

**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**

<b>Paper</b>	<b>Course</b>	<b>SEMESTER - V CBCS Syllabus (New)</b>	<b>Course</b>	<b>SEMESTER - V CGPA Syllabus (Old)</b>
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 CRYPTOGRAMS**

**(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 cryptogamic 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

### REFERENCE BOOKS

1. Alexopoulos C. J, Mims C.W. and Blacwel M. I. (1996). Introductory Mycology. John Wiley and Sons Inc. New York, U.S.A.
2. Bold, H. C. and M. J. M. Wynne (1978). Introduction to the Algae - Structure and Reproduction. Prentice Hall of India Pvt. Ltd. New Delhi.
3. Chapman, V. J. and D. J. Chapman (1979). The Algae. English Language Book Soc. & Mac Millons, London.
4. Dube, H. C. (1990). An Introduction to Fungi. Vikas Pub. House Ltd. New Delhi, India.
5. Ganguli, H. C. and Kar, A. K. (2001). College Botany Vol. I. Books and Allied Press Ltd. Kolkata, India
6. Kumar H. D. (1988). Introductory Phycology. Affiliated East West Press Ltd. New Delhi
7. Kumar H. D. and H. N. Singh (1976). A Text Book of Algae. Affiliated East West Press Ltd. New Delhi, India
8. Pandey, B. P. (1994). A Text Book of Botany - Algae. S. Chand & Co. Ltd. New Delhi, India.
9. Pandey, S. N., Trivedi, P. S. and S. P. Misra (1995). A Text Book of Algae. Vikas Pub. House Pvt. Ltd. New Delhi, India.
10. Prescott, G. W. (1969). The Algae: A Review. Thomas Nelson and Press, London, U.K.
11. Sharma, O. P. (1990). Text Book of Algae. Tata McGraw Hill Pub. Co. Ltd. New Delhi, India.
12. Sharma, O. P. (1990). Text Book of Fungi. Tata McGraw Hill Pub. Co. Ltd, New Delhi, India.
13. Singh, Pande and Jain. (2004). Text book of Botany. Diversity of Microbes and Cryptogams. Rastogi Publications, Gangotri, Shivaji Road, Meerut
14. Smith G. M. (1955). Cryptogamic Botany Vol. I: Algae and Fungi. McGraw Hill Book Co. New York, U.S.A.
15. Vashishta, B. R. (2012). Botany for Degree Students - Algae. S. Chand & Co. Ltd. New Delhi, India.

\*\*\*\*\*

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, Epiphylous 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**

**(09 Lectures)**

- 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

#### REFERENCE BOOKS

1. Ganguly, H. C. and Das, K. S. (1986). College Botany Vol.I (6<sup>th</sup> Edition). New Central Book Agency, Calcutta, India.
2. Ganguly, H. C., Dasand, K. S. and Datta, C. T. (1968). College Botany Vol. I. New Central Book Agency, Calcutta, India.
3. Heywood, V. H. and Moore, D. M. (Eds.) (1984). Current Concepts in Plant Taxonomy. Academic Press, London, U.K.
4. Jeffrey, C. E. (1982). An Introduction to Plant Taxonomy. Cambridge University Press, Cambridge, London, U.K.
5. Kumar, N. C. (1995). An Introduction to Taxonomy of Angiosperms. Himalaya Publishing House, Nagpur, India.
6. Lawrence, G. H. M. (1951). Taxonomy of Vascular Plants. McMillan, New York, U.S.A.
7. Mondal, A. K. (2005). Advanced Plant Taxonomy. New Central Book Agency (P) Ltd. Kolkata, India.
8. Naik, V. N. (1985). Taxonomy of Angiosperms. Tata McGraw Hill Publ. Co. Ltd. New Delhi, India.
9. Pandey, B. P. (1997). A Text Book of Angiosperms. S. Chand & Company Ltd., New Delhi.
10. Sharma, O.P. (1993). Plant Taxonomy. Tata McGraw Hill. Publ. Co. Ltd. New Delhi, India.
11. Singh, V. (1993). Taxonomy of Angiosperms. Rastogi Publication, Meerut (U.P.) India.
12. Singh, V., Pande, P. C. and Jain, D. K. (2013). A Text Book of Botany: Angiosperms. Rastogi Publications, Meerut (U. P.), India.
13. Singh, M. P., Nayar, M. P. and Roy, R. P. (1994). Text Book of Forest Taxonomy. Anmol Publ. P. (Ltd.) New Delhi, India.
14. Subramanyam, N. S. (1997). Modern Plant Taxonomy. Vikas Publ. House, New Delhi, India.
15. Sivarajan, V. V. (1984). Introduction to Principles of Plant Taxonomy. Oxford & I. B. H. Publishing Co. New Delhi, India.
16. Vashistha, P. C. (1992). Taxonomy of Angiosperms. S. Chand & Co. Publishers, New Delhi, India.

\*\*\*\*\*

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* sp.).

**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

**REFERENCE BOOKS**

1. Gardner, E. J., Simmons, M. J. and Snustad, D. P. (2008). Principles of Genetics, 8<sup>th</sup> Ed. John Wiley and Sons, New Jersey, U.S.A.
2. Snustad, D. P. and Simmons, M. J. (2010). Principles of Genetics, 5<sup>th</sup> Ed. John Wiley and Sons, New Jersey, U.S.A.
3. Klug, W. S., Cummings M. R., Spencer C. A., Palladino, M. A. (2011). Concepts of Genetics, 10<sup>th</sup> Ed. Benjamin Cummings Publishing, San Francisco, California, U.S.A.
4. Griffiths, A. J. F., Wessler, S. R., Carroll, S. B., Doebley, J. (2010). Introduction to Genetic Analysis, 10<sup>th</sup> Ed. W. H. Freeman and Co., U.S.A.
5. Pierce, B. A. (2011). Genetics: A Conceptual Approach, 4<sup>th</sup> Ed. Macmillan Higher Education Learning.
6. Karp, G. (2010). Cell Biology, 6<sup>th</sup> Ed. John Wiley & Sons, New Jersey, U.S.A.
7. Hardin, J., Becker, G., Kleinsmith, L. J. (2012). Becker's World of the Cell, 8<sup>th</sup> Ed. Pearson Education Inc. U.S.A.
8. Cooper, G. M. and Hausman, R. E. (2009). The Cell: A Molecular Approach, 5<sup>th</sup> Ed. ASM Press; Sunderland, Washington, D. C., Sinauer Associates, MA.
9. Becker, W.M., Kleinsmith, L. J., Hardin. J. and Bertoni, G. P. (2009). The World of the Cell, 7<sup>th</sup> Ed. Pearson Benjamin Cummings Publishing, San Francisco California, U.S.A.

\*\*\*\*\*

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

## **REFERENCE BOOKS**

1. Bidwell, R. G. S. (1974). Plant Physiology. Macmillan Publishing Co. Third Avenue, New York.
2. Buchanan B. B., Gruissem, W. and Jones, R. L. (2000). Biochemistry and Molecular Biology of Plants. American Society of Plant Physiologists Maryland, U.S.A.
3. Dennis, D. T., Turpin, D. H., Lefebvre D. D. and Layzell D. B. (eds) (1997). Plant Metabolism, 2<sup>nd</sup> Ed. Longman, Essex, England.
4. Galstone, A. W. (1989). Life processes in Plants. Scientific American Library, Springer Verlag, New York, U.S.A.
5. Leninger, A. C. (1987). Principles of Biochemistry. CBS Publishers and Distributers (Indian Reprint)
6. Lincoln, Taiz and Eduardo, Zeiger (2003). Plant Physiology, 3<sup>rd</sup> Ed. Published by Panima Publishing Corporation
7. Moore, T. C. (1989). Biochemistry and Physiology of Plant Hormones. Springer Verlag, New York, U.S.A.
8. Singhal, G. S., Renger, G., Sopory, S. K., Irrgang, K. D. and Govindjee (1999). Concept in Photobiology, Photosynthesis and Photomorphogenesis. Narosa Publishing House, New Delhi, India.
9. Pandey, S. N. and Sinha, B. K. (2014). Plant Physiology. Vikas Publishing House Pvt. Ltd. India.
10. Salisbury, F. B. and Ross, C. W. (1992). Plant physiology, 4<sup>th</sup> Ed. Wadsworth Publishing Company, California, U.S.A.
11. Taiz, L. and Zeiger, E. (1998). Plant Physiology, 2<sup>nd</sup> Ed. Sinauer Associates, Inc. Publishes, Massachusetts, USA.

12. William, G. Hopkins (1995). Introduction to Plant Physiology. John Wiley and Sons, New Jersey, U.S.A.
13. Verma, S. K. and Verma, Mohit (2007). A Textbook of Plant Physiology Biochemistry and Biotechnology. S. Chand & Co. Ltd. New Delhi, India.

\*\*\*\*\*

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

**REFERENCE BOOKS**

1. Dubey, R. C. (2005). A text book of Biotechnology. S. Chand & Co. New Delhi, India.
2. Kumaresan, V. (2005). Biotechnology. Saras Publication, New Delhi, India.
3. Sathe, T. V. (2004). Vermiculture and Organic Farming. Daya Publishers, Delhi, India.
4. Jshon, Jothi Prakash, E. (2004). Outline of Plant Biotechnology. Emkay Publication, New Delhi, India.
5. Subha Rao, N. S. (2000). Soil Microbiology. Oxford and IBH Publishers, New Delhi, India.
6. Vayas, S. C., Vayas S. and Modi, H. (1990). Biofertilizers and Organic Farming. Ekta Publication, Nanded, India.

**Webliography**

1. Production of various Biofertilizers.[www.biologydiscussion.com](http://www.biologydiscussion.com)
2. Biofertilizers [vikaspedia.in](http://vikaspedia.in)
3. [www.solverchem.com](http://www.solverchem.com)

\*\*\*\*\*



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

**Unit 4: Chromatography (09 Lectures)**

- 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**

1. Plummer, D. T. (1996). An Introduction to Practical Biochemistry, 3<sup>rd</sup> Ed. Tata McGraw Hill Publishing Co. Ltd. New Delhi, India.
2. Ruzin, S. E. (1999). Plant Micro technique and Microscopy. Oxford University Press, New York. U.S.A.
3. Ausubel, F., Brent, R., Kingston, R. E., Moore, D. D., Seidman, J. G., Smith, J. A., Struhl, K. (1995). Short Protocols in Molecular Biology, 3<sup>rd</sup> Ed. John Wiley and Sons, New Jersey, U.S.A.
4. Zar, J. H. (2012). Biostatistical Analysis, 4<sup>th</sup> Ed. Pearson Publication, U.S.A.
5. Banerjee, Pranab Kumar (2007). Introduction to biostatistics. S. Chand & Co. New Delhi, India.
6. Irfan A. Khan and Khan, Irfan A. (1994). Fundamentals of biostatistics. Ukaaz Publications, Hyderabad, India.
7. Mahajan, B. K. (1989). Methods in Biostatistics for medical students and research workers. Jaypee Brothers Medical Publishers (P) Ltd. Mumbai, India.
8. Parikh, M. N. and Gogtay, Nithya (2009). ABC of Research Methodology and Applied Biostatistics. Jaypee Brothers Medical Publishers (P) Ltd. New Delhi, India.
9. Rao, K. Visweswara (2010). Biostatistics in brief: Made Easy. Jaypee Brothers Medical Publishers (P) Ltd. New Delhi, India.
10. Purohit, S. G., Ranade, V. D. and Dusane, A. V. (2002). Introduction to Biometry. Narendra Prakashan, Pune, India.
11. Daniel, Wayne W. (2010). Biostatistics: Basic Concepts and Methodology for the Health Sciences. John Wiley & Sons, New Jersey, U.S.A.
12. Agarwal, B. L. (2009). Basic statistics. New Age International(P) Ltd. New Delhi, India.
13. Antonisamy, B., Christopher, Solomon and Samuel P. Prasanna (2010). Biostatistics: Principles and Practice. Tata McGraw Hill Pub. Co. Ltd. New Delhi, India.
14. Rao, Sundar P. S. S., Richard, J. (2006). Introduction to biostatistics and research methods. PHI Learning Pvt. Ltd. New Delhi, India.
15. Laware, Shankar And Shinde, Bajirao (2012). Drought stress in peanut. LAP Lambert Academic Publishing, Saarbrucken, Germany.

\*\*\*\*\*

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)



- b) Wood apple/Guava Jelly
- c) Lemon/ Orange Squash
- d) Tomato ketchup

### **REFERENCE BOOKS**

1. Azad, K. C. and Sharma, V. K. (2000). Horticulture Technology (Vol. I&II). Deep and Deep Publications, New Delhi, India.
2. Bal, J. S. (1997). Fruit growing. Kalyani Publication, New Delhi, India.
3. Bose, T. (1996). Fruit tropical and Sub tropical. Naya Pracation , Calcutta, India.
4. Edmond, J. B., Senn, T. L., Andrew, F. S. and Halfacr, R. G. (1990). Fundamentals of Horticulture. Tata McGraw Hill Publishing Co. Ltd. New Delhi, India.
5. Girdhari Lal., Siddhappa, G. S. and Tandon, G. L. (1998). Preservation of fruits and vegetables. ICAR New Delhi, India.
6. Hartmann, H. T. and Kester, D. E. (1989). Plant propagation principles and practice. Prentice Hall of India (P) Ltd. New Delhi, India.
7. Khan, M. R. (1995). Horticulture and Gardening. Nirali Prakashan, Pune, India.
8. Sen, S. (1992). Economic Botany. New Central Book Agency, Calcutta, India.
9. Sharma, N. K. and Arora, S. K. (1985). New Routes to increase Brinjal production. Fmr. Parlim 20 (6) 11 - 12.
10. Sharma, V. K. (2004). Advances in Horticulture. Deep and Deep Publications, New Delhi, India.
11. Sharma, V. K. (1999). Encyclopedia of Practical Horticulture.
12. Singh, V. B. (1990). Fruits of NE Region. Wiley Eastern Limited, New Delhi, India.
13. Sonane, H. N., Deore, B. P. and Patil, S. K. (1984). Vaishali (RHR 51) A High yielding Variety of Brinjal for Maharashtra. Journal of Maharashtra Agriculture Uni. 9(3):341-342
14. Vishnu Swarup (1997). Ornamental horticulture. Macmillan Ltd. New Delhi, India.
15. Reddy, Mallikarjun and Rao, Aparna (2010). Applied Horticulture. Pacific Book International, Delhi, India.
16. Sharaf, Sandhya (2012). Green House Management of Horticulture Crops. Oxford book Co. New Delhi, India.
17. Sharon Pastor Simson, Martha C. Straus (2010). Basics of Horticulture. Oxford Book Co. New Delhi, India.
18. George, Acquaah (2008). Horticulture: Principles and Practices, 4<sup>th</sup> Ed. PHI Learning private Ltd. New Delhi, India.

\*\*\*\*\*

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) Siphonaceous thallus: *Vaucheria*, *Caulerpa*
- e) Pseudoparenchymatous: (Uniaxial/Multiaxial) thallus: *Batrachospermum*,  
*Polysiphonia*
- f) Parenchymatous thallus: *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, Farm Yard Manure (FYM).

**Practical - 15:** Study of Ectomycorrhiza and Endomycorrhiza with the help of PS/  
Photograph.

\*\*\*\*\*

**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

\*\*\*\*\*

**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 peel 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.

\*\*\*\*\*



**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 Enhancement Course	Paper- V	BOT.605	Floriculture	3	3	45	40	60
DSC Elective 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 Course (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**

<b>Paper</b>	<b>Course</b>	<b>SEMESTER - VI CBCS Syllabus (New)</b>	<b>Course</b>	<b>SEMESTER - VI CGPA Syllabus (Old)</b>
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 CRYPTOGRAMS**

**(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**

## REFERENCE 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, Hyderabad, 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.
7. Sundara Rajan, S. (1995). Introduction to Pteridophyta. Wiley Eastern Limited, New Delhi, India.
8. Vashishta, P. C. (1994). Botany: Pteridophyta. S. Chand & Co. Ltd. New Delhi, India.

\*\*\*\*\*

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, Petrification, 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, 4<sup>th</sup> 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 Reinhart & 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.

\*\*\*\*\*

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,  $\theta$  (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.

### **REFERENCE BOOKS**

1. Watson J. D., Baker, T. A., Bell, S. P., Gann, A., Levine, M., Losick, R. (2007). Molecular Biology of the Gene, 6<sup>th</sup> Ed. Pearson Benjamin Cummings, CSHL Press, New York, U.S.A.
2. Snustad, D. P. and Simmons, M. J. (2010). Principles of Genetics, 5<sup>th</sup> Ed. John Wiley and Sons Inc., U.S.A.
3. Klug, W. S., Cummings, M. R., Spencer, C. A. (2009). Concepts of Genetics, 9<sup>th</sup> Ed. Benjamin Cummings, U.S.A.
4. Russell, P. J. (2010). I - Genetics - A Molecular Approach, 3<sup>rd</sup> Ed. Benjamin Cummings, U.S.A.
5. Griffiths, A. J. F., Wessler, S. R., Carroll, S. B., Doebley, J. (2010). Introduction to Genetic Analysis, 10<sup>th</sup> 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.

\*\*\*\*\*

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 *Cinchona* 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*

### REFERENCE BOOKS

1. Aiyer, A. K. Y. N. (1954). Field Crops in India. The Bangalore Printing And Publishing Company, Bangalore.
2. Bendre, Ashok and Ashok Kumar (1998 - 1999). Economic Botany for undergraduate Students. Rastogi Publications, Meerut, India.
3. Hill, A. F. (1952). Economic Botany, 2<sup>nd</sup> 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.
6. Pruthi, J. S. (1976). Spices and Condiments. National Book Trust, Delhi.
7. Sambamurthy, A. V. S. S. and Sambamurthy, N. S. (1889). A Textbook of Economic Botany. Wiley Estern Ltd. New Delhi.
8. Sharma, B. K. and Awasthi, P. B. (1984). Economic Botany. Prakash book Depot, Bareilly.
9. Kochhar, S. L. (2012). Economic Botany in Tropics. MacMillan & Co. New Delhi, India.
10. Wickens, G. E. (2001). Economic Botany: Principles & Practices, Kluwer Academic Publishers, The Netherlands.
11. Chrispeels, M. J. and Sadava, D. E. (1994). Plants. Genes and Agriculture, Jones & Bartlett.
12. Jacob Thankamma (1975). Foods, Drugs And Cosmetics: A Consumer Guide. The Mac millan Company of India Ltd. Delhi.
13. Parthasarathy, S. V. (1972). Sugarcane in India. K. C. P. Ltd., Madras.
14. Kannaiyana, S. and A. Gopalam (Ed.) (2007). Agro biodiversity: Crop Genetic Resources And Conservation. Vol. I. Associated Publishing Co., New Delhi, India.
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.

\*\*\*\*\*



- |                   |                        |                     |
|-------------------|------------------------|---------------------|
| 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

**REFERENCE 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 potted plants. Timber Press, INC. Portland, Oregon.
6. Randhawa G. S, and Mukhopadhyay A. (2007). Floriculture in India. Allied Publishers Pvt. Ltd., New Delhi.
7. Randhawa, G. S. and Mukhopadhyay, A. (1986). Floriculture in India. Allied Publishers.

\*\*\*\*\*



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*

## REFERENCE 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.
3. Agnes Arber, (1999). Herbal plants and Drugs. Mangal Deep Publications, Jaipur, India.
4. Sivarajan V. V. and Balachandran Indira (1994). Ayurvedic drugs and their plant source. Oxford IBH Publishing Co., Delhi, India.
5. Miller, Light and Miller, Bryan, (1998). Ayurveda and Aromatherapy. Banarsidass, Delhi, India.
6. Anne Green, (2000). Principles of Ayurveda. Thomsons, London.
7. Kokate C. K. *et al.* (1999). Pharmacognosy. Nirali Prakashan, Pune, India.

\*\*\*\*\*

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 varieties.

**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 domestication 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

## REFERENCE BOOKS

1. Agrawal, R. L. (1998). Fundamentals of Plant Breeding and Hybrid seed production. Oxford and IBH Publishing Co. New Delhi, India.
2. Allard, R.W. (1960). Principles of plant breeding. John Wiley and Sons, New York.
3. Hayes, H. K. (2017). Breeding Crops Plants. Shree Publishersbooks in India.
4. Chaudhary, H. K. (2001). Plant Breeding, Theory and Practice. Oxford IBH (P.) Ltd. New Delhi, India.
5. Gupta, P. K. (1998). Genetics, Plant Breeding and Evolution. Rastogi Publication, Meerut, India.
6. Xijendro Das, L. D. (1998). Plant Breeding. New age International Publication India.
7. Phundan, Sings (2006). Essential of Plant Breeding. Kalyani Publishers, New Delhi.
8. Poehlman, J. M. and Borthakur D. (1995). Breeding Asian Field Crops. Oxford IBH (P.) Ltd. New Delhi, India.
9. Phundan, Singh (2006). Principles of Plant Breeding. Rastogi Publication Meerut, India.
10. Sheenivas, Y. S. Seed Technology and Seed Pathology. Shree Publishers.
11. Sharma, J. R. (1994). Principles and Practice of Plant Breeding. Tata McGraw Hill Publishing Company Ltd. New Delhi.
12. Singh, B. D. (2006). Plant Breeding: Principles and Methods. Kalyani Publishers, New Delhi.
13. Singh, B. D. (1996). Plant Breeding. Kalyani Publishers, New Delhi.

\*\*\*\*\*

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.

\*\*\*\*\*

**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) <i>Rhynia</i>        | ii) <i>Lepidodendron</i>     | iii) <i>Lepidostrobus</i> |
| iv) <i>Calamites</i>    | v) <i>Annularia</i>          | vi) <i>Lyginopteris</i>   |
| vii) <i>Cycadeoidea</i> | viii) <i>Rhizopalmoxylan</i> |                           |

**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) Protandry ----- (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

\*\*\*\*\*



**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

\*\*\*\*\*