Practical No 12: Comparison of the rate of respiration in any two parts of a plant by using Ganong's potometer.

Practical No 13: Separation of amino acids by paper chromatography.

Practical No 14 and 15: Demonstration experiments

i. To demonstrate the presence of starch in chloroplast

ii. CO_2 essential for Photosynthesis

iii. R.Q. (Respiratory Quotient)

iv. Kuhne's Tube experiment

v . Isolation and Inoculation of *Rhizobium*

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PAPER – IV

SKILL ENHANCEMENT COURSE (SEC)

BOT.404: NURSERY AND GARDENING

Lectures: 30

AIMS AND OBJECTIVES

1. To know the concept of nursery and Gardening.
2. To improve the skills for growing fresh and safe vegetables.
3. To create awareness about home gardening.
4. To develop different skills regarding the gardening operations among the students

Unit 1. Nursery **04 L**

Definition, objectives and scope, building up of infrastructure for nursery, planning and seasonal activities. Planting :direct seedling and transplant.

Unit 2. Seed structures and types **04 L**

Seed dormancy, causes and methods of breaking dormancy, Seed storage: Seed banks, factors affecting seed viability and genetic erosions.

Unit 3. Vegetative propagation **05 L**

Cutting and Air-layering: selection, techniques of cutting, rooting medium, planting and hardening of plants in green house or glass house.

Harvesting, Packing, Storage and Marketing of Nursery stock.

Unit 4. Gardening **07 L**

Definition, objectives and scope,. Different types of gardening: Landscape, home gardening and park, and its Components, suitable plants, soil, manuring and watering.

Unit 5. Indoor Gardening **04 L**

Definition, characters of indoor plants, containers, selection of indoor plants, Potting media, watering tips.

Botanical name, cultivation practices, Ornamental value, maintenance and care of Cycads and Pothas (Two examples each)

Unit 6: Cultivation practices **06 L**

Introduction, study of cultivation of some vegetables: Brinjal and Tomato w.r.t.

i) Sowing ii) Transplanting of seedling

iii) Varieties iv) Mannuaring and irrigation

v) Pest, Diseases and control measures vi) Harvesting

vii) Storage and Marketing

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1.Bose T.K. and Mukherjee. D. (1972). Gardening in India, Oxford and IBH Publishing Vo., New Delhi.

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Equivalence: Theory and Practicals
Class: S. Y. B. Sc.
Subject : Botany

PAPER	**Old Courses (W.E.F. June, 2016)**	**PAPER**	**New Courses (W.E. F. June, 2019)**
SEM-III			
BOT. 231	Bryophytes and Pteridophytes	Bot. 402	Plant Metabolism
BOT. 232	Morphology of Angiosperms	Bot. 401	Plant Embryology
BOT. 233	Based on BOT.231, BOT.- 232,	Bot. 403	Practical (LAB – I) Based on Bot. 401 and Bot. 402
SEM-IV			
BOT. 241	Plant Physiology	Bot. 302	Plant Physiology
BOT. 242	Taxonomy of Angiosperms	Bot. 301	Plant Anatomy
BOT. 243	Based On BOT.-241 and BOT.-242	Bot. 303	Practical (LAB – I) Based on Bot. 301 and Bot. 302

KAVAYITRI BAHINABAI CHAUDHARI NORTH MAHARASHTRA UNIVERSITY, JALGAON

Faculty of Science and Technology

(NAAC Re-Accredited)

SYLLABUS FOR CORE AND SKILL ENHANCEMENT COUESES IN BOTANY

As Per U. G. C. Guidelines

Based on

Choice Based Credit System (CBCS)

T. Y. B. Sc. BOTANY SEMESTER - WISE SYLLABUS

(Theory and Practicals)

To Be Implemented From

Academic Year 2020 - 2021

KAVAYITRI BAHINABAI CHAUDHARI NORTH MAHARASHTRA UNIVERSITY, JALGAON

Faculty of Science and Technology

SYLLABUS FOR CORE AND SKILL ENHANCEMENT COUESES IN BOTANY

As Per U. G. C. Guidelines

Based on

Choice Based Credit System (CBCS)

T. Y. B. Sc. BOTANY SEMESTER - WISE SYLLABUS

(Theory and Practicals)

SEMESTER - V

DISCIPLINE SPECIFIC COURSES

Bot. 501: Lower Cryptogams

Bot. 502: Morphology and Systematics of Angiosperms

Bot. 503: Cell biology and Genetics

Bot. 504: Plant Physiology and Biochemistry

SKILL ENHANCEMENT COURSE

Bot. 505: Biofertilizers

ELECTIVE COURSES

Bot. 506A: Analytical Techniques in Plant Sciences

Bot. 506B: Horticulture

PRACTICAL COURSES

Bot. 507: Practical - I: Based on BOT. 501 & BOT. 505

Bot. 508: Practical - II: Based on BOT. 502 & BOT. 506 A & BOT. 506B

Bot. 509: Practical - III: Based on BOT. 503 & BOT. 504

W. E. F. JUNE. 2020

SEMESTER - V

Discipline	Core Course Type	Course Code	Course Title	Credits	Total Hrs./ Week	Total Teaching Hrs.	Total Mark (100)	
							CA	UA
Discipline Specific Course (DSC)	Paper - I	BOT.501	Lower Cryptogams	3	3	45	40	60
	Paper - II	BOT.502	Morphology and Systematics of Angiosperms	3	3	45	40	60
	Paper -III	BOT.503	Cell Biology and Genetics	3	3	45	40	60
	Paper -IV	BOT.504	Plant Physiology and Biochemistry	3	3	45	40	60
DSC Skill Enhancement Course	Paper - V	BOT.505	Biofertilizer	3	3	45	40	60
DSC Elective Course (Any one)	Paper -VI	BOT.506 A	Analytical Techniques in Plant Sciences	3	3	45	40	60
		BOT.506 B	Horticulture	3	3	45	40	60
DSC Core Practicals	Practical I	BOT.507	Practicals Based on BOT.501 and BOT.505	4	4/Batch	60	40	60
	Practical II	BOT.508	Practicals Based on BOT.502 and BOT.506A or Bot.506B	4	4/Batch	60	40	60
	Practical III	BOT.509	Practicals Based on BOT.503 and BOT.504	4	4/Batch	60	40	60
Non-Credit Audit Course (Any One)	Paper-VII	AC-510	NSS	No Credit	2	30	100	--
		AC-511	NCC					
		AC-512	Sports					

KAVAYITRI BAHINABAI CHAUDHARI NORTH MAHARASHTRA UNIVERSITY, JALGAON

Equivalence of the T. Y. B. Sc. Botany CBCS Syllabus

Paper	Course	SEMESTER - V CBCS Syllabus (New)	Course	SEMESTER - V CGPA Syllabus (Old)
I	Bot. 501	Lower Cryptogams	Bot. 351	Cryptogams
II	Bot. 502	Morphology and Systematics of Angiosperms	Bot. 352	Angiosperm Taxonomy
III	Bot. 503	Cell biology and Genetics	Bot. 353	Cell and Molecular Biology
IV	Bot. 504	Plant Physiology and Biochemistry	Bot. 354	Advanced Plant Physiology
V	Bot. 505	Biofertilizers	Bot. 355	Plant Ecology and Phytogeography
VI	Bot.506A/ Bot.506B	Analytical Techniques in Plant Sciences/ Horticulture	Bot.356.1/ Bot.356.2/ Bot.356.3/ Bot.356.4	Plant Biotechnology/ Ethnobotany/ Gardening/Seed Technology and seed pathology

KAVAYITRI BAHINABAI CHAUDHARI NORTH MAHARASHTRA UNIVERSITY, JALGAON

Syllabus of T. Y. B. Sc. Botany w. e. f. June, 2020

CBCS Pattern

DISCIPLINE SPECIFIC COURSE (DSC)

SEMESTER - V

PAPER - I

BOT. 501: LOWER CRYPTOGAMS (Lectures: 45)

AIMS AND OBJECTIVES:

1. To study salient features of cryptogamic plants.
2. To make students aware about 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 cryptogramic plants.

Unit 1: An introduction to Algae (09 Lectures)

1.1. Definition and general characters
1.2. Habit and habitat
1.3. Organization of thallus
1.4. Similarities, differences with fungi and Bryophytes
1.5. Reproduction
1.6. Life cycle patterns: Haplontic, Diplontic and Diplohaplontic
1.7. Outline classification of Algae according to F. E. Fritsch (1945) up to classes with suitable examples

Unit 2: Study of Life cycle with emphasis on systematic position, occurrence, morphology, reproduction and alternation of generation of ***Chara*** and ***Sargassum*** **(09 Lectures)**

Unit 3: An introduction to fungi (09 Lectures)

3.1. Definition and General Characters
3.2. Habit and habitat
3.3. Structure of thallus
3.4. Reproduction
3.5. Outline classification of fungi according to Ainsworth (1973) up to classes with suitable examples.

Unit 4: Study of Life cycle of fungi with reference to systematic position, thallus structure, reproduction of *Albugo* and *Uncinula* **(09 Lectures)**

Unit 5: Applied Phycology and Mycology (09 Lectures)

5.1. Role of Algae in i) Agriculture ii) Industry iii) Biotechnology iv) Water Pollution
5.2. Role of Fungi in i) Agriculture ii) Industry iii) Food iv) Medicine
5.3. Contribution of following Phycologists
i) Prof. M. O. P. Iyengar ii) Prof. T. V. Deshikachary
5.4. Contribution of following mycologists

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

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13. Singh, Pande and Jain. (2004). Text book of Botany. Diversity of Microbes and Cryptogams. Rastogi Publications, Gangotri, Shivaji Road, Meerut
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DISCIPLINE SPECIFIC COURSE (DSC)

SEMESTER - V

PAPER - II

BOT. 502: MORPHOLOGY AND SYSTEMATICS OF ANGIOSPERMS (Lectures: 45)

AIMS AND OBJECTIVES:

1. To study vegetative and floral morphology of angiospermic plants
2. To study the status of angiosperm in plant kingdom
3. To study the origin of angiosperm with respect to age and probable ancestors
4. To study various angiosperm families emphasizing their morphology, salient features etc.
5. To know the role of anatomy and embryology in taxonomy

Unit1. Vegetative Morphology (09 Lectures)

1.1. Definition and scope of Morphology

1.2. Root: Definition, General characters and functions

Types of root: Tap and Adventitious

1.3. Stem: Definition, General characters and functions

1.4. Leaf: Definition,

a) Parts of typical leaf.

b) Types of leaf: Simple, Compound: Pinnately and Palmately.

c) Phyllotaxy: Alternate, Opposite and whorled.

d) Venation: Reticulate and parallel

1.5. Leaf Modifications: Phyllode, Pitcher

Unit 2: Floral Morphology (09 Lectures)

2.1. Inflorescence: Definition, Parts of Inflorescence

Types of Inflorescence:

a) Racemose - Raceme, Spike, Catkin, Spadix, Corymb, Umbel and Capitulum

b) Cymose: Solitary, Uniparous, Biparous and Multiparous cyme

c) Special Types: Cyathium, Verticillaster, Hypanthodium

2.2. Flower: Definition, Parts of typical flower and their functions

2.3. a) Insertion of floral leaves on thalamus: Hypogynous, Perigynous and Epigynous

b) Symmetry: Actinomorphic, Zygomorphic and Asymmetric

2.4. Calyx: Polysepalous, Gamosepalous

2.5. Corolla:

a) Regular polypetalous - Cruciform, Caryophyllaceous and Rosaceous

b) Irregular polypetalous - Papilionaceous,

c) Regular gamopetalous: Campanulate, Tubular, Infundibuliform, Rotate and Hypocrateriform

d) Irregular gamopetalous: Bilabiate, Ligulate and Personate

2.5. Androecium:

i) Cohesion of Stamen:

a) Adelphy: Monadelphous, Diadelphous, Polyadelphous

b) Syngeny

c) Synandry

ii) Adhesion of stamen: Episepalous, Epipetalous, Epiphyllous and Gynandrous

2.6. Gynoecium: Apocarpous and Syncarpous pistil, Monocarpellary, Bicarpellary and polycarpellary

Types of Placentation: Marginal, Basal, Axile, Parietal, Free central and superficial

2.7. Fruit: Definition, Parts of typical fruit

Types: a) Simple - Loculicidal capsule

b) Aggregate - Etaerio of berries

c) Composite - Syconus

Unit 3: Study the origin of Angiosperms (09 Lectures)

3.1. Definition, Distinguishing Characters of Angiosperms

3.2. Taxonomy : Aims of taxonomy - Empirical and Interpretative approach

3.4. The origin of Angiosperms: w. r. t.

i) Age of Angiosperms

ii) Probable ancestors of angiosperms:

a) The Anthostrobilus (Bennettitalean) theory

b) The Gnetales theory

Unit 4: Systems of Classification and Modern Trends in Taxonomy (09Lectures)

4.1. Study of Systems of Classification w. r. t. outline, merits and demerits of Hutchinson's system and Engler and Prantl's system

4.2. Modern Trends in Taxonomy

Role of following with suitable examples:

a) Anatomy

b) Embryology

Unit 5: Study of Angiosperm Families (09 Lectures)

(*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. Rutaceae
3. Caesalpiniaceae
4. Compositae (Asteraceae)
5. Sapotaceae
6. Asclepiadaceae
7. Amaranthaceae

8. Liliaceae

Point of biological interest of Asclepiadaceae

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DISCIPLINE SPECIFIC COURSE (DSC)

SEMESTER - V

PAPER - III

BOT. 503: CELL BIOLOGY AND GENETICS (Lectures: 45)

AIMS AND OBJECTIVES:

1. To study the Prokaryotic and eukaryotic cell
2. To study the cell components and their functions
3. To study the cell cycle
4. To introduce the students with "Science of Heredity"
5. To study linkage and crossing over

Unit 1: Cell and Cell Cycle (09 Lectures)

1.1. Introduction, definition and history of cell, types of cell, Characteristics of Prokaryotic and eukaryotic cells, Cell theory

1.2. Cell Wall and Cell Membrane: Definition, Physical and chemical Properties and functions of plant cell wall and Membranes Unit Membrane model, Fluid Mosaic model

1.3. Various phases of Eukaryotic cell cycle, Mitosis and Meiosis

Unit 2: Cell organelles (09 Lectures)

2.1. Mitochondria: Ultra Structural organization and function of Mitochondria

2.2. Chloroplast: Ultra Structural organization and function of Chloroplast

2.3. Endoplasmic reticulum: Ultra Structure, types and functions

2.4. Golgi Complex: Ultra Structure and function

2.5. Nucleus: Structure, Morphology and Ultra structure (Nuclear envelope, Nucleoplasm, Chromatin material and Nucleolus)

2.6. Chromosome: Morphology, Types of chromosomes on the basis of centromere

Genetics

Unit 3: Introduction (09 Lectures)

3.1. Genetics: Introduction, History and scope

3.2. Mendelian Genetics: Mendelism, History, Terminology, Mendel's laws, Monohybrid, Dihybrid cross.

3.3. Gene interaction: Lethal gene, Complementary gene, Duplicate and Dominant epistatic.

3.4. Cytoplasmic inheritance: Definition, chloroplast inheritance in variegated 4o clock plant (*Mirabilis jalapa*). Cytoplasmic male sterility in maize.

3.5. Multiple alleles: Definition, characters and examples (*Nicotiana* sps.).

Unit 4: Linkage and Crossing over (09 Lectures)

4.1. Introduction: Concept and history of linkage, Kinds of Linkages, Hypothesis of Linkages (Bateson and Punnett)

4.2. Crossing over: Introduction, Definition, Mechanism and types (Single and Double)

Unit 5: Chromosomal aberrations (09 Lectures)

5.1. Introduction, Definition.

5.2. Types of Chromosomal Aberrations

5.3. Numerical change: Euploidy, aneuploidy and its types

5.4. Structural changes: Addition, deletion, substitution, translocation and inversion

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DISCIPLINE SPECIFIC COURSE (DSC)

SEMESTER - V

PAPER - IV

BOT. 504: PLANT PHYSIOLOGY AND BIOCHEMISTRY (Lectures: 45)

AIMS AND OBJECTIVES:

1. To study the growth pattern of plant
2. To know the phenomenon of photoperiodism and effect of phytochrome on flowering
3. To study the vernalization process
4. To know the path of translocation
5. To study the biomolecules in plants
6. To study secondary metabolites and their role in plants

Plant Physiology

Unit 1: Plant growth and Movement (09 Lectures)

1.1. Plant growth: Introduction and Definition

1.2. Phases of growth

1.3. Growth curve

1.4. Factors affecting growth

1.5. Plant movement: Introduction and Definition

1.6. Types of plant movement: i) Tropic ii) Tactic iii) Nastic

Unit 2: Physiology of flowering (09 Lectures)

2.1. Photoperiodism:

a) Introduction, Definition

b) Classification of plants: SDP, LDP, DNP

c) Photoperiodic induction

d) Phytochrome and role of phytochrome in flowering

2.2.Vernalisation:

a) Introduction and Definition

b) Mechanism of vernalization, hypothesis of phasic development and hypothesis of hormonal involvement

c) Devernalization

Unit 3: Translocation of organic solutes (09 Lectures)

3.1. Definition

3.2. Path of translocation

3.3. Evidences for phloem transport

3.4. Mechanism of translocation: Pressure flow theory, Diffusion

3.5. Source to sink relationship

3.5. Phloem loading and unloading

3.6. Factors affecting phloem translocation i) External: temperature, light ii) Internal: Hormonal and metabolic inhibition

Biochemistry

Unit 4: Biomolecules **(09 Lectures)**

4.1. Introduction

4.2. Carbohydrates: Introduction, definition, classification, properties and functions of carbohydrates

4.3. Amino acids and proteins: Introduction, definition, properties of amino acids. Role of amino acids in plants. Classification of proteins (Primary and secondary proteins), properties and functions of proteins

4.4. Lipids: Introduction, definition, classification, properties and functions of lipids

Unit 5: Secondary Metabolites **(09 Lectures)**

5.1. Introduction, Definition

5.2. Distribution of Secondary metabolites

5.2. Brief account of sec. metabolites w. r. t. occurrence in plants, and function of a) alkaloids, b) flavonoids c) Terpenes.

5.6. Role of Secondary metabolites in plants

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DSC SKILL ENHANCEMENT COURSE

SEMESTER - V

PAPER - V

BOT. 505: BIOFERTILIZERS (Lectures: 45)

AIMS AND OBJECTIVES:

1. To introduce application of Biofertilizer technology in Agriculture
2. To familiarize students with microbes used as biofertilizers
3. To demonstrate the low cost media preparation and cultural practices in biofertilizers
4. To aware the students about benefits of applications of biofertilizers
5. To create self employment opportunities among the students

Unit 1: Introduction (09 Lectures)

1.1. Introduction, Scope and importance of Biofertilizers

1.2. General account of the microbes used as Biofertilizers

1.3. Isolation of *Rhizobium*, Identification, Mass multiplication, Carrier based inoculants

Unit 2: Bacterial Biofertilizers (09 Lectures)

2.1. *Azospirillum* isolation and mass multiplication, carrier based inoculants and associative effect of different organisms

2.2. *Azotobacter*, classification and characteristics

2.3. Crop response to *Azotobacter* inoculums, Mass multiplication of *Azotobacter*

2.4. Applications of *Azospirillum*

Unit 3: Algal Biofertilizers (09 Lectures)

3:1. Cyanobacteria (Blue Green Algae): Isolation of *Anabaena* from *Azolla*, Mass Multiplication of *Anabaena*

3.2. *Azolla* - *Anabaena* relationship

3.3. Biological Nitrogen fixation

3.4. Blue Green algae in a rice cultivation.

3.5. Applications of BGA

Unit 4: Fungal Biofertilizers (09 Lectures)

4.1. Introduction, Occurrence and Distribution of Mycorrhizal association.

4:2. Types of Mycorrhizal association, growth and yield - colonization of VAM - Vesicular Arbuscular Mycorrhiza

4.3. Mycorrhizal applications in agriculture

Unit 5: Compost and Manure (09 Lectures)

5.1. Organic Farming, green manuring, organic manures and their uses

5.2. Recycling by composting method of biodegradable, municipal, agricultural and industrial wastes

5.3. Biocompost making methods, Types and methods of

vermicomposting

5.4. Benefits of vermicompost, field applications

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DSC ELECTIVE COURSE

SEMESTER - V

PAPER - VI

BOT. 506 A: ANALYTICAL TECHNIQUES IN PLANT SCIENCES (Lectures: 45)

AIMS AND OBJECTIVES:

1. To study Imaging technique for the study of plants
2. To study micrometry and calibration of microscope.
3. To study techniques of slide preparation and staining.
4. To know the principle and working of Instruments.
5. To study chromatography techniques
6. To study statistical analysis methods.

Unit 1: Microscopy (09 Lectures)

1.1. Introduction,

1.2. Principles of microscopy; Image quality, Magnification concept, Choice of eye piece and objective combinations to ensure optimal magnification, magnification power,

1.3. Resolution - phenomenon, resolving power of microscope, contrast and resolution of images

1.4. Light microscopy; Fluorescence microscopy

1.5. Brief account of Transmission and Scanning electron microscopy

Unit 2: Micrometry and Micro technique (09 Lectures)

2.1. Introduction,

2.2. Principle, micrometer types, Eye piece Reticle/inserts, stage micrometer

2.3. Calibration of ocular scale and microscope

2.4. Micro technique: Introduction, preparations for microscopic observation - WM, smears, squashes, sections, Materials - cover glass, micro slides

2.5. Stains: nature and use of Haematoxyline, Cotton blue, Light Green, Safranin, Sectioning - Free hand

Unit 3: Biophysicochemical techniques (09 Lectures)

3.1. Centrifugation: Principle of Centrifugation; types centrifuge and applications.

3.2. Spectrophotometry**:** Introduction, types, Principle and its application in biological research

Unit4: Chromatography (09Lectures)

4.1 Principle

4.2 Paper chromatography

4.3 TL chromatography

4.4. HPLC

Unit 5: Biostatistics (09 Lectures)

5.1. Introduction to Statistics
5.2. Sampling Methods: Random, Systematic
5.3. Representation of Data: Tabular, Graphical
5.4. Measures of central tendency, Arithmetic mean, mode, median
5.5. Measures of dispersion: Range, mean deviation
5.6. Standard deviation
5.7. Chi square test

REFERENCE BOOKS

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DSC ELECTIVE COURSE

SEMESTER - V

Paper - VI

BOT. 506B: HORTICULTURE **(Lectures: 45)**

AIMS AND OBJECTIVES:

1. To know horticulture, its scope, disciplines and importance
2. To understand different horticultural practices and their methods
3. To study importance, principles and types of Bahar treatment
4. To study role played by green and poly houses in horticulture
5. To understand methods of preservations and preparations of preserved products prevailing especially in this part of the state

Unit: 1 Introduction **(04 Lectures)**

1.1. Definition, Scope and importance of Horticulture

1.2. Disciplines of Horticulture

i) Pomology ii) Olericulture iii) Floriculture

iv) Ornamental horticulture v) Landscape horticulture

1.3. Nutritive value of Fruits and Vegetables

Unit2: Propagation of Horticultural plants **(10 Lectures)**

2.1. Sexual Propagation: Advantages and Disadvantages

2.2. Asexual /Vegetative Propagation: Advantages and Disadvantages

2.3. Natural methods of vegetative propagation:

Bulb, Corm, Tuber, Rhizome, Runner, Offset, Sucker

2.4. Artificial methods of vegetative propagation

A) Cutting:

a) Definition

b) Types of Cutting:

i) Stem cutting - Soft wood cutting and Hard wood Cutting

ii) Leaf Cutting

iii) Root Cutting

B) Layering:

a) Definition

b) Types of Layering:

i) Simple layering

ii) Compound layering

iii) Air layering/Gootee

C) Budding:

a) Definition

b) Types of Budding - i) Shield/T - Budding ii) Patch Budding

D) Grafting:

a) Definition

b) Types of Grafting - i) Whip grafting ii) Tongue grafting

Unit3: Special Horticultural Practices **(12 Lectures)**

3.1. Training and pruning of Plants:

a) Definition

b) Objectives of Training and Pruning

c) Advantages of Training and Pruning

d) Difference between Training and Pruning

e) Methods of Training: i) Central leader system ii) Open centre system
iii) Modified leaders

f) Methods of Pruning: i) Heading back ii) Thinning out

3.2. Bahar Treatment:

a) Definition, Principles and Importance

b) Types of Bahar: i) Ambe Bahar ii) Mrig Bahar
iii) Hasta Bahar

3.3. Cultural practices:

a) Definition

b) Types of cultural practices: i) Ringing ii) Girdling
iii) Notching iv) Bending

Unit 4: A) Fruits (Grapes) and vegetables (Tomato) production technology (09 Lectures)

i) Introduction

ii) Soil and climate requirement

iii) Commercial varieties

iv) Pest and disease management

v) Harvesting and post harvest management

B) Polyhouse, Green house and Glass house technology with reference to Ornamental Horticulture, Scope and importance

Unit5: Preservation of Fruits and Vegetables (10 Lectures)

5.1. Introduction, scope and importance of fruits and vegetables preservation

5.2. Methods of preservation:

a) Temporary preservation:

i) Asepsis ii) Exclusion of moisture

i. e. Drying of vegetables e. g. Potato, Cabbage, Onions, 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, salts, vinegar or preservation by food additives i. e. Chemical preservatives: citric acid. Potassium meta-bisulphite, sodium benzoate, Sulphur-dioxide

ii) Drying, Dehydration and concentration of fruits and vegetables

iii) Ionizing radiation

5.3. Preparation of preserved products:

a) Mix fruit Jam

b) Wood apple/Guava Jelly
c) Lemon/ Orange Squash
d) Tomato ketchup

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SEMESTER - V

PRACTICAL COURSES

PRACTICAL PAPER - I

BOT. 507: Based on Theory Paper - I & V

(BOT. 501 and BOT. 505)

Practicals Based on Bot. 501: Lower cryptogams

Practical - 1 & 2: 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*, *Drapanaldia*, *Fritscheilla* and *Oedogonium*

d) Siphonaceousthallus: *Vaucheria*, *Caulerpa*

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

f) Parenchymatousthallus: *Ulva*, *Enteromorpha*

Practical - 3: Study of life cycle of ***Chara***

Practical - 4: Study of life cycle of ***Sargassum***

Practical - 5: Study of fungal forms (any four)

i) *Stemonitis* ii) *Saprolegnia* iii) *Rhizopus*

iv) *Eurotium* v) *Puccinia* vi) *Alternaria*

Practical - 6: Study of life cycle of ***Albugo***

Practical - 7: Study of life cycle of ***Uncinula***

Practical - 8: Culture of Algae (Venkatraman method)/Culture of Fungi on PDA medium

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

Practicals Based on Bot. 505: Biofertilizers

Practical - 9: Diversity of BGA with the help of locally available specimens - *Nostoc*, *Anabaena*, *Oscillatoria*, *Gloecapsa* (Any three)

Practical - 10: Preparation of Yeast Extract Mannitol Agar Medium (YEMA Medium)

Practical - 11 and 12: *Rhizobium* culture with the help of healthy leguminous root nodules.

Practical- 13: Mass culture of BGA (Venkatraman method)

Practical - 14: Preparation of Compost, FarmYard Manure (FYM).

Practical - 15: Study of Ectomycorrhiza and Endomycorrhiza with the help of PS/ Photograph.

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PRACTICAL PAPER - II

BOT. 508: Based on Theory Papers - II and VI

(BOT. 502 and BOT. 506A/BOT. 506B)

Practicals Based on Bot. 502: Morphology and Systematics of Angiosperms

Practical - 1: Study of Leaf Morphology (as per theory): Phyllotaxy and Types of leaf

Practical - 2: Study of Inflorescences (as per theory)

Practical - 3: Study of Flower: Types of Flower and Forms of Corolla

Practical - 4 to 6: Study of **any six** plant families as per theory with respect to systematic position, morphological characters (vegetative and floral), floral formula and floral diagram (*sensu* Bentham and Hookers system)

Practical - 7: Identification of genus and species (any suitable) by using local, regional, state and national flora

NOTE : i) Excursion tour is compulsory

ii) Submission of photograph of any ten plants and tour report at the time of practical examination.

Practicals Based on Bot. 506 A: Analytical Techniques in Plant Sciences

Practical - 8 & 9: Extraction and Separation of amino acids by paper chromatography

Practical -10: Isolation of chloroplasts by solvent method

Practical - 11: Study of different microscopic techniques light and fluorescence by using photographs

Practical - 12: Preparation of different types of stains (Permanent and temporary)

Practical -13: Preparation of permanent slides (double staining)

Practical - 14 & 15: Computation of mean, mode, median, variance and standard deviation from the given data.

Practicals Based on Bot. 506B: Horticulture

Practical - 8: Study of Garden tools and equipment: Sprayer, Duster, Pruning knife, Sprinkler.

Practical - 9: Study of propagation requirement:

i) Media ii) Containers iii) Potting iv) Repotting

Practical - 10 & 11: Study of propagation methods:

a) Cutting b) Layering c) Budding d) Grafting

Practical - 12 to 15: Preparations of different types of fruit products (Any three)

a) Mix fruit Jam b)Wood apple/Guava Jelly

b) Lemon/Orange Squash c)Tomato ketchup

Note: Visit to any one Nursery Unit, Commercial orchard

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PRACTICAL PAPER - III

BOT. 509: Based on Theory Papers - III and IV

(BOT. 503 and BOT. 504)

Practicals Based on Bot. 503: Cell Biology and Genetics

Practical - 1: To study prokaryotic cells (bacteria), viruses, eukaryotic cells with the help of light and electron micrographs

Practical - 2: Study of the Ultra structure of cell organelles with the help of Photomicrographs

Practical - 3: To prepare temporary stained preparation of mitochondria from onion peal using vital stain Janus green.

Practical - 4 & 5: Study of mitosis and meiosis (temporary mounts and permanent slides).

Practical - 6: Measure the cell size (either length or breadth/diameter) by micrometry

Practical - 7: Study of salivary gland chromosome in Chironomous larvae

Practicals based on Bot. 504: Plant Physiology and Biochemistry

Practical - 8: Estimation of soluble proteins by Lowery *et. al.* method.

Practical - 9 & 10: Demonstration:

a) Ringing experiment for path of solute translocation.

b) Geotropic Movement of root, by using germinating seeds

c) Phototropic movement

Practical - 11 & 12: Separation of sugar by paper chromatography

Practical - 13: Qualitative tests for primary metabolites starch, lipids and proteins by using available plant materials

Practical - 14 & 15: Qualitative tests for Secondary metabolites: alkaloids, terpenes, Flavonoids by using available plant materials.

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KAVAYITRI BAHINABAI CHAUDHARI NORTH

MAHARASHTRA UNIVERSITY, JALGAON

Faculty of Science and Technology

(NAAC Re-Accredited)

SYLLABUS FOR CORE AND SKILL ENHANCEMENT COUESES IN BOTANY

As Per U. G. C. Guidelines

Based on

Choice Based Credit System (CBCS)

T. Y. B. Sc. BOTANY SEMESTER - WISE SYLLABUS

(Theory and Practicals)

SEMESTER - VI

To Be Implemented From

Academic Year 2020 - 2021

KAVAYITRI BAHINABAI CHAUDHARI NORTH MAHARASHTRA UNIVERSITY, JALGAON

Faculty of Science and Technology

SYLLABUS FOR CORE AND SKILL ENHANCEMENT COUESES IN BOTANY

As Per U. G. C. Guidelines

Based on

Choice Based Credit System (CBCS)

T. Y. B. Sc. BOTANY SEMESTER - WISE SYLLABUS

(Theory and Practicals)

SEMESTER - VI

DISCIPLINE SPECIFIC COURSES

BOT. 601, Paper - I: Higher Cryptogams

BOT. 602, Paper - II: Gymnosperms & Paleobotany

BOT. 603, Paper - III: Molecular Biology

BOT. 604, Paper - IV: Economic Botany

SKILL ENHANCEMENT COURSE

BOT. 605, Paper - V: Floriculture

ELECTIVE COURSES

BOT. 606.A, Paper - VI: Herbal Techniques

BOT. 606.B, Paper - VI: Plant Breeding

PRACTICAL COURSES

BOT. 607, Practical - I: Based on BOT. 601 and BOT. 605

BOT. 608, Practical - II: Based on BOT. 602 and BOT. 606

BOT. 609, Practical - III: Based on BOT. 603 and BOT. 604

W. E. F. JUNE - 2020

SEMESTER - VI

Discipline	Core Course Type	Course Code	Course Title	Credits	Total Hrs./ Week	Total Teaching Hrs.	Total Marks (100)	
							CA	UA
Discipline Specific Course (DSC)	Paper-I	BOT.601	Higher Cryptogams	3	3	45	40	60
	Paper-II	BOT.602	Gymnosperms and Paleobotany	3	3	45	40	60
	Paper-III	BOT.603	Molecular Biology	3	3	45	40	60
	Paper-IV	BOT.604	Economic Botany	3	3	45	40	60
DSC Skill Enhanceme Course	Paper- V	BOT.605	Floriculture	3	3	45	40	60
DSC Electi Course (Any one)	Paper-VI	BOT.606 A	Herbal Technology	3	3	45	40	60
		BOT.606 B	Plant Breeding	3	3	45	40	60
DSC Core Practicals	Practical I	BOT.607	Practicals Based on BOT.601 and BOT.605	4	4 /Batch	60	40	60
	Practical II	BOT.608	Practicals Based on BOT.602 and BOT.606A/Bot.566B	4	4/Batch	60	40	60
	Practical III	BOT.609	Practicals Based on BOT.603 and BOT.604	4	4/Batch	60	40	60
Non-Credit Audit Cour (Any One)	Paper-VII	AC-610	Soft Skill	No Credit	2	30	100	--
		AC-611	Yoga					
		AC-612	Practicing Cleanliness					

KAVAYITRI BAHINABAI CHAUDHARI NORTH MAHARASHTRA UNIVERSITY, JALGAON

Equivalence of the T. Y. B. Sc. Botany CBCS Syllabus

Paper	Course	SEMESTER - VI CBCS Syllabus (New)	Course	SEMESTER - VI CGPA Syllabus (Old)
I	Bot. 601	Higher Cryptogams	Bot. 361	Gymnosperms & Paleobotany
II	Bot. 602	Gymnosperms and Paleobotany	Bot. 362	Anatomy & Embryology
III	Bot. 603	Molecular Biology	Bot. 363	Genetics, Plant Breeding and Evolution
IV	Bot. 604	Economic Botany	Bot. 364	Plant Biochemistry
V	Bot. 605	Floriculture	Bot. 365	Applied Botany
VI	Bot.606.A/ Bot.606.B	Herbal Technology/ Plant Breeding	Bot. 366.1/ Bot. 366.2/ Bot. 366.3/ Bot. 366.4	Botanical Techniques/ Medico botany and Pharmacognosy/ Horticulture/ Plant Protection

KAVAYITRI BAHINABAI CHAUDHARI NORTH MAHARASHTRA UNIVERSITY, JALGAON

Syllabus of T. Y. B. Sc. Botany w. e. f. June, 2020

CBCS Pattern

DISCIPLINE SPECIFIC COURSE (DSC)

SEMESTER - VI

Paper - I

BOT. 601: HIGHER CRYPTOGAMS **(Lectures: 45)**

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 importance of cryptogamic plants.

Unit 1: Introduction **(09 Lectures)**

A) Bryophytes

1.1. General characters of Bryophyta

1.2. Classification of Bryophyta up to classes giving reasons with at least two examples of each class as per G. M. Smith (1955).

1.3. Alternation of generation in Bryophytes

1.4. Contribution of Indian Bryologist - Prof. Shiv Ram Kashyap

1.5. Economic importance

B) Pteridophytes

1.6. General characters of Pteridophytes

1.7. Classification of Pteridophytes up to classes giving reasons with at least two examples of each class according to Prof. G. M. Smith.

1.8. Contribution of Indian Pteridologist - S. S. Bir

1.9. Economic importance

Unit 2: A) Life History of *Marchantia* with respect to **(11 Lecture)**

2.1. Systematic position, habit and habitat

2.2. External and internal morphology of gametophytes.

2.3. Reproduction: Vegetative and sexual.

2.4. Structure of sex organs. (Development is not expected)

2.5. Fertilization,

2.6. Structure of sporophyte.

2.7. Dehiscence of capsule and dispersal of spores,

2.8. Structure and germination of spores

2.9. Graphical representation of Alternation of Generation

B) *Anthoceros*

2.10. *Anthoceros* is synthetic type discuss

2.11. Elaborate detail structure of sporophyte of *Anthoceros*

Unit 3: Life History of *Polytrichum* with respect to **(07 Lecture)**

3.1. Systematic position, habit and habitat
3.2. External and internal morphology of gametophytes.
3.3. Reproduction: Vegetative and sexual
3.4. Position and structure of sex organs. (Development is not expected)
3.5. Fertilization,
3.6. Structure of sporophyte,
3.7. Dehiscence of capsule and dispersal of spores,
3.8. Structure and germination of spores

Unit 4: Life History **(11 Lecture)**

A) *Psilotum* with respect to

4.1. Systematic position, habit and habitat
4.2. External and internal morphology of sporophyte
4.3. Reproduction, vegetative and asexual
4.4. Morphological nature and dehiscence of synangium.
4.5. Structure and germination of spores,
4.6. Structure of mature gametophyte (Prothallus),
4.7. Structure of mature male and female sex organ.
(Development is not expected)
4.8. Fertilization.
4.9. Structure of embryo.
4.10. Graphical representation of alternation of generation.

B) *Lycopodium* with respect to:

4.11. Systematic position, habit and habitat
4.12. External and internal morphology of sporophyte.
4.13. Reproduction: Vegetative and Asexual
4.14. Position and structure and dehiscence of sporangium.
4.15. Structure and germination of spores.
4.16. Structure of gametophyte
4.17. Structure of mature sex organs. (Development is not expected)
4.18. Fertilization.
4.19. Structure of embryo
4.20. Graphical representation of alternation of generation.

Unit 5: A) Life History of *Marsilea* with respect to: **(07 Lecture)**

5.1. Systematic position, Habit and habitat
5.2. External and internal morphology of sporophyte,
5.3. Reproduction
5.4. External and internal morphology of sporocarp,
5.5. Morphological nature and dehiscence of the sporocarp.
5.6. Structure of microspore and megaspore.
5.7. Structure of male and female gametophytes (Development is not expected)
5.8. Fertilization
5.9. Structure of embryo,
5.10. Graphical representation of alternation of generation,

B) Heterospory and its significance

REFFERENCE BOOKS

BRYOPHYTES AND PTERIDOPHYTES

1. Ganguli, H. G. and Kar, A. K. (2001). College Botany Vol. II. Books and Allied Press, Ltd. Kolkata, India.
2. Pandey, B. P. (1995). A Text Book of Botany Bryophyta. S. Chand & Co. Ltd. New Delhi, India.
3. Parihar, N. S. (1972). An Introduction to Embryophyta. Vol.1 Bryophyta, Central Book Depot, Hydrabad, India.
4. Puri, P. (1985). Bryophyta A Broad Perspective. Atma Ram and Sons, New Delhi, India. House. Pvt. Ltd. New Delhi.
5. Saxena A. K. and R. M. Sarabhai (1992). Text Book of Botany - Vol. II Embryophyta. Ratan Prakashan Mandir, Agra, India.
6. Sporne, K. R. (1965). The Morphology of Pteridophytes. The Hutchinson Univ. Lib., London, U.K.
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8. Vashishta, P. C. (1994). Botany: Pteridophyta. S. Chand & Co. Ltd. New Delhi, India.

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DISCIPLINE SPECIFIC COURSE (DSC)

SEMESTER - VI

Paper - II

BOT. 602: GYMNOSPERMS AND PALEOBOTANY (Lectures: 45)

AIMS AND OBJECTIVES:

1. To study Gymnosperms with respect to distinguishing characters, comparison with Angiosperms, 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 (30 Lectures)

Unit 1: General topics (06 Lectures)

1.1. Introduction
1.2. Distinguishing features of the group
1.3. Comparison of Gymnosperms with Angiosperms
1.4. Economic importance of Gymnosperms
1.5. Classification of Gymnosperms by K. R. Sporne up to orders giving reasons

Unit 2: Life cycle of *Pinus* with respect to (12 Lectures)

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
2.5. Reproductive structure
  a) Male cone
  b) Structure & development of Male gametophyte
  c) Female cone
  d) Structure & development of Female gametophyte
2.6. Pollination
2.7. Fertilization
2.8. Structure of embryo and polyembryony
2.9. Seed structure and germination
2.10. Alternation of generation

Unit 2: Life cycle of *Gnetum* with respect to (12 Lectures)

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) Anomalous Secondary growth in *Gnetum ula*

2.5. Reproductive structure

a) Male cone

b) Structure and development of Male gametophyte

c) Female cone

d) Structure and development of Female gametophyte

2.6. Pollination

2.7. Fertilization

2.8. Structure of embryo and polyembryony

2.9. Seed structure and germination

2.10. Alternation of generation

2.11. Resemblance with Angiosperms

PALEOBOTANY (15 Lectures)

Unit 4: Introduction (06 Lectures)

4.1. Introduction, definition and scope

4.2. Contribution of Birbal Sahani in Paleobotany

4.3. Definition of Fossil

4.4. Fossilization process, Conditions favorable for fossilization

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

4.6. Types of fossils: Impression, Compression, Petrifaction, Cast, Coal ball, Amber

Unit 5: Study of the following fossil groups w. r. t. morphology and structure (09 Lectures)

5.1. Psilopsida: *Rhynia*

5.2. Lycopsida: *Lepidostrobus* (Cone)

5.3. Sphenopsida: *Annularia* (Leaf)

5.4. Pteridopsperm: *Lyginopteris oldhamia* (Stem)

5.5. Bennettitales: *Cycadeoidea* (Flower)

5.6. Angiosperm: *Sahanipushpum* (Flower)

REFERENCE BOOKS

GYMNOSPERMS

1. Datta, S. C. (1966). Introduction to Gymnosperms. Asia Pub. House, New Delhi, India.
2. Datta, S. C. (1998). Systematic Botany, 4th Ed. New Age International Pvt. Ltd. New Delhi, India.
3. Gangulee, H. C. and Kar, A. K. (1998). College botany Vol. II. New central book agency (P) Ltd. Kolkata, India.
4. Chopra, G. L. (1962). Introduction to Gymnosperms. Asia Pub. House, New Delhi. India.
5. Vashishta, P. C. (1983). Botany for degree students: Gymnosperms. S. Chand & Co. New Delhi, India.

6. Sporne, K. R. (1967). Morphology of Gymnosperms. Hutchinson university library London,U. K.
7. Pandey, B. P. (1982). College botany Vol. II. S. Chand & Co. New Delhi, India.

PALEOBOTANY

1. Delevoryas, T. (1962). Morphology and Evolution of fossil plants. Holt Reihart & Winston, New York.
2. Surange, K. R. (1966). Indian fossil Pteridophytes. CSIR New Delhi, India.
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.
5. Andrews Henry N. (1961). Studies in Paleobotany. John Wiley & Sons, USA.
6. Dick, M. W. and Edwards D. (1983). Contribution to Paleobotany. The white friars press ltd. Tonbridge.
7. Shukla, Ashok C. &Shital P. Misra (1975). Essentials of Paleobotany. Vikas Publ. House, New Delhi, India.
8. Chapman, Meyen S. V. 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.
10. Mishra, S. R. (2010). Text Books of Paleobotany. Discovery Publication House Pvt. Ltd.

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DISCIPLINE SPECIFIC COURSE (DSC)

SEMESTER - VI

PAPER - III

BOT. 603: MOLECULAR BIOLOGY **(Lectures: 45)**

AIMS AND OBJECTIVES:

1. To study molecular biology in relation to genetic material, its inheritance, modification, replication
2. To study the mitochondria and chloroplast DNA
3. To study transcription, translation post translation modification of protein.
4. To study gene regulation in prokaryotes and eukaryotes.

Unit 1: Nucleic acids: Carriers of genetic information **(02 Lectures)**

1.1. Historical perspective

1.2. DNA as the carrier of genetic information Griffith's, Hershey & Chase, Avery, McLeod & McCarty experiment

Unit 2: The Structures of DNA and RNA / Genetic Material **(10 Lectures)**

2.1. Types of genetic material, Types of DNA

2.2. DNA Structure: Watson and Crick - historic perspective, Salient features of double helix

2.3. Organization of DNA: Prokaryotes (*E. coli*) and Eukaryotes

2.4. Types of RNA

2.5. Organelle DNA - Mitochondria and Chloroplast DNA

2.6. Chromatin structure - Nucleosome, Euchromatin, Heterochromatin - Constitutive and Facultative heterochromatin

Unit 3: DNA replication **(10 Lectures)**

3.1. General principles - bidirectional, semi conservative and semi discontinuous replication, RNA priming

3.2. Various models of DNA replication, including rolling circle, θ (theta) model of replication, replication of linear ds - DNA, replication of the 5'end of linear chromosome

3.3. Enzymes involved in DNA replication

3.4. The Central Dogma

3.5. Genetic code: Nature and properties

Unit 4: Transcription and Gene Regulation **(10 Lectures)**

4.1. Transcription in prokaryotes and eukaryotes. Principles of transcriptional regulation

4.2. Prokaryotes: Regulation of lactose metabolism and tryptophan synthesis in *E. coli.*

4.3. Eukaryotes: Eukaryotic transcriptional regulation (promoter enhancer and silencer, Gene battery) and post transcriptional regulation

Unit 5: Processing and modification of RNA **(13 Lectures)**

5.1. Split genes concept of introns and exons, removal of introns, spliceosome machinery, splicing pathways

5.2. RNA editing and mRNA transport
5.3. Ribosome structure and assembly, mRNA,
Charging of tRNA, aminoacyl tRNA synthetases
5.4. Various steps in protein synthesis, proteins involved in
initiation, elongation and termination of polypeptides
5.5. Inhibitors of protein synthesis, Post translational modifications of proteins.

REFFERENCE BOOKS

1. Watson J. D., Baker, T. A., Bell, S. P., Gann, A., Levine, M., Losick, R. (2007). Molecular Biology of the Gene, 6th Ed. Pearson Benjamin Cummings, CSHL Press, New York, U.S.A.
2. Snustad, D. P. and Simmons, M. J. (2010). Principles of Genetics, 5th Ed. John Wiley and Sons Inc., U.S.A.
3. Klug, W. S., Cummings, M. R., Spencer, C. A. (2009). Concepts of Genetics, 9th Ed. Benjamin Cummings, U.S.A.
4. Russell, P. J. (2010). I - Genetics - A Molecular Approach, 3rd Ed. Benjamin Cummings, U.S.A.
5. Griffiths, A. J. F., Wessler, S. R., Carroll, S. B., Doebley, J. (2010). Introduction to Genetic Analysis, 10th Ed. W. H. Freeman and Co., U.S.A.
6. Verma, Agarwal, (2005). Cell Biology, Genetics, Molecular Biology, Evolution and Ecology. S. Chand & Company, New Delhi, India.
7. Powar, C. B. (2003). Genetics I & II. Himalaya Publishing House, Nagpur, India.
8. Sadhasivam and Manickam (2005). Biochemical Methods. New Age International Pvt. Ltd. New Delhi, India.

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DISCIPLINE SPECIFIC COURSE (DSC)

SEMESTER - VI

PAPER - IV

BOT. 604: ECONOMIC BOTANY **(Lectures: 45)**

AIMS AND OBJECTIVES:

1. To know useful bio resources of prime importance to mankind.
2. To acknowledge students about various groups of plants of the world as well of India.
3. To know botanical, chemical and nutritional values and value additions of food grains, legumes, sugars, vegetable, fruits, spices, etc.
3) To reveal new *vis-a-vis* forgotten food sources and their current practices.
4) To know the general account and uses of rubber, fiber and Timber.

Unit 1: Introduction and Origin of Cultivated Plants **(09 Lectures)**

1.1. Scope and Importance
1.2. Green Evolution in Indian context
1.3. Concept of Centers of Origin, their importance with reference to Vavilov's work
1.4. Examples of major plant introductions
1.5. Crop domestication and loss of genetic diversity
1.6. Evolution of new crops/varieties,
1.7. Importance of germplasm diversity

Unit 2: Cereals, Legumes and Millets, Sources of Sugars and Starches **(09 Lectures)**

2.1. Origin, morphology, processing and uses of Wheat and Rice
2.2. Origin, morphology and uses of Chick pea and Pigeon Pea
2.3. Origin, morphology, processing and uses of Pearl millet and Sorghum
2.4. Sources of Sugars, Morphology and processing of sugarcane
2.5. Products and byproducts of sugarcane industry
2.6. Morphology, propagation and uses of Potato

Unit 3: Spices, Beverages and Drugs **(09 Lectures)**

3.1. Spices: Listing of important spices, their family and part used
3.2. Economic importance with special reference to clove and black pepper
3.3. Beverages: Morphology, processing and uses of Tea and Coffee
3.4. Drugs: Morphology, processing, uses and health hazards of C*inchona* and *Papaver*

Unit 4: Oils and Fats **(09 Lectures)**

4.1. General description, classification of oils
4.2. Extraction, their uses and health implications of groundnut and Soybean (Botanical name, family & uses)
4.3. Essential Oils: General account, extraction methods of *Eucalyptus* oil comparison with fatty oils and their uses

Unit 5: Rubber, Fiber and Timber yielding plants **(09 Lectures)**

5.1. Para rubber: tapping, Industrial processing and uses

5.2. Fibres: Definition, Structure and classification based on the origin of fibers, morphology, extraction and uses of Cotton and Coir

5.3. Timber: Botanical Source, structure of wood and uses of Teak and *Pinus*

REFFERENCE BOOKS

1. Aiyer, A. K. Y. N. (1954). Field Crops in India. The Banglore Printing And Publishing Company, Banglore.
2. Bendre, Ashok and Ashok Kumar (1998 - 1999). Economic Botany for undergraduate Students. Rastogi Publications, Meerut, India.
3. Hill, A. F. (1952). Economic Botany, 2nd Ed. McGraw Hill Co. Pvt. Ltd. New York.
4. Pandey, S. N. and Archana (1996). Economic Botany. Vikas Publishing house, New Delhi.
5. Pal, B. P. (1996). Wheat Monograph. Council of Agricultural Research, New Delhi.
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8. Sharma, B. K. and Awasthi, P. B. (1984). Economic Botany. Prakash book Depot, Bareilley.
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11. Chrispeels, M. J. and Sadava, D. E. (1994). Plants. Genes and Agriculture, Jones & Bartlett.
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15. Majumdar, D. K. (2011). Pulse Crop Production: Principles And Technologies. RHZ Learning (P.) Ltd., New Delhi, India.
16. Mitra, S. K. and Borse, T. K. (Ed.) (1996). Fruits: Tropical And Subtropical. Naya Prakash, Calcutta, India.
17. Patil, D. A. (2019). Food Crops: Evolution, Diversity and Advances. Scientific Publishers, Jodhpur, India.
18. Patil, D. A. and Dhale, D. A. (2013). Spices and Condiments: Origin, History and Applications. Daya Publishing House, New Delhi, India.
19. Patil, D. A. (2008). Useful Plants: Origin, History and Civilization. Navyug Publishers and Distributors, Delhi, India.

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DSC SKILL ENHANCEMENT COURSE

SEMESTER - VI

PAPER - V

BOT. 605: FLORICULTUR **(Lectures: 45)**

AIMS AND OBJECTIVES:

1. To know floriculture, its scope and importance.
2. To know the commercial floriculture.
3. To study the different features of garden.
4. To study methods of propagation.
5. To study diseases and pests of ornamental Plants.

Unit 1: Introduction: **(09 Lectures)**

1.1. History of gardening
1.2. Importance and scope of floriculture
1.3. Landscape gardening
1.4. Some Famous gardens of India
1.5. Landscaping Places of Public Importance
   a. Landscaping highways
   b. Landscaping of Educational institutions

Unit 2: Nursery Management and Routine Garden Operations: **(09 Lectures)**

2.1. Sexual and vegetative methods of propagation
2.2. Soil sterilization
2.3. Seed sowing: i) Pricking ii) Planting and transplanting
iii) Shading iv) Stopping or pinching
v) Defoliation vi) Wintering
vii) Mulching
2.4. Topiary
2.5. Role of plant growth regulators

Unit 3: Study of Ornamental Plants w.r.t. list of plants, description and cultivation method of at least two examples of each: **(09 Lectures)**

3.1. Flowering annuals
3.2. Herbaceous perennials
3.3. Climbers
3.4. Shade and ornamental trees
3.5. Ornamental bulbous and foliage plants
3.6. Cacti and succulents
3.7. Palms and Cycads
3.8. Ferns and Selaginellas
3.9. Bonsai

Unit 4: Principles of Garden Designs: **(09 Lectures)**

4.1. i) English ii) Italian iii) French
iv) Persian v) Mughal vi) Japanese gardens.
4.2. Features of a garden

i) Garden wall ii) Fencing iii) Path and roads
iv) Hedge v) Edging vi) Lawn
vi) Flower beds vii) Shrubbery viii) Borders
ix) Water garden. x) Arches and Pergolas

Unit 5: Commercial Floriculture: (09Lectures)

5.1. Factors affecting flower production
5.2. Production and packaging of cut flowers
5.3. Flower arrangements
5.4. Methods to prolong vase life
5.5. Cultivation of Important cut flowers
i) Carnation ii) Aster iii) Chrysanthemum
iv) Gerbera v) Gladiolous vi) Marigold
vii) Rose viii) Lilium
5.6. Diseases and Pests of Ornamental Plants: Rose and Gladiolus

REFFERENCE BOOKS

1. Arora J. S. (1998). Introductory Ornamental Horticulture. Kalyani Publishers Pvt. Ltd., W. Bengal.
2. Bhattacharjee S. K. (2004). Landscape gardening and design with plants.Pointer Publishers Pvt. Ltd., Jaipur.
3. Bhattacharjee S. K., and De L. C. (2005). Post harvest technology of flowers and ornamental plants. Pointer Publishers, Jaipur.
4. De L. C. (2011). Value addition in flowers and Orchids. New India Publishing Agency, New Delhi.
5. Nowak J., Rudnicki R. M. and Duncan A. A. (1990). Post Harvest handling and storage of cut flowers, florists greens and pottled plants. Timber Press, INC. Portland, Oregon.
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7. Randhawa, G. S. and Mukhopadhyay, A. (1986). Floriculture in India. Allied Publishers.

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DSC ELECTIVE COURSE

SEMESTER - VI

PAPER - VI

BOT. 606.A: HERBAL TECHNOLOGY **(Lectures: 45)**

AIMS AND OBJECTIVES:

1. To create optimum awareness and interest amongst the students about Medicinal Plants.
2. To conserve the biodiversity of Medicinal Plants in Maharashtra.
3. To strengthen the educational system and research on Medicinal Plants.
4. To increase students awareness about the efficacies of herbal drugs.
5. To develop awareness for utilization of herbal medicines for home remedies.

Unit 1: Herbal medicines **(06 Lectures)**

1.1. History, scope and importance

1.2. Definition of herbal medicines

1.3. Role of medicinal plants in Siddha systems of medicine

1.4. Herbal foods : future of pharmacognosy

Unit 2: Pharmacognosy **(09 Lectures)**

2.1 Systematic position and medicinal uses of the following herbs in curing various ailments -

i) Tulsi, ii) Ginger, iii) Fenugreek,

iv) Amla v) Ashoka (*Saraca indica*)

Unit 3: Herbal phytochemistry **(10 Lectures)**

3.1 Active principles and methods of their testing, identification and utilization of the medicinal herbs -

i) *Catharanthus roseus* (cardiotonic)

ii) *Withania somnifera* (drugs acting on nervous system)

iii) *Clerodendron phlomoides* (antirheumatic)

iv) *Centella asiatica* (memory booster).

Unit 4: Analytical pharmacognosy **(10 Lectures)**

4.1. Drug adulteration

4.2. Types and methods of drug evaluation

4.3. Biological testing of herbal drugs

4.4. Phytochemical screening tests for secondary metabolites

i) Alkaloids, ii) Phenolic compounds

Unit 5: Cultivation, harvesting, processing, storage, marketing and utilization of following medicinal plants **(10 Lectures)**

5.1. *Aloe vera*

5.2. *Mentha*

REFFERENCE BOOKS

1. Chopra, R. N., Nayar S. L. and Chopra, I. C. (1956). Glossary of Indian medicinal plants. C. S. I. R, New Delhi.
2. Kanny, Lall, Dey and Raj Bahadur, (1984). The indigenous drugs of India. International Book Distributors, Dehradun, India.
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DSC ELECTIVE COURSE

SEMESTER - VI

PAPER - VI

BOT. 606.B: PLANT BREEDING **(Lectures: 45)**

AIMS AND OBJECTIVES:

1. To introduce the student with science of plant breeding
2. To introduce the student with branch of plant breeding for the survival of human being from starvation.
3. To study the techniques of production of new superior crop verities.

Unit 1: **Plant breeding** **(08 Lectures)**

1.1. Introduction, Scope and objectives

1.2. Breeding systems: Inbreeding and outbreedings

1.3. Modes of reproductions in crop plants,
Self pollination, Cross pollination and Geitonogamy

1.4. Important achievements and undesirable consequences of
Plant breeding

Unit 2: **Methods of Crop Improvements** **(14 Lectures)**

2.1. Introduction

2.2. Centre of origin and domestification of crop plants

2.3. Plant genetic resources of wild relatives of domesticated crops

2.4. Procedure, advantages and limitations of

i) Plant introduction and Acclimatization

ii) Selection: Pure line selection, Mass selection and clonal selection

iii) Hybridization: Bulk method, Single cross and double cross method
Interspecific hybridization for improvement of clonal crops

2.7. Procedure, advantages and limitations

Unit 3: Male Sterility **(08 Lectures)**

3.1. Genetic male sterility

3.2. Cytoplasmic male sterility

3.3. Genetic Cytoplasmic male sterility

3.4. Use of male sterility in hybrid seed production

Unit 4: Inbreeding depression and heterosis **(07 Lectures)**

4.1. History

4.2. Genetic basis inbreeding depression and heterosis

4.3. Applications

Unit 5: Crop improvement and breeding **(08 Lectures)**

5.1. Role of followings in crop improvement with suitable examples one from each

a) Mutation breeding

b) Polyploidy breeding

c) Distant hybridization

d) Genetically modified crops

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SEMESTER - VI

PRACTICAL COURSES

PRACTICAL PAPER - I

BOT. 607: Based on Theory Paper - I and V

(BOT. 601 and BOT. 605)

Practicals based on Bot. 601: Higher Cryptogams

Practical - 1 and 2: Study of life cycle of *Marchantia* w. r. t.

a) Systematic Position

b) External morphology: Mounting of rhizoids & scales

c) Internal morphology: i) T. S. of Thallus

ii) V. S. of thallus through gemma cup (P.S)

d) V. S. of antheridiophore (P. S.)

e) V. S. of archegoniophore (P. S.)

f) V. S. of sporophyte (P. S.)

Practical - 3: Study of life cycle of *Anthoceros* w. r. t.

a) Systematic Position

b) External morphology: Mounting of rhizoids

c) Internal morphology: i) T. S. of Thallus,

d) T. S. of thallus through antheridia (P. S.)

e) T.S. of thallus through archegonia (P. S.)

f) L. S. of sporophyte (P. S.)

Practical - 4: Study of life cycle of *Polytrichum* w. r. t.

a) Systematic Position

b) External morphology

c) Internal morphology

i) T. S. of axis

ii) T. S. of Leaf

d) L. S. of Sporophyte (P. S.)

Practical - 5: Study of life cycle of *Psilotum* w. r. t.

a) Systematic Position

b) External morphology

c) Internal morphology

i) T. S. of stem

ii) T. S. of rhizome (P. S.)

d) T. S. of synangium (P. S.)

Practical - 6: Study of life cycle of *Lycopodium* w. r. t.

a) Systematic Position

b) External morphology

c) Internal morphology: T. S. of stem

d) Mounting of Sporangium and Spores

e) L. S. Strobilus (P. S.)

Practical - 7 and 8: Study of life cycle of *Marsilea* w. r. t.

a) Systematic Position

b) External morphology
c) Internal morphology
i) T. S. of stem/rhizome
ii) T. S. of petiole
d) External structure of sporocarp
e) Internal structure of sporocarp in different planes:
i) H. L. S. of sporocarp
ii) V. T. S. of sporocarp
iii) V. L. S. of sporocarp

NOTE: Study tour is compulsory. Students are expected to submit two forms or photographs of Bryophytes and Pteridophytes along with tour report.

Practicals based on Bot. 605: Floriculture

Practical - 9: Arrangement of Flowers
i) In Container ii) Bouquet iii) Floral carpet (Any Two)

Practical - 10: Technique and aftercare of a Bonsai.

Practical - 11 and 12: Study of different
i) Flowering annuals ii) Herbaceous perennial iii) Palms and Cycad plants. (One examples of each) with respect to Botanical name, ornamental value & place of choice.

Practical - 13 and 14: Study of different ornamental plants such as
i) Shrubs ii) Trees iii) Climbers iv) Cacti & succulents
v) Ferns and Selaginellas (one examples of each) with respect to Botanical name, ornamental value & place of choice.

Practical - 15: Visit to suitable garden to study various salient features such as layout, components, list of plants and special features (if any) OR Visit to nearby nursery to observe various operations in nurseries.

Note: Students should submit Report of visit to garden/Nursery at the time of examination.

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PRACTICAL PAPER - II

BOT. 608: Based on Theory Paper - II and VI

(BOT. 602 and BOT. 606)

Practicals based on Bot. 602: Gymnosperms & Paleobotany

Practical - 1 and 2: Study of *Pinus* w. r. t.

a) Systematic Position
b) External morphology
c) Internal morphology
  i) T. S. of stem
  ii) T. S. of Needle
d) Male cone
  i) Morphology (Specimen)
  ii) L. S. of male cone (P. S.)
  iii) Microsporophyll (Specimen/P. S.)
  iv) Mounting of pollen grains
e) Female cone
  i) Morphology (Specimen)
  ii) L. S. of female cone (P. S.)
  iii) Megasporophyll (Specimen/P. S.)
  iv) V. S. of mature ovule (P. S.)

Practical - 3 and 4: Study of *Gnetum* w. r. t.

a) Systematic Position
b) External morphology
c) Internal morphology:
  i) T. S. of stem
  ii) T. S. of leaf
  iii) Secondary growth in the stem of *G. ula* (P. S.)
d) Morphology of male cone (Specimen)
e) Female cone
  i) Morphology (Specimen)
  ii) V. S. of mature ovule (P. S.)

Practical - 5 and 6: Study of different types of fossils.

Practical - 7 and 8: Study of the following with the help of slides/specimens

i) *Rhynia* ii) *Lepidodendron* iii) *Lepidostrobus*
iv) *Calamites* v) *Annularia* vi) *Lyginopteris*
vii) *Cycadeoidea* viii) *Rhizopalmoxylan*

Practicals based on Bot. 606.A: Herbal Technology

Practical - 9 and 10: Study of following w. r. t. classification, botanical source, part used and medicinal uses of

i) Tulsi ii) Ginger iii) Fenugreek,
iv) Indian Goose berry v) Ashoka

Practical - 11 and 12: Study of botanical source, active principles and Medicinal uses of

i) *Catharanthus roseus* ii) *Withania somnifera*,
iii) *Clerodendron phlomoides* iv) *Centella asiatica.*

Practical - 13 to 15: Phytochemical screening test of
i) Alkaloids ii) Flavonoids iii) Steroids
iv) Triterpenoids v) Phenolic compounds

Bot. 606.B: Plant Breeding

Practical - 9: Study of factors promoting self pollination (By demonstration Flower/Photograph)
- Bisexuality (Hermaphroditism) ---------- (Wheat, Rice)
- Cleistogamy ---------- (Wheat, Rice)
- Homogamy ---------- (Tomato, Lady's finger)

Practical - 10: Study of factors promoting cross pollination (By demonstration Flower/Photograph)
- Dichogamy (i) Protandary ---------- (Maize)
  (ii) Protogyny ---------- (Pearlmillet)
- Unisexuality (i) Monoecious ---------- (Maize, Pumpkins)
  (ii) Dioecious ---------- (Hemp, Asparagus)
- Self incompatibility ---------- (Radish, Cabbage)

Practical - 11 &12: Techniques of Hybridization in Self Pollinated and Cross Pollinated Crops

Practical - 13: Estimation of heterosis
i) Standard heterosis
ii) Mid Parent heterosis
iii) Useful or Economic heterosis

Practical - 14: Pollen viability test by
i) Aceto Carmine method
ii) Sugar solution method

Practical - 15: To show artificial induction of polyploidy

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PRACTICAL PAPER - III

BOT. 609: Based on Theory Paper - III and IV

(BOT. 603 and BOT. 604)

Practicals based on Bot.603: Molecular Biology

Practical - 1: DNA isolation from any suitable material.

Practical - 2: DNA estimation by diphenylamine reagent/UV Spectrophotometry.

Practical - 3 and 4: RNA estimation by orcinol reagent/ UV Spectrophotometry.

Practical - 5: Study of DNA replication mechanisms through photographs (Rolling circle, Theta replication and semi-discontinuous replication).

Practical - 6: Study of structures of prokaryotic RNA polymerase and eukaryotic RNA polymerase II through photographs.

Practical - 7: Photographs establishing nucleic acid as genetic material (Messelson and Stahl's, Avery *et. al*, Griffith's, Hershey & Chase's and Fraenkel & Conrat's experiments)

Practical - 8: Study of the following through photographs: Assembly of Spliceosome machinery; Splicing mechanism in group I & group II introns; Ribozyme and Alternative splicing.

Practicals based on Bot.604: Economic Botany

Practical - 9 & 10: Study of cereals, Legumes and Millets

Wheat (habit sketch, L. S/T. S. of grain, starch grains)

Rice (habit sketch, study of paddy and grain, starch grains)

Chick pea, Pigeon Pea Pearl millet, Sorghum (Morphology of plant and grain)

Practical - 11 & 12: Sources of sugars and starches

Sugarcane (habit sketch; cane juice - micro chemical tests),

Potato (habit sketch, tuber morphology, T. S. of tuber to show localization of starch grains)

Legumes: Soybean, Groundnut (habit, fruit, seed structure).

Practical - 13: Spices, Beverages and Drugs

Morphology of Clove, Black pepper, Tea, Coffee, Papaver, Cinchona (Plant Specimen and products)

Practical - 14: Oils and fats

Coconut: Nut Morphology

Essential oil yielding plants: Habit sketch of *Eucalyptus* (specimens/ photographs).

Practical - 15: Rubber: a) Specimen, photograph/model of tapping, samples of rubber products.

b) Characteristic features of Coir and Teak/*Pinus* wood

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