Khandesh College Education Society's

Moolji Jaitha College, Jalgaon

An "Autonomous College" Affiliated to
KBC North Maharashtra University, Jalgaon

ESTD. 1945

SYLLABUS

Botany

T.Y.B.Sc.

(Semester V & VI)

Under Choice Based Credit System (CBCS)

[w. e. f. Academic Year: 2021-22]

T.Y.B.Sc. Botany (CBCS pattern)

Program Specific Outcomes (PSO):

- T.Y. B.Sc. (Botany) graduates will have basic and applied knowledge of Plant Science.
- Acquire academic excellence with an aptitude for higher studies, research and to meet competitive exams.
- A student completing the course is able to understand different branches of Botany such as Plant systematics, evolution & ecology, physiology, biochemistry, interactions of plant with microbes and insects, morphology, anatomy, reproduction, genetics and molecular biology of various life-forms.
- Build life skills in Analytical Techniques in Plant Science, Medico Botany and Pharmacognosy, Food processing and preservation and Seed technology and Pathology through value-added and skill enhancement courses.
- After successful completion of the program, students will acquire laboratory, natural field and transferable skills which will help them to boost their career.
- Students can apply their knowledge in public as well as private sector and build successful career.

Learning Objectives:

- To acquaint the students with various disciplines of Botany.
- To articulate foundation and pillar level knowledge of Botany for the beneficiaries to apply them for advanced studies in the subject.
- To develop practical as well as field skills with a sound theoretical background.
- To apply the knowledge gained for higher education, research and profession of their choice.
- To analyse their interests among the various disciplines and implement them in their professional endeavours.

Exam Pattern:

- Each theory and practical course will be of 50 marks comprising of 10 marks internal and 40 marks external examination.

External Theory Examination (40 marks):

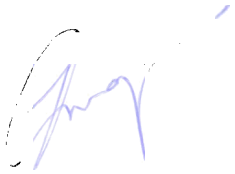
- External examination will be of two hours duration for each theory course. There shall be 4 questions each carrying equal marks (10 marks each) while the tentative pattern of question papers shall be as follows;
    - Q1 (A), Q2 (A) and Q3 (A), each will be of 6 marks (attempt any 2 out of 3 sub-questions),
    - Q1 (B), Q2 (B) and Q3 (B), each will be of 4 marks (attempt any 1 out of 2 sub-questions),
    - Q4 will be of 10 marks (attempt any 2 out of 3 sub-questions).

External Practical Examination (40 marks):

- Practical examination shall be conducted by the respective department at the end of the semester. Practical examination will be of minimum 3 hours duration and shall be conducted as per schedule. There shall be 05 marks for journal, 10 marks for *viva-voce*. Certified journal is compulsory to appear for practical examination.

Internal Theory/ Practical Examination (10 marks):

- Internal theory assessment of the student by respective teacher will be comprehensive and continuous, based on written test/ assignment. The written test may comprise of both objective and subjective type questions.
- Internal practical examination should be conducted by respective department as per schedule given. For internal practical examination student should perform at least one major and one minor experiment and should have completed journal.



Structure of T.Y.B.Sc. (Botany) Curriculum Semester V

Discipline	Course Type	Course Code	Course Title	Credits	Hours/ Week (Clock Hours)	Total Teaching hours	Marks	
							Int	Ext
DSC	Core I	BOT-351	Algae, Fungi & Bryophytes	3	3	45	10	40
	Core II	BOT-352	Pteridophytes Gymnosperms, Paleobotany	3	3	45	10	40
	Core III	BOT-353	Angiosperm Taxonomy	3	3	45	10	40
	Core IV	BOT-354	Plant Anatomy & Embryology	3	3	45	10	40
	Core V	BOT-355	Cell and Molecular biology	3	3	45	10	40
	Core VI	BOT-356	Advanced Plant Physiology	3	3	45	10	40
SEC	Skill Based	BOT-350	Analytical Techniques in Plant Science	2	2	30	10	40
DSC	Core (Practical)	BOT-357	Practical Course Based on BOT-351 and 352	2	4 / batch	60	10	40
		BOT-358	Practical Course Based on BOT-353 and 354	2	4 / batch	60	10	40
		BOT-359	Practical Course Based on BOT-355 and 356	2	4 / batch	60	10	40

Structure of T.Y.B.Sc. (Botany) Curriculum Semester VI

Discipline	Course Type	Course Code	Course Title	Credits	Hours/ Week (Clock Hours)	Total Teaching hours	Marks	
							Int	Ext
DSC	Core I	BOT-361	Genetics and Plant Breeding	3	3	45	10	40
	Core II	BOT-362	Plant Biotechnology	3	3	45	10	40
	Core III	BOT-363	Economic Botany and Plant Resource Utilization	3	3	45	10	40
	Core IV	BOT-364	Plant Ecology and Phytogeography	3	3	45	10	40
	Core V	BOT-365	Seed Technology and Pathology	3	3	45	10	40
	Core VI	BOT-366	Medico Botany and Pharmacognosy	3	3	45	10	40
SEC	Skill Based	BOT-360	Food processing and preservation	2	2	30	10	40
DSC	Core (Practical)	BOT-367	Practical Course Based on BOT-361 and 362	2	4 / batch	60	10	40
		BOT-368	Practical Course Based on BOT – 363 and 364	2	4 / batch	60	10	40
		BOT-369	Practical Course Based on BOT – 365 and 366	2	4 / batch	60	10	40

DSC: Discipline Specific Core Courses/Core Practical; **SEC:** Skill Enhancement Course;
Int : Internal examination; **Ext :** External examination

T.Y. B.Sc. (Botany): Semester V
Discipline Specific Core (DSC) Course
BOT-351: Algae, Fungi and Bryophytes

Total hours: 45 **Credits: 03**

Course Objectives:

- To study salient features of cryptogamic plants.
- To make students aware about the status of cryptogams as a group in plant kingdom.
- To study the life cycles of selected genera.
- To study economic and ecological importance of cryptogamic plants

Course outcomes:

Students will be able to:

- Classify algae, fungi based on their characteristics and structures
- Develop critical understanding on morphology, anatomy and reproduction of Bryophytes
- Demonstrate proficiency in the experimental techniques and methods of appropriate analysis of algae, fungi, bryophytes.
- Increase the awareness and appreciation of human friendly algae, fungi, bryophytes and their economic importance.
- Conduct experiments using skills appropriate to divisions of cryptogams.

Unit-I: An Introduction to Algae **(08 h)**

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-II: Study of Life cycle of Algae (*Chara* & *Sargassum*) **(08 h)**

1.1. Study of Life cycle of ***Chara***: (with emphasis on systematic position, Occurrence, Morphology, Reproduction and Alternation of generation)
1.2. Study of Life cycle of ***Sargassum***: (with emphasis on systematic position, Occurrence, Morphology, Reproduction and Alternation of generation)
1.3. Useful and harmful aspect of **algae.**
1.4. Contribution of following **Phycologists**
i. Prof. M. O. P. Iyengar
ii. Prof. T. V. Deshikachary

Unit-III: An Introduction to fungi **(08 h)**

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-IV: Study of Life cycle of fungi (*Albugo* & *Penicillium*) **(07 h)**

4.1. Study of Life cycle of ***Albugo***: with reference to systematic position, thallus structure and reproduction.

4.2. Study of Life cycle of ***Penicillium***: with reference to systematic position, thallus structure and reproduction.

4.3. Role of Fungi in:

i. Agriculture
ii. Industry
iii. Food
iv. Medicine

4.4. Contribution of following mycologists

i. Prof. E. J. Butler
ii. Prof. C. V. Subramanian

Unit-V: An Introduction to Bryophyta **(06 h)**

Introduction & General characters of Bryophyta

5.1. Classification of Bryophyta up to classes giving reasons with at least two examples of each class as per G. M. Smith (1955),

5.2. Alternation of generation in Bryophytes

Unit-VI: Study of Life cycle of Bryophytes (*Anthoceros*) **(08 h)**

6.1. Study of Life cycle of Anthoceros: With emphasis on systematic position, occurrence, external internal structure of thallus, reproduction (vegetative & sexual), Structure of sex organs, fertilization, structure of sporophyte, development of sporophyte (sporangium), dehiscence of capsule & dispersal of spores.

6.2. Contribution of Indian Bryologist - Prof. Shiv Ram Kashyap

6.3. Economic importance of bryophytes.

References:

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Methods of Teaching:

- Discussion, analysis and feedback, discussion and problem solving, classroom teaching, lecture method, demonstration methods, lecture cum demonstration methods, laboratory method, project method, problem solving method, question answer method, brain storming method, assignment method.
- Innovative teaching: audio video hands on learning, science museum, project-based learning, ICT enabled teaching, video clips/ movies, science fairs, science kit, mobile apps like zoom google platform, field trips.

T.Y. B.Sc. (Botany): Semester V
Discipline Specific Core (DSC) Course
BOT 352: Pteridophytes, Gymnosperms and Paleobotany

Total hours: 45 Credits: 03

Course Objectives:

- To study Pteridophytes with respect to distinguishing characters, economic importance and classification.
- To study Gymnosperms with respect to distinguishing characters, comparison with Angiosperms, and classification
- To study the life cycle of Pinus and Gnetum.
- To study the scope of Paleobotany, types of fossils and geological time scale
- To study the various fossil genera representing different fossil groups.

Course outcomes:

Students will be able to,

- Learn distinguishing characters and economic importance of the pteridophytes, gymnosperms.
- Compare the groups angiosperms and gymnosperms
- Learn the life cycle of *Pinus*, *Gnetum* and *Marsilea*, *Lycopodium*
- Learn the scope of paleobotany, they will learn fossils and geological time scale

PTERIDOPHYTES

Unit-I: Introduction of Pteridophytes (03 h)

1.1 General characters of Pteridophytes

1.2 Classification of Pteridophytes up to classes giving reasons with at least two examples of each class according to Prof. C. M. Smith.

1.3 Ecological and Economic importance

Unit-II: Life cycle of *Lycopodium* with respect to (08 h)

2.1 Systematic position, habit and habitat

2.2. External and internal morphology of sporophyte

2.3. Reproduction: Vegetative and Asexual

2.4. Position, structure and dehiscence of sporangium.

2.5. Structure and germination of spores.

2.6. Structure of gametophyte

2.7. Structure of mature sex organs. (Development is not expected)

2.8. Fertilization.

2.9. Graphical representation of alternation of generation.

Unit-III: Life History of *Marsilea* with respect to (06 h)

3.1 Systematic position, Habit and habitat

3.2 External and internal morphology of sporophyte.

3.3 Reproduction

3.4 External and internal morphology of sporocarp.

3.5 Morphological nature and dehiscence of the sporocarp

3.6. Structure of microspore and megaspore.
3.7. Structure of male and female gametophytes
3.8. Fertilization
3.9. Graphical representation of alternation of generation.
3.10. Heterospory and Seed Habit

GYMNOSPERMS

Unit-IV: General topics **(04 h)**

4.1. Introduction
4.2. Distinguishing features of the group
4.3. Comparison of Gymnosperms with Angiosperms
4.4. Economic importance of Gymnosperms
4.5. Classification of Gymnosperms by K. R. Sporne up to orders giving reasons

Unit-V: Life cycle of *Pinus* with respect to **(08 h)**

5.1. Distribution in India
5.2. Systematic position
5.3. External morphology
5.4. Internal morphology- Primary structure of root, stem and leaf
5.5. Reproductive structure
  a) Male cone Structure
  b) Female cone Structure
5.6. Pollination
5.7. Fertilization
5.8. Polyembryony

Unit-VI: Life cycle of *Gnetum* with respect to **(05 h)**

6.1. Distribution in India
6.2. Systematic position
6.3. External morphology
6.4. Internal morphology
  a) Primary structure of root, stem and leaf
  b) Anomalous Secondary growth in *Gnetum ula*
6.5. Reproductive structure
  a) Male cone
  b) Female cone
6.6. Pollination
6.7. Fertilization
6.8. Polyembryony
6.9. Seed structure and germination
6.10. Alternation of generation
6.11. Resemblance with Angiosperms

PALEOBOTANY

Unit-VII: Introduction of Paleobotany **(06 h)**

7.1. Introduction, definition and scope
7.2. Contribution of Birbal Sahani in Paleobotany
7.3. Definition of Fossil
7.4. Fossilization process, Conditions favorable for fossilization
7.5. Geological time scale, Eras, Periods, Epochs and major plant groups

7.6. Types of fossils: Impression, Compression, Petrifaction, Cast, Coal ball, Amber

Unit-VIII: Study of the following fossil groups w. r. t. morphology and structure (05 h)

8.1. Psilopsida: *Rhynia*
8.2. Lycopsida: *Lepidostrobus* (Cone)
8.3. Sphenopsida: *Annularia* (Leaf)
8.4. Pteridopsperm: *Lyginopteris oldhamia* (Stem)
8.5. Bennettitales: *Cycadeoidea* (Flower)
8.6. Angiosperm: *Sahanipushpum* (Flower)

References:

- Saxena A. K. and R. M. Sarabhai (1992), Text Book of Botany - Vol. II Embryophyta. Ratan Prakashan Mandir, Agra, India.
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Methods of Teaching:

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T.Y. B.Sc. (Botany): Semester V
Discipline Specific Core (DSC) Course
BOT-353: Angiosperm Taxonomy

Total hours: 45 **Credits: 03**

Course Objectives:

- To classify plant systematics and recognize the importance of herbarium and Virtual herbarium
- To evaluate the Important herbaria and botanical gardens
- To Interpret the rules of ICN in botanical nomenclature
- To Assess terms and concepts related to Phylogenetic Systematics
- To Generalize the characters of the families according to Bentham & Hooker's system of classification

Course outcomes:

Students will be able to:

- From this paper student will get the importance of herbariums, systematics and classification.
- They will learn the terms and concepts related to phylogenetic studies.
- Student will get the knowledge of Rules of ICN and Botanical Nomenclature
- They will be able to generalize the characters of families as per Bentham and Hookers system of classification.

Unit-I: Study of origin of Angiosperms **(08 h)**

1.1. Definition, Distinguishing Characters of Angiosperms
1.2. Taxonomy: Aims of taxonomy - Empirical and Interpretative approach
1.3. 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
  c. Pteridospermales theory

Unit-II: Systems of Classification and Modern Trends in Taxonomy **(08 h)**

2.1. Study of Systems of Classification w. r. t. outline, merits and demerits of Hutchinson's system and Engler and Prantl's system
2.2. Principles of Angiosperm Phylogeny Group (APG IV) classification.
2.3. Modern Trends in Taxonomy; Role of following with suitable examples:
  a) Anatomy
  b) Embryology
  c) Palynology

Unit-III: Significance of Plant systematic **(07 h)**

3.1. Importance of Herbarium
3.2. Important herbaria and botanical gardens of the world and India
3.3. Virtual Herbarium
3.4. Flora, Monographs, Journals

Unit-IV: Botanical Nomenclature and System of Classification **(07 h)**

4.1. Principles and rules (ICN)
4.2. Ranks and names
4.3. Typification, author citation.
4.4. Rejection of names
4.5. Principle of priority and its limitations

Unit-V: Study of Angiosperm Families **(15 h)**

5.1. (*Sensu* Bentham and Hooker's system of classification).
5.2. 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:
Annonaceae; Rutaceae; Cruciferae; Caesalpiniaceae; Compositae (Asteraceae); Labiatae; Asclepiadaceae; Acanthaceae; Nyctaginaceae; Liliaceae; Orchidaceae; Musaceae.
5.3. Biological importance of Asclepidaceae and Orchidaceae

References:

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- Pandey, B. P. (2009). A Textbook of Botany Angiosperms. S. Chand and Company.

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T.Y. B.Sc. (Botany): Semester V
Discipline Specific Core (DSC) Course
BOT-354: Plant Anatomy and Embryology

Total hours: 45 **Credits: 03**

Course objectives:

- To understand the fundamental concepts of plant anatomy and embryology
- To analyze and recognize the different organs of plant and secondary growth.
- To examine the structure and functions of eco-system.
- To evaluate the structural organization of flower and the process of pollination and fertilization.

Course outcomes:

Students will be able to:

- The students will be able to understand the fundamental concepts of plant anatomy and Embryology
- The students will be able to analyze the different organs of plant and secondary growth.
- The students will be able to learn the structure and functions of eco-system.
- They will learn to evaluate the structural organization of flower and process of pollination and fertilization.

Unit-I: Plant Tissues and Organs **(10 h)**

1.1. Root and shoot apical meristems
1.2. Simple and complex tissues
1.3. Structure of dicot and monocot root stem and leaf.

Unit-II: Secondary Growth, Adaptive and Protective systems of Flower **(08 h)**

2.1. Vascular cambium – structure and function
2.2 Seasonal activity
2.3. Secondary growth in root and stem.
2.4 Wood (heartwood and sapwood).
2.5. Hard wood and soft wood

Unit-III: Adaptive and protective systems **(08 h)**

2.6. Epidermis, cuticle, stomata
2.7. General account of adaptations in xerophytes and hydrophytes.

Unit-IV: Structural Organization of flower and fertilization **(10 h)**

3.1. Structure of anther and pollen
3.2. Structure and types of ovules
3.3. Types of embryo sacs.
3.4. Organization and ultrastructure of mature embryo sac
3.5. Pollination mechanisms and adaptations
3.6. Double fertilization (Syngamy and triple fusion)
3.7. Seed-structure appendages and dispersal mechanisms.

Unit-V: Embryo and Endosperm, Apomixis and Polyembryony **(09 h)**

4.1. Endosperm types
4.2. Structure and functions
4.3. Dicot and monocot embryo
4.4. Embryo- endosperm relationship
4.5 Definition, types and Practical applications of apomixis and
4.6. Polyembryony – causes
4.7. Types of polyembryony

References:

- Bhojwani, S.S. and Bhatnagar, S.P (2011), Embryology of Angiosperms. Vikas Publication House Pvt. Ltd. New Delhi.
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Methods of Teaching:

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T.Y. B.Sc. (Botany): Semester V
Discipline Specific Core (DSC) Course
BOT-355: Cell and Molecular Biology

Total hours: 45 **Credits: 03**

Course objectives:

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

Course outcomes:

Students will be able to,

- Acquire the knowledge of Cell organelles and cell division
- Know the scope and importance of molecular biology
- Know the biochemical nature of nucleic acids, and their role in living systems.
- Know the process of synthesis of proteins and role of genetic code in polypeptide formation.

Cell Biology

Unit-I: Introduction, Cell wall and Plasma membrane **(04 h)**

1.1. Definition and Brief History
1.2. Prokaryotic and Eukaryotic cell
1.3. Scope and Importance
1.4. Morphology, Ultra-structure, Chemical composition, Functions of Cell wall, Plasma membrane, (Lamellar model and fluid mosaic model)

Unit-II: Cytoplasmic matrix and Cell organelles, cell cycle and cell division **(19 h)**

2.1. Physical nature of Cytoplasmic matrix
2.2. Chemical organization- organic and inorganic compounds of cytoplasmic matrix
2.3. Morphology, Ultrastructure, Chemical composition, Functions of Endoplasmic Reticulum, Golgi apparatus, Lysosomes, Mitochondria, Chloroplast, Vacuoles, Ribosomes
2.4. Nucleus- Morphology, Ultra-structure, Nucleoplasm, Nucleolus, Functions
2.5. Chromosome- Number, Morphology, Structure, Euchromatin and Heterochromatin and Karyotype
2.6. Special types of chromosome: Lamp-brush chromosome and salivary gland chromosome
2.7. Definition of cell cycle
2.8. Brief explanation of Cell Cycle
2.9. Cell division: Mitosis and Meiosis
2.10. Significance of Mitosis and Meiosis

Unit-IV: Introduction and DNA as Genetic Material **(06 h)**

4.1. Definition and History
4.2. Scope and Importance
4.3. Discovery of genetic material
4.4. Watson and Crick's model of DNA, Rosalind Franklin work
4.5. Chargaff rule
4.6. Forms of DNA: A-DNA, B-DNA, Z-DNA

Unit-V: DNA Replication and Transcription **(10 h)**

5.1 Introduction and types of DNA Replication
5.2 Meselson and Stahal's Experiment
5.3 Molecular Mechanism of DNA Replication
5.4 Sanger Method of DNA Sequencing
5.5 Central Dogma of Molecular Biology
5.6 Types of RNA and its role (m-RNA, r-RNA, t-RNA)
5.7 Definition and Mechanism of Transcription in Prokaryotes

Unit-VI: Genetic Code, Translation and gene regulation in prokaryotes **(06 h)**

6.1 Definition, Concept and Properties of Genetic code
6.2 Work of Nirenberg
6.3 Definition of Translation
6.4. Mechanism of Translation, Initiation, Elongation and Termination
6.5. Operon concept
6.6 Inducible and Repressible operon

References:

- G.M. Cooper. (2015). The cell: A Molecular Approach 7th Edition Sinauer Associates
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- Klug, W.S., Cummings, M.R., Spencer, C.A. (2009). Concepts of Genetics. 9th edition. Benjamin Cummings, U.S.A
- Russell, P. J. (2010). i-Genetics- A Molecular Approach. 3rd edition. Benjamin Cummings, U.S.A.

Methods of Teaching:

- Discussion, analysis and feedback, discussion and problem solving, classroom teaching, lecture method, demonstration methods, lecture cum demonstration methods, laboratory method, project method, problem solving method, question answer method, brain storming method, assignment method.
- Innovative teaching, audio video, hands on learning, science museum, project-based learning, ICT enabled teaching, video clips/ movies, science films, science kit, mobile apps like zoom,google platform, field trips.

Semester V
(DSC) Course

growth pattern of plant
phenomenon of translocation

e of growth p
translocation

v the mechanism of stress
be acquainted with the mc

ant Growth and Development:
Introduction, Definitions of growth, Development a
Introduction and roles of following phytohormones:
a) Auxins
b) Gibberellins
c) Cytokinins
d) Ethylene
e) Abscisic Acid.
Factors affecting growth.

Translocation of organic solutes
. Definition
. Path of translocation
. Evidences for phloem transport
. Mechanism of translocation: Pressure

loading and
affecting on

Jaighon

Unit-IV: Plant StressPhysiology (09 h)

4.1 Stress and stress factors

4.2 Resistance Mechanisms

4.3 Tolerance

4.4 Acclimation and avoidance

Unit V : Plant Movement (04 h)

5.1 Plant movement: Introduction and Definition

5.2 Types of plant movement: i) Tropic ii) Tactic iii) Nastic

References:

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- 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.
- Dennis, D. T., Turpin, D. H., Lefebvre D. D. and Layzell D. B. (eds.) (1997). Plant Metabolism, 2nd Ed. Longman, Essex, England.
- Galston, A. W. (1989). Life processes in Plants. Scientific American Library, Springer Verlag, New York, U. S. A.
- Lehninger, A. L. (1987). Principles of Biochemistry. CBS Publishers and Distributors (Indian Reprint)
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- Verma, S. K. and Verma, Mohit (2007). A Textbook of Plant Physiology, Biochemistry and Biotechnology. S. Chand & Co. Ltd. New Delhi, India.

Methods of Teaching:

- Discussion, analysis and feedback, discussion and problem solving, chalk and talk lecture, lecture method, demonstration methods, lecture cum demonstration methods, laboratory method, project method, problem solving method, question answer method, brain storming method, assignment method.
- Innovative teaching, audio video, hands on learning, science museum, project-based learning, ICT enabled teaching, video clips, movies, science fairs, science kit, mobile apps like zoom, google platform, field trips

T.Y. B.Sc. (Botany): Semester V
Skill Enhancement Course (SEC)
BOT 350: Analytical Techniques in Plant Sciences

Total hours: 30 **Credits: 02**

Course objectives:

- To study Imaging technique for the study of plants
- To study microscopy and calibration of microscope
- To study techniques of slide preparation and staining.
- To know the principle and working of instruments.
- To study chromatography techniques
- To study statistical analysis methods.

Course outcomes:
Students will be able to:

- Develop conceptual understanding of micrometry & micro technique
- Classify different types of chromatography techniques.
- Explain the principles of Light microscopy, compound microscopy, Fluorescence microscopy and confocal microscopy
- Apply suitable strategies in data collections and disseminating research findings

Unit-I: Microscopy & Micrometry **(08 h)**

a) **Microscopy**
   i. Introduction,
   ii. Light microscopy; Fluorescence microscopy
   iii. Brief account of Transmission and Scanning electron microscopy
b) **Micrometry**
   i. Introduction,
   ii. Principle, micrometer types, Eye piece Reticle/inserts, stage micrometer
   iii. Calibration of ocular scale and microscope
   iv. Microtechnique Introduction, preparations for microscopic observation-WM smears, squashes, sections, Materials - cover glass, Microslides, Maceration
c) Microphotography techniques (edition of microphotographs by using computerized app.

Unit-II: Bio-physicochemical techniques & Chromatography **(12 h)**

a) **Centrifugation:** Principle of Centrifugation: types centrifuge and application.
b) **Chromatography**
   i. Principle of chromatography
   ii. Paper chromatography
   iii. Thin Layer chromatography (TLC), HPLC

Unit-III: Biostatistics **(10 h)**

3.1 Importance and scope of statistical methods in biology
3.2 Sampling Methods, Random, Systematic
3.3 Representation of Data - Tabular, Graphical
3.4 Measures of central tendency, Arithmetic mean, mode, median
3.5 Measures of dispersion: Range, mean deviation

3.6. Standard deviation
3.7. Chi square test
3.8. Testing of hypothesis- Null hypothesis

References:

- Plummer, D. T. (1996). An Introduction to Practical Biochemistry. 3rd Ed. Tata McGraw Hill Publishing Co. Ltd. New Delhi, India.
- Ruzin, S. E. (1999). Plant Microtechnique and Microscopy. Oxford University Press, New York, U. S. A.
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Methods of Teaching:

- Discussion, analysis and feedback, discussion and problem solving, classroom teaching, lecture method, demonstration methods, lecture cum demonstration methods, laboratory method, project method, problem solving method, question answer method, brain storming method, assignment method,
- Innovative teaching: audio video hands on learning, science museum, project-based learning, ICT enabled teaching, video clips/ movies, science fairs, science kit, mobile apps like zoom google platform, field trips.

T.Y. B.Sc. (Botany): Semester V
Discipline Specific Core (DSC) Course
BOT-357: Practical course Based on Theory Paper BOT-351 and BOT-352

Total Hours: 60 **Credits: 02**

Course objectives:

- To accustom students with Algae, Fungi and Bryophytes.
- To attune students with Pteridophytes, Gymnosperms
- To study Paleo botany.

Course outcomes:

Students will be able to:

- Understand the fundamental concepts related to algae, fungi and bryophytes
- Examine morphology and range of thallus structure in algae
- Evaluate the significance of fungi and its different types
- Analyze the anatomy and reproduction of *Pinus* and *Gnetum*
- Examine various types of Paleo botanical fossils.

Sr. No.	Topic Particular	Hours
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*	04
2	Study of range of thallus structure in algae with the help of materials or Permanent slides (any one from the examples): a) **Siphonaceous thallus**: *Vaucheria*, *Caulerpa* b) **Pseudoparenchymatous thallus:** (Uniaxial/Multiaxial) thallus: *Batrachospermum*, *Polysiphonia* c) **Parenchymatous thallus**: *Ulva*, *Enteromorpha*	04
3	Study of life cycle of ***Chara***	04
4	Study of life cycle of ***Sargassum***	04
5	Study of life cycle of ***Albugo* and *Penicillium***	04
6	Study of fungal forms (any four) i) *Stemonitis* ii) *Saprolegnia* iii) *Rhizopus* iv) *Eurotium* v) *Puccinia* vi) *Alternaria*	04
7	Study of life cycle of *Anthoceros*	04
8	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.)	04
9	Study of life cycle of *Marsilea* w. r. t. a) Systematic Position	04

		a) External morphology c) Internal morphology i. T. S. of stem/rhizome ii. T. S. of petiole iii. External structure of sporocarp	
10 to 11	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. T. S. of male cone (P. S.) iii. Microsporophyll (Specimen/P. S.) iv. Mounting of pollen grains e) Female cone: i. Morphology (Specimen) ii. T. S. of female cone (P. S.) iii. Megasporophyll (Specimen/P. S.) iv. T. S. of mature ovule (P. S.)	08
12 to 13	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 Dicot stem of *Gnetum* (P. S.) d) Morphology of male cone (Specimen) e) Female cone: i. Morphology (Specimen) iv. T. S. of mature ovule (P. S.)	08
14	Study of different types of fossils		01
15	Study of the following with the help of slides/ specimens. i) *Nostoc* ii) *Lyngbya/Oscillatoria* iii) *Lepidodendron* iv) *Calamites* v) *Annularia* vi) *Sphenophyllum* vii) *Pteridium aquilinum* viii) *Marsilea*		01

References:

- Vashishta, P.C., Sinha, A.K., Kumar, A. (2010), Pteridophyta, S. Chand Delhi, India.
- Vanderpoorten, A. and Goffinet, B. (2009), Introduction to Bryophytes, Cambridge University Press, Cambridge.
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Methods of Teaching:

- Laboratory method, Lecture cum demonstration methods

T.Y. B.Sc. (Botany): Semester V
Discipline Specific Core (DSC) Course
BOT-358: Practical course Based on Theory Paper BOT-353 and BOT-354

Total Hours: 60 **Credits: 02**

Course objectives:

- To classify plant systematics and recognize the importance of herbarium and Virtual herbarium
- To Interpret the rules of ICN in botanical nomenclature
- To Generalize the characters of the families according to Bentham & Hooker's system of classification
- To understand the fundamental concepts of plant anatomy and embryology
- To analyze and recognize the different organs of plant and secondary growth.

Course outcomes:

Students will be able to:

- Get the importance of herbarium, systematics and classification
- Learn the terms and concepts related to phylogenetic studies.
- Get the knowledge of Rules of ICN and Botanical Nomenclature
- Able to understand the fundamental concepts of plant anatomy and Embryology

Sr. No.	Topic Particular	Hours
1 to 6	Study of vegetative and floral characters of the following families (Description, V.S. flower, section of ovary, floral diagram/s, floral formula/e and systematic position according to Bentham & Hooker's system of classification): 1. Annonaceae- *Artabotrys odorattisimus, Annona squamosa* 2. Cruciferae - *Alyssum / Iberis, Raphanus sativus* 3. Caesalpinaceae- *Caesalpina , Cassia* 4. Asteraceae - *Sonchus/Launaea, Vernonia/Ageratum, Eclipia/Tridax* 5. Asclepidaceae - *Calatropis procera, Calatropis gigantea* 6. Lamiaceae - *Salvia/Ocimum* 7. Acanthaceae- *Crossandra/ Ruellia* 8. Nyctaginaceae- Bouganvillea, Mirabilis 9. Liliaceae - *Asphodelus/Lilium/Allium*	24
7	Field visit (local or outside depending on situation)	04
8	Mounting of a properly dried and pressed specimen of any 10-wild plant with Herbarium label (to be submitted in the record book).	04
9 to 11	1. Anatomy of Stem: Monocot: *Zea mays;* Dicot: *Helianthus;* Secondary: *Helianthus* (only Permanent slides), 2. Anatomy of Root: Monocot: *Zea mays;* Dicot: *Helianthus;* Secondary: *Helianthus* (only Permanent slides), 3. Anatomy of Leaf: Dicot and Monocot leaf (Study through transverse section, Double staining)	12
12	Adaptive anatomy: Xerophyte (*Nerium, Ficus* leaf); Hydrophyte (*Hydrilla, Eichornia* stem),	04
13	Structure of anther (young and mature), tapetum (amoeboid and secretory) (Permanent slides)	04

14	Female gametophyte: Polygonum (monosporic) type of Embryo sac Development (Permanent slides/photographs).	04
15	Dissection of embryo/endosperm from developing seeds.	04

References:

- Jeffrey, C. (1982), An Introduction to Plant Taxonomy. Cambridge University Press. Cambridge.
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Methods of Teaching:

- Laboratory method, Lecture cum demonstration methods

T.Y. B.Sc. (Botany): Semester V
Discipline Specific Core (DSC) Course
BOT-359: Practical course Based on Theory Paper BOT-355 and BOT-356

Total Hours: 60 **Credits: 02**

Course objectives:

- To Study of Mitosis and Meiosis techniques
- To study Isolation of DNA from any plant material
- Study of polytene chromosome from Chironomus larvae
- To study Morphological and anatomical variation in plants under stress
- To study Effect of hormone on germinating seeds.

Course outcomes:

Students will be able to:

- Acquire the knowledge of Cell organelles and cell division
- Know the biochemical nature of nucleic acids, and their role in living systems
- Know the process of synthesis of proteins and role of genetic code in polypeptide formation.
- Students will get the knowledge of growth patterns in plants
- Students know the mechanism of stress in plants
- Students will be acquainted with the movements in the plants

Sr. No.	Topic Particular	Hours
1	Preparation of fixative and stains (Acetocarmine or suitable cytological stain)	04
2	Study of Mitosis techniques (Root tip of onion or any suitable material)	04
3 & 4	Study of Meiosis techniques	08
5	Study of polytene chromosome from Chironomus larvae	04
6 & 7	Isolation of DNA from any plant material (e.g., Cauliflower, Banana etc.) or any suitable plant material	08
8	Mitochondria staining by Janus green stain.	04
9 &10	Study of lipase activity in germinating seeds.	08
11 & 12	Effect of hormone on germinating seeds.	08
13	Demonstration: Geotropic Movement, Phototrophic Movement, Phloem loading experiment	04
14 & 15	Morphological and anatomical variation in plants under stress (such as number of stomata, chl a/b ratio and anatomical variations)	08

References:

- G.M. Cooper. (2013). The cell: A Molecular Approach. 7th Edition. Sinauer Associates.
- Alberts, B., Johnson, A.D., Lewis, J., Morgan, D., Raff, M., Roberts, K., Walter, P. (2014). Molecular Biology of Cell. 6th Edition. WW Norton & Co.
- Berg, J.M., Tymoczko, J.L., and Stryer, L. (2011). Biochemistry. W.H. Freeman and Company.
- Nelson, D.L., and Cox, M.M. (2008). Lehninger Principles of Biochemistry. 5th Edition. W.H. Freeman and Company.
- Karp, G. (2010). Cell Biology. 6th edition. John Wiley & Sons, U.S.A.

- Hardin, J., Becker, G., Skliensmith, L.J. (2012), Becker's World of the Cell. 8th edition. Pearson Education Inc. U.S.A.
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Methods of Teaching:

- Laboratory method, Lecture cum demonstration methods

T.Y. B.Sc. (Botany): Semester VI
Discipline Specific Core (DSC) Course
BOT-361: Genetics and Plant Breeding

Total hours: 45 **Credits: 03**

Course objectives:

- To study historicsl and classical approach of genetics
- To study the chromosomal aberrations, gene mutation and population genetics.
- To study different concepts of plant breeding
- To understand Male sterility, heterosis, polyploidy and seed certification

Course outcomes:

Students will be able to:

- Students will elaborate about historicsl and classical approach of genetics
- Students will known and familier with chromosomal aberrations, gene mutation and population genetics.
- Students will understands various concepts of plant breeding
- Students will develop understanding on Male sterility, heterosis, polyploidy and seed certification

Unit-I: Study of Genetics with historical and classical approach **(11 h)**

1.1. History of Genetics
1.2. Mendel's contribution
  a) Law of dominance
  b) Law of segregation
  c) Law of independent assortment; 3:1 ratio and 9:3:3:1 ratio
1.3. Extra mendelian inheritance: 9:7 ratio, 9:6:1 ratio, 13:3 ratio and 15:1 ratio
1.4. Multiple alleles, examples with blood groups and Nicotiana, sterility genes.
1.5. Linkage and crossing over; history, original concept, detection of linkage from F_2 data, contribution of T.H. Morgan. Concepts of crossing over and its types. Chromosome mapping by three-point test cross.

Unit-II: Chromosomal aberrations, gene mutation and population genetics **(12 h)**

2.1. Chromosomal aberrations, Deletion, Duplication, Inversions and Translocations.
2.2. Numerical changes in chromosomes, Euploidy and Aneuploidy.
2.3. Gene mutations: Concept, mutagens, U.V., I.R., and Chemical
2.4. Population Genetics
  a) Hardy-Weinberg's law of genetics equilibrium
  b) Factors affecting the equilibrium in population:
    i. Migration
    ii. Mutation
    iii. Selection
    iv. Genetic drift
  c) Cytoplasmic and extra chromosomal inheritance

Unit-III: Plant Breeding **(11 h)**

3.1. Definition, principles, scope and importance of plant breeding.
3.2. Mode of reproduction in relation to Breeding methods

a) Methods of reproduction: Vegetative, Asexual and Sexual
b) Modes of reproduction
i. Self-pollination
ii. Cross pollination
iii. Geitonogamy

3.3. Introduction and acclimatization
a) Plant introduction, centers of origin, N.I. Vavilov concept.
b) Procedure, purpose, merits and demerits of introduction
c) Function of plant introduction agencies, Role of NBPGR

3.4. Selection
a) For cross pollination crops: Mass selection
b) For self pollination crops: Pure line selection
c) For vegetative propagated crops: Clonal selection

3.5. Hybridization
a) Definition and types of hybridization
b) Hybridization procedure
i. Selection of parents
ii. Selfing procedure
iii. Hybridization technique
iv. Raising of F1 generation
v. Trials, multiplication and distribution

Unit-IV: Male sterility, heterosis, polyploidy and seed certification **(11 h)**

4.1. Male sterility
i. Gamatic male sterility
ii. Cytoplasmic male sterility
iii. Genetic cytoplasmic male sterility
iv. Use of male sterility in hybrid seed production

4.2. Heterosis
i. Definition and history
ii. Effects of hybrid vigor
iii. Causes of heterosis
iv. Utilization and limitation

4.3. Polyploidy
i. Role of polyploidy in crop evolution e.g. Wheat, *Raphanus brassica*
ii. Utilization of Allopolyploidy in plant breeding
iii. Utilization of Autopolyploidy in plant breeding

4.4. Improved seed production and certification
i. Importance of quality seeds
ii. Plant variety testing
iii. Seed quality control
iv. Seed certification, purpose and standard

References:

- Verma, P.S. and Agarwal, V.K. (2005). Genetics. S. Chand Publication
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- Das L.D.V. (2006), Plant breeding. New Age international Publishers, New Delhi.

Methods of Teaching:

- Discussion, analysis and feedback, discussion and problem solving, classroom teaching, lecture method, demonstration methods, lecture cum demonstration methods, laboratory method, project method, problem solving method, question answer method, brain storming method, assignment method,
- Innovative teaching: audio video hands on learning, science museum, project-based learning, ICT enabled teaching, video clips/ movies, science fairs, science kit, mobile apps like zoom google platform, field trips.

T.Y. B.Sc. (Botany): Semester VI
Discipline Specific Core (DSC) Course
BOT-362: Plant Biotechnology

Total hours: 45 **Credits: 03**

Course objectives:

- To know the scope and importance of plant biotechnology
- To study various techniques in plant tissue culture
- To study the role of enzymes and vectors in plant genome modification
- To study different methods of gene cloning and gene transfer
- To know the applications of transgenetic tehnology

Course outcomes:

Students will be able to:

- Understand core and fundamental concepts of plant and tissue culture
- Develop their competency on different types of plant tissue culture
- Explore knowledge of enzymes and vectors for genetic manipulation
- Examine gene cloning and evaluate different methods of gene transfer
- Analyze the major concerns and application of transgenic technology

Unit-I: Fundamentals Plant Tissue Culture **(05 h)**

1.1. Definitions, scope & importance of plant tissue culture.
1.2. Concepts of cell differentiation and totipotency.
1.3. Requirements of plant tissue culture laboratory.
1.4. Requirement for basal media. Formulation of nutrient media: Sterilization, role of vitamins and hormones

Unit-II: In vitro Culture **(08 h)**

2.1. Embryogenesis (somatic and zygotic); Organ culture, Embryo culture, Anther and triploid culture, Callus culture,
2.2. Protoplast isolation, culture and fusion;
2.3. Tissue culture applications including micropropagation, androgenesis, production of virus free plants,
2.4. Cryopreservation and usages.

Unit-III: Enzymes and Vectors for Genetic Manipulations **(08 h)**

3.1. Restriction Endonucleases (History, Types I-IV and subtypes of II, Structures, biological role, Mechanism, and usages in cloning):
3.2. Ligases enzymes, Cloning Vectors: History, basic sequences of any vector, types of bacterial vectors (pBR322, Ti plasmid, BAC); viral vectors including Lambda phage, Cosmid, Shuttle vector; Eukaryotic Vectors (YAC),

Unit-IV: Plant Molecular Biology **(05 h)**

4.1. Organization and function of Plant nuclear genome (*Arabidopsis thaliana*), Genetic transformation of plants by *Agrobacterium*: Genetic organization of Ti plasmids Functions encoded by integrated T- DNA.

Unit-V: rDNA Technology **(08 h)**

5.1 Gene library, cDNA library, molecular probes, Molecular techniques: Electrophoresis, Southern, Northern, Western & Slot blots, Polymerase Chain Reaction. Gene delivery system: Particle gun bombardment, microinjection, electroporation.

Unit-VI: Major Concerns and Applications of Transgenic Technology **(11 h)**

6.1. Transgenic technology and sustainable agriculture.

6.2. Biosafety concerns with transgenic technology.

6.3. History of transgenic development across the world. Major concerns with implementation of transgenic technology in India.

6.4. Applications as Pest resistant (Bt-cotton); herbicide resistant plants (Roundup Ready soybean); Transgenic crops with improved quality traits in major crops (Flavr Savr tomato, Golden rice); Improved horticultural varieties (Moondust carnations); Role of transgenics in bioremediation (Superbug).

References:

- Bhojwani, S.S. and Razdan, M.K., (1996). Plant Tissue Culture: Theory and Practice. Elsevier Science Amsterdam. The Netherlands.
- Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology: Principles and Applications of recombinant DNA. ASM Press, Washington.
- A. Slater, N.W. Scott and M.R. Fowler (2008). Plant Biotechnology. Second Edition. Oxford.
- Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics. John Wiley and Sons, U.K.
- Stewart, C.N. Jr. (2008). Plant Biotechnology & Genetics: Principles, Techniques and Applications. John Wiley & Sons Inc. U.S.A.
- Chrispeels, M.J. and Sadava, D.E. (1994). Plants, Genes and Agriculture. Jones & Bartlett Publishers.
- N. Sateesh and V. Madhavi (2010). Practical Book of Biotechnology and Plant Tissue Culture. S. Chand & Co.

Methods of Teaching:

- Discussion, analysis and feedback, discussion and problem solving, classroom lecture method, lecture method, demonstration methods, lecture cum demonstration methods, [illegible] method, project method, problem solving method, question answer method, brainstorming method, assignment method.
- Innovative teaching: audio visual, hands on learning, science museum, project based learning, ICT enabled teaching, video clips, movies, science fairs, science [illegible] model, apps like zoom, moodle platform, field trips.

T.Y. B.Sc. (Botany): Semester VI
Discipline Specific Core (DSC) Course
BOT-363: Economic Botany and Plant Resource Utilization

Total hours: 45 **Credits: 03**

Course objectives:

- To know the commercial importance and scope of plant science.
- To study the Aromatic, Drug yielding and medicinal plants
- To study the utilization of plant wealth (Spices, Beverages, Oil seeds fats and Essential oils)
- Study of some plants which are used as herbal cosmetics.
- Study of the role plants in forensic science.

Course outcomes:

Students will be able to:

- Understand core concepts of Economic Botany use of plants in applied way
- Develop critical understanding on the Medicinal, aromatic and drug yielding plants
- Understand the utilization of plant wealth as spices, Beverages, Oils, and Essential oils etc.
- Increase the awareness and appreciation of plants & plant products in herbal cosmetics
- Understand the role of plants in its products in forensic science

Unit-I: Origin and conservation of Cultivated Plants **(09 h)**

1.1. Origin, Importance and domestication of plant species: Origin of Agriculture and ancient economic botany.

1.2. Vavilov's Centres of Origin and diversity of crop plants, domestication, evaluation, bioprospection,

1.3. Major plant introductions: Crop domestication and loss of genetic diversity: Germplasm augmentation and conservation.

1.4. History and importance of germplasm collection: Overview of: Ecogeographical distribution of diversity.

Unit-II: Botany, Utilization of Plant Wealth (Spices, Beverages, Oil seeds fats and Essential oils) **(12 h)**

2.1. **Spices**: Listing of important spices (Saffron, Cloves, Cardamom, Cinnamon, Tejpat, Nutmeg and Mace, Anise, Cumin, Celery, Tamrind, Vanilla, Asafoetida, Dill, Fenugreek, Fennel, Coriander), their botanical name, family and part used.

2.2. **Beverages**: Tea and Coffee: History, origin, growing countries, Botany, cultivation practices, common diseases and pests, major chemical constituents, processing and quality control of economic product.

2.3. **Oil seeds and fats**: General description, classification, extraction and uses of groundnut, coconut, linseed, soybean, mustard. Essential Oils: General description, uses extraction / distillation of essential oil, chemical constituents of major essential oil yielding aromatic plants, namely Rose, Geranium, Lemongrass / Palmarosa / Citronella, Menthol, Basil, Lavender, Eucalyptus, Clove, Camphor and Sandal wood.

Unit-III: Botany, Utilization and Processing of Plant Wealth (Aromatic Plants, Drug-yielding and Medicinal plants, Timber plants) **(12 h)**

3.1. **Drug-yielding and Medicinal plants**: Fumitories and Masticatories: Processing, therapeutic uses, and health hazards of habit-forming drugs. Botany and cultivation / regulatory practices of such drug yielding plants with special reference to Papaver, Cannabis and Tobacco.

3.2. **Major Medicinal Plants**: Botany, Uses, Cultivation and Processing of major medicinal plants, namely: Ashwagandha, Satavar, Isabgol, Senna, Bhui Amla (*Phyllanthus*), *Stevia*, Sarpagandha, *Atropa*, *Digitalis*, Gilloi (*Tinospora*),

3.3. **Timber plants and Fibres**: General account and Botany of the Tree, wood structure and quality characteristics, and timber processing with special reference to, Saal (*Shorea robusta*), Teak and Pine. General account of the Fiber yielding plants, Extraction, processing, morphology and uses of fibers, with special reference to Cotton, Sunhemp, flax, Coir, Jute.

Unit-IV: Plants used in Forensic Science, herbal cosmetics industries and Ayurvedic Medicines **(12 h)**

4.1. **Forensic Science**: Introduction, Definition, Scope and Importance of Forensic science, 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)

4.2. **Herbal Cosmetics**: Introduction and Definition and multiple benefits of medicinal plants used in herbal cosmetics, 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) Jaswand (iii) Amla (iv) Shikekai
C. Dental Care: (i) Neem (ii) Babool (iii) Khair (iv) Bakul

4.3. Preparation of *Aloe Vera* gel (for skin); Preparation of Jaswand gel (for hair).

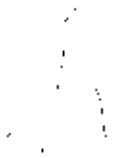
4.4. **Ayurvedic Medicines**: Preparation of following Ayurvedic medicines with respect to Botanical Source, Part used and methods of preparation: Triphala churna, Kumariasav, Arjunarishta (Aristha), Rosha and Khas oil

References:

- Chrispeels, M.J. and Sadava, D.E. (1994), Plants, Genes and Agriculture. Jones & Bartlett Publishers.
- CSIR- Central Institute of Medicinal and Aromatic Plants, Lucknow (2016), Aush Gyanya : Handbook of Medicinal and Aromatic Plant Cultivation.
- Kochhar, S.L. (2016), Economic Botany: A Comprehensive Study. 5th Edition. Cambridge
- Samba Murty, AVSS and Subrahmanyam, N.S. (1989), a text book of Economic Botany. Wiley Eastern Ltd., New Delhi
- Sambamurty, AVSS and Subrahmanyam, N.S. (2008), A Textbook of Modern Economic Botany, 1st Edition, Paperback. CBS Publishers & Distributors Pvt.Ltd.;
- Wickens, G.E. (2001), Economic Botany: Principles & Practices. Kluwer Academic Publishers, The Netherlands.
- Any local/state/regional flora published by BSI or any other agency.

Methods of Teaching:

- Discussion, analysis and feedback, discussion and problem solving, classroom lecture method, demonstration methods, lecture cum demonstration methods, laboratory method, project method, problem solving method, question answer method, brain storming method, assignment method.
- Innovative teaching, audio video, hands on learning, science museum, project-based learning, ICT enabled teaching, video clips/ movies, science fairs, science kit, mobile apps like zoom, google platform, field trips.



T.Y. B.Sc. (Botany): Semester VI
Discipline Specific Core (DSC) Course
BOT-364: Plant Ecology and Phytogeography

Total hours: 45 **Credits: 03**

Course objectives:

- To know the core concept of biotic and abiotic factors
- To study various types of ecological adaptation and concepts of population ecology
- To study different plant communities and ecosystem concept
- To study energy sources of ecological system
- To know the functional aspects of ecosystem and phytogeography and its divisions

Course outcomes:

Students will be able to:

- Understand core concepts of biotic and abiotic factors
- Elaborate the knowledge of classification of soils on the basis of physical,
- chemical and biological components
- Analysis the phytogeography or phytogeographical division of India
- Evaluate energy sources of ecological system
- Assess the adaptation of plants in relation to light, temperature, water, wind and fire.
- Conduct experiments using skills appropriate to subdivisions

Unit-I: Introduction, soil and water **(11 h)**

1.1. Basic concepts; Levels of organization. Abiotic and biotic Components and their interrelationships and dynamism, homeostasis.

1.2. Soil: Origin; Types and Formation; Composition; Physical, Chemical and Biological components; Soil profile. Types of soils in India.

1.3. Water: States of water in the environment; Precipitation types (rain, fog, snow, hail, dew); Hydrological Cycle; Atmospheric moisture; Water in soil; Ground water table. Water resources of India

Unit-II: Ecological adaptations, Population ecology **(12 h)**

2.1. Study the Variations in adaptation of plants in relation to light, temperature, water, wind and fire.

2.2. **Biotic interactions**: Competition: Inter- and intraspecific competition; Ammensalism, heterotrophy; mutualism, commensalism, parasitism; herbivory, carnivory, protocooperation.

2.3. **Population ecology**: Characteristics and population growth, population regulation, life history strategies; r and k selection. Ecological Speciation.

Unit-III: Plant Communities and Ecosystem **(11 h)**

3.1. **Community characteristics**: analytical and synthetic; Concept of ecological amplitude; Habitat and niche; Ecotone and edge effect;

3.2. **Succession**: processes, types; climax concept. Primary vs Secondary succession.

3.3. **Ecosystem**: Structure; Processes; Trophic organization; Food chains and Food webs; Ecological pyramids. Ecosystems of India.

Unit-IV: Functional Aspects of Ecosystem and Phytogeography **(11 h)**

1.1. Principles and models of energy flow; Production and productivity; Ecological efficiencies; Biogeochemical cycles of carbon, nitrogen and phosphorus.

1.2. **Phytogeography**: Principles; Continental drift; Theory of tolerance; Endemism; Brief description of major terrestrial biomes (one each from tropical, temperate & tundra); Phyto-geographical division of India; Local Vegetation.

References:

- Odum, E.P. (2005), Fundamentals of ecology, 5th edition Cengage Learning India Pvt. Ltd., New Delhi.
- Singh, J.S., Singh, S.P., Gupta, S. (2006), Ecology Environment and Resource Conservation. Anamaya Publications, New Delhi, India.
- Sharma, P.D. (2010), Ecology and Environment, 8th edition Rastogi Publications, Meerut, India.
- Wilkinson, D.M. (2007), Fundamental Processes in Ecology: An Earth Systems Approach. Oxford University Press. U.S.A.
- Kormondy, E.J. (1996), Concepts of ecology, 4th edition PHI Learning Pvt. Ltd., Delhi, India.

Methods of Teaching:

- Discussion, analysis and feedback, discussion and problem solving, classroom teaching, lecture method, demonstration methods, lecture cum demonstration methods, laboratory method, project method, problem solving method, question answer method, brain storming method, assignment method,
- Innovative teaching: audio video hands on learning, science museum, project-based learning, ICT enabled teaching, video clips/ movies, science fairs, science kit, mobile apps like zoom google platform, field trips.

T.Y. B.Sc. (Botany): Semester VI
Discipline Specific Core (DSC) Course
BOT-365: Seed Technology and Seed Pathology

Total hours: 45 **Credits: 03**

Course objectives:

- To develop theoretical orientation of seed development
- To analyze seed processing in various plants
- To examine seed testing methods
- To know seed production method in different plants

Course outcomes:

Students will be able to:

- Understand the theoretical orientation of seed development
- Analyze the different ways of seed processing in different plants
- Examine the various methods of Seed testing
- Understand the method of seed production in different plants

Unit-I: An Introduction of Seed Technology **(12 h)**

1.1. Aims and role of seed Technology in modern agriculture relation of seed technology with other disciplines history of seed technology in India development of seed programme problem of seed industry role of various agencies in development of Indian seed industry

1.2. The Seed, difference between seed and grain, types of seed, seed development, apomixis chemical composition of seed and physiology of seed, seed dormancy, seed vigour

1.3. Types of cultivar (varieties)

1.4. Composite seed, hybrid seed, Terminator seed, role of producer, Seed production agencies

Unit-II: Seed quality, production, processing **(12 h)**

2.1. Principles of quality seed production

i. Stage of seed multiplication purity genetic purity

ii. Methods of certified seeds production isolation seed inspection roughing

2.2. Seed harvesting drying processing seed sampling

2.3. Seed testing

i. Physical purity

ii. Genetic purity

iii. Seed viability and Vigour test

iv. Seed Health test

v. Tolerance value real value

vi. Calculation of seed requirement of various crops based on test values

Unit-III: Production of seeds of major crops and vegetables **(14 h)**

3.1. Seed production of major field crops and vegetables

i. Seed production of cereals and millets

ii. Seed production of pulses and oilseeds

iii. Seed production of fibre and sugar crops

iv. Seed production of vegetables

3.2. Seed processing
   i. Main principles of seed processing
   ii. Various steps in seed processing
   iii. Seed drying cleaning grading blending
   iv. Layout of seed processing plant

3.3. **Seed treatment**: Types and advantages of seed treatment seed treatment for control of pest, for promotion of germination and breaking of seed dormancy. Seed priming, chilling treatment for vernalization effect

3.4. **Seed bagging and storage**: Methodology of begging storage difficulty in seed storage advantages of seed storage

3.5. **Seed certification**: Methods of seed certification field inspection quality of an inspector minimum certification standard

3.6. **Seed marketing and legislation:** forecasting of seed demand trade marketing structure seed sale promotion cost and pricing of seed Organisation in seed marketing the seed act 1966 the seed control order (1983) plant varieties and farmers right protection act

SEED PATHOLOGY

Unit-IV: Seed Pathology **(07 h)**

4.1. Introduction to Seed pathology

4.2. Significance of seed borne diseases.

4.3. Types of micro-organism associated with seeds and diseases caused by them

4.4. Location of seed borne inoculum and seed infection:
   i. Factors affecting the seed infection
   ii. Longevity of seed borne diseases.
   iii. Control of seed borne pathogens
   iv. Quarantine and post-entry quarantine

References:

- Agrawal R. L. (2015), Seed Technology, Oxford and IBH Publication Co. New Delhi, India.
- Khase D and Bhale M .S (2014), Seed Technology 2nd revision Jain Book Agency
- Agrawal, P.K. (2010), Principles of seed technology, ICAR New Delhi, India.
- Tomar H. S (2010), Seed Technology, Aman Publishing house Meerat
- Singh R. S. (1996), Plant Pathology Oxford and IBH Publication Co. New Delhi, India,
- Agarwal V.K. and Sinclair J.B. (1996), Principles of Seed Pathology, 2nd edition, Lewis Publisher.

Methods of Teaching:

- Discussion, analysis and feedback, discussion and problem solving, classroom teaching, lecture method, demonstration methods, lecture cum demonstration methods, laboratory method, project method, problem solving method, question answer method, brain storming method, assignment method,
- Innovative teaching: audio video hands on learning, science museum, project-based learning, ICT enabled teaching, video clips/ movies, science fairs, science kit, mobile apps like zoom google platform, field trips.

T.Y. B.Sc. (Botany): Semester VI
Discipline Specific Core (DSC) Course
BOT-366: Medico Botany and Pharmacognosy

Total hours: 45 **Credits: 03**

Course objectives:

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

Course outcomes:

Students will be able to:

- Understand Scope and importance of Medico Botany and Pharmacognosy.
- Analyze the different types of plant drug processing.
- Examine the chemical and analytical characterization of crud drugs.
- Understand biopiracy and legislation of medicinal plants.

Unit-I: Ethnobotany and Folk Medicine **(10 h)**

1.1. Ethnobotany and Folk medicines.
1.2. Definition; Ethnobotany in India: Methods to study ethnobotany
1.3. Applications of Ethnobotany: National interacts, Palaeo-ethnobotany
1.4. Folk medicines of ethnobotany,
1.5. Ethnomedicine, ethnoecology, ethnic communities of India.

Unit-II: Classification of Plant Drugs **(07 h)**

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

Unit-III: Collection and processing of crude drugs: **(12 h)**

3.1. Collection
  a) Root
  b) Stem and bark
  c) Leaf
  d) Flower
  e) Fruits and Seeds
  f) Gums and resins
3.2. Processing
  a) Harvesting
  b) Drying
  c) Garbling/Dressing,
  d) Packing e. Storage
3.3. Drug aduleration and types of adulterants

Unit-IV: Preparation of following Ayurvedic medicines with respect to Botanical source, part used and method of preparation: **(05 h)**

4.1. Triphala churn
4.2. Kumari asav
4.3. Arjunarishtha (Aristha)

Unit-V: Botanical source, distribution, botanical characterization of drug constituents and uses of the following drugs **(06 h)**

5.1. Root drug: *Asparagus racemosus* (Shatavari)
5.2. Stem bark drug: *Teminalia arjuna* (Arjun sadada)
5.3. Leaf drug: *Adathoda zeylanica* (Adulsa)
5.4. Fruit drug: *Aegle marmelos* (Bel)
5.5. Entire plant: *Ocimum sanctum* (Tulasi)

Unit-VI: Drug Ethics: **(05 h)**

6.1. Biopiracy of medicinal plants from India
6.2. Drug legislation and patenting

References:

- Jeffery, B. and Harborn. (1998), Photochemical Methods: A guide to Modern Techniques of Plant analysis. Springer Netherlands. eBook ISBN 978-94-009-5921-7.
- Khandelwal, K.R. (2008), Practical Pharmacognocy, Pragati Books Pvt. Ltd. 50. ISBN13: 9788185790305
- Kokate, C.K. Purohit A.P. and Gokhale S.B. (2021), Pharmacognocy (degree), Nirali Prakashan. ISBN 9788196396152
- Iyengar MA. (1995), Study of crude drugs, 8th ed., Manipal power press. Manipal, India.
- Iyengar, M.A. (2017), Pharmacognocy Lab. Pharma Med Press; 1st edition. ISBN-10 : 9386819449
- Rangari, V.D. (2017), A Textbook of Pharmacognocy and Photochemistry. Vol-I and II
- CSIR- Central Institute of Medicinal and Aromatic Plants, Lucknow (2016), Aush Gyanya: Handbook of Medicinal and Aromatic Plant Cultivation.
- Evans, W.C. (2009), Trease and Evans Pharmacognosy, 16th edn. Philadelphia, PA: Elsevier Saunders Ltd.
- Sharma, R. (2013), Agro Techniques of Medicinal Plants. Daya Publishing House, Delhi.

Methods of Teaching:

- Discussion, analysis and feedback, discussion and problem solving, classroom teaching, lecture method, demonstration methods, lecture cum demonstration methods, laboratory method, project method, problem solving method, question answer method, brain storming method, assignment method,
- Innovative teaching: audio video hands on learning, science museum, project-based learning, ICT enabled teaching, video clips/ movies, science fairs, science kit, mobile apps like zoom google platform, field trips.

T.Y. B.Sc. (Botany): Semester V
Skill Enhancement Course (SEC)
BOT-360: Food Processing and Preservation

Total hours: 30 **Credits: 02**

Course objectives:

- To understand the concept of functional food, food microbiology and nutraceutical
- Study of post-harvest handling methods of foods and food processing
- To study post-harvest processing and transport of food
- To understand various food lows and food biotechnology

Course outcomes:

Students will be able to:

- Understand food microbiology, nutraceuticals and functional food concepts.
- Take a knowledge of post-harvest handling methods of food and its processing
- Study post-harvest food processing and its transport
- Elaborate their knowledge on food lows and food biotechnology

Unit-I: Food Science and food Microbiology and Post-harvest Technology (15 h)

1.1. Introduction to Food Science food ingredients functional food and nutraceuticals
1.2. Classification and characteristics of functional food. Food toxins, natural, microbial and chemical toxins in food processing
1.3. Food microbiology: intrinsic and extrinsic factors influencing growth of microbes in food. microbe as a source of food mushrooms, SCP single cell protein, microbial spoilage in cereals vegetables pickles dairy products, Jam, jellies, Bakery products, wine etc.
1.4. Importance and overview of post-harvest handling principles and methods of Preservation and processing methods of minimising losses during storage and transportation: Harvesting and handling of fruits, Cut flowers, vegetables, Herbs, storage tissues, organs.
1.5. Post-harvest processing: Food processing Canning, fruit juice, beverages, pickles, jam, jellies, candies, food additives labelling, food safety, importance and advantages of appropriate Technology.

Unit-II: Post-harvest preservation, Processing and Food law, Biotechnology (15 h)

2.1.Protection of post-harvest product concept of maturity, maturity indices, pre-harvest quality modifiers, trimming cleaning and drying
2.2.Prevention techniques for post-harvest loss. storage techniques biorational approaches value addition standardization improvement of quality
2.3.Concept of Residue tree vegetables and fruit processing
2.4.Post-harvest processing and transport. Treatment prior to shipment chemicals biocontrol agents' methods of storage ventilator cold storage unit grading packing and cool chain
2.5.Food laws, Quality Control and Standards act 2006 FSSAI guidelines and FSSAI act amendment.
2.6.Food biotechnology: biotechnology in food industry production of bio colours flavours and bio preservatives genetically modified food

References:

- Potter N. N. (2007), Food Science, CBS publisher
- Varzakay T. Tzia C. (2016), Handbook of Food Processing, CRC Press
- Smith J. S. Hui Y. H (2014), Food Processing, Wiley's publisher
- Kumari S (2012), Basics of Food Biochemistry and Microbiology. Koros Press Ltd. ISBN 10: 1781631778
- Ramaswamy H. (2015), Post-harvest Technologies of Fruits and Vegetables DES tech Publication
- Mathur G. K. Rathore N. S. and Chasta S. S. (2012), Post-harvest Management and Processing of Fruits and Vegetables. The energy and resource Institute, New Delhi. ISBN: 9788171641154, 8171641156
- Wills R. Goldings J. (2016), Post-harvest an Introduction to The Physiology and Handling of Fruits and Vegetables, UNSW press.

Methods of Teaching:

- Discussion, analysis and feedback, discussion and problem solving, classroom teaching, lecture method, demonstration methods, lecture cum demonstration methods, laboratory method, project method, problem solving method, question answer method, brain storming method, assignment method,
- Innovative teaching: audio video hands on learning, science museum, project-based learning, ICT enabled teaching, video clips/ movies, science fairs, science kit, mobile apps like zoom google platform, field trips.

T.Y. B.Sc. (Botany): Semester V
Discipline Specific Core (DSC) Course
BOT-367: Practical course Based on Theory Paper BOT-361 and BOT-362

Total Hours: 60 **Credits: 02**

Course objectives:

- To prepare fixative and stains for cytology
- To study Mitosis and Meiosis
- To study floral biology and hybridization technique of self- and cross-pollinated plant species
- To study solid and liquid growth media
- To study various types of sterilization and micropropagation techniques

Course outcomes:

Students will be able to:

- Known and familiar with chromosomal aberrations, gene mutation and population genetics.
- Understands various concepts of plant breeding
- Develop understanding on Male sterility, heterosis, polyploidy and seed certification
- Develop their competency on different types of plant tissue culture
- Examine gene cloning and evaluate different methods of gene transfer
- Analyze the major concerns and application of transgenic technology

Sr. No.	Topic Particular	Hours
1 & 2	Preparation of fixative preservative and stain used in cytology	08
3	Mitosis: squash technique. [any suitable material- root tips]	04
4 & 5	Meiosis: Smear technique [Flower buds]	08
6	4. Floral biology in Self Pollinated and Cross-Pollinated Species. 5. Factors promoting self-pollination (By demonstration Flower/Photograph),	04
7	Techniques of Hybridization in Self Pollinated and Cross-Pollinated Crops.	04
8	Estimation of heterosis i. Standard heterosis ii. Mid- Parent heterosis iii. Useful or Economic heterosis	04
9 & 10	a) Preparation of liquid and solid MS medium. b) Demonstration of in vitro sterilization of seeds and germination in MS media containing petri plates. c) In vitro selection and inoculation methods using leaf and nodal explants of tobacco, Datura, Brassica etc.	08
11	Callus formation in tobacco and rice using MS medium containing phytohormones.	04
12	Study of anther, embryo and endosperm culture, micropropagation, somatic embryogenesis & artificial seeds through photographs.	04
13	Isolation of protoplasts and protoplast culture using photographs	04
14	Construction of restriction map of circular and linear DNA from the data	04

provided.

15	Study of methods of gene transfer through photographs: Agrobacterium-mediated, direct gene transfer by electroporation, microinjection, microprojectile bombardment.	04

References:

- Chaudhari, H.K. (1984), Elementary Principles of Plant Breeding. Oxford – IBH. 2ndedition.
- Das, L.D. Vijendra (2006), Plant Breeding. New Age International Publishers, New Delhi.
- Sharma, J.R. (1994), Principles and practices of Plant Breeding. Tata McGraw-Hill Publishing Company Ltd. , New Delhi
- Gardner, E.J., Simmons, M.J., Snustad, D.P. (1991), Principles of Genetics. 8th edition. John Wiley & sons, India.
- Griffiths, A.J.F., Wessler, S.R., Carroll, S.B., Doebley, J. (2010), Introduction to Genetic Analysis. 10th edition. W. H. Freeman and Co., U.S.A.
- Gupta, P.K. (2018), Genetics. 5th Edition, Rastogi Publications, Meerut.
- Hartl, D.L. and Jones, E.W. (1999), Essential Genetics, 2nd Edition, Jones and Barlett Publishers, Boston.
- Bhojwani, S.S. and Razdan, M.K., (1996), Plant Tissue Culture: Theory and Practice. Elsevier Science Amsterdam. The Netherlands.
- Slater, N.W. Scott and M.R. Fowler (2008), Plant Biotechnology. Second Edition. Oxford.
- Stewart, C.N. Jr. (2008), Plant Biotechnology & Genetics: Principles, Techniques and Applications. John Wiley & Sons Inc. U.S.A.
- N. Santosh and A. Madhavi. (2010), Practical Book of Biotechnology and Plant Tissue Culture. S. Chand & Co.

Methods of Teaching:

- Laboratory method, Lecture cum demonstration methods

T.Y. B.Sc. (Botany): Semester V
Discipline Specific Core (DSC) Course
BOT-368: Practical course Based on Theory Paper BOT-363 and BOT-364

Total Hours: 60 **Credits: 02**

Course objectives:

- To know the commercial importance and scope of plant science.
- To study the utilization of plant wealth (Drugs, Medicine, Spices, Beverages, essential oils)
- To Study of the role plants in forensic science.
- To Analyzed various nutrients from soils
- To study morphological adaptation and biotic interaction of plants
- To study the quantitative analysis of herbaceous vegetation
- To know the functional aspects of ecosystem and phytogeography and its divisions

Course outcomes:

Students will be able to:

- Develop critical understanding on the Medicinal, aromatic and drug yielding plants
- Understand the utilization of plant wealth as spices, Beverages, Oils, and Essential oils etc.
- Understand the role of plants in its products in forensic science
- Understand core concepts of biotic and abiotic factors
- Analysis the phytogeography or phytogeographical division of India
- Evaluate energy sources of ecological system
- Assess the adaptation of plants in relation to light, temperature, water, wind and fire.

Sr. No.	Topic Particular	Hours
1	Spices: Black pepper, Fennel, Curcuma and Clove (habit and sections),	04
2	Sources of oils and fats: Coconut- T.S. nut, Mustard–plant specimen, seeds; tests for fats in crushed seeds.	04
3	Essential oil-yielding plants: Habit sketch of *Rosa/ Santalum/ Cymbopogon* spp., Mint, Basil, *Eucalyptus* (specimens/photographs),	04
4	Drug-yielding plants: Specimens of Ashwagandha, *Phyllanthus*, Satavar. Gilloi, *Digitalis*, *Papaver* and *Cannabis*.	04
5	Woods: *Tectona, Pinus*: Specimen, Section of young stem.	04
6	Botanical name and uses of following plant material in forensic science. (a) *Argemone mexicana* (b) *Abrus precatorius* (c) *Jatropha curcas* (d) *Datura metal.*	04
7 & 8	Preparation of *Aloe vera* gel & Jaswand gel	08
9 & 10	Analysis for carbonates, chlorides, nitrates, sulphates, organic matter and base deficiency from two soil samples by rapid field tests.	08
11	Determination of organic matter of different soil samples by Walkley & Black rapid titration method.	04
12	Study of morphological adaptations of hydrophytes and xerophytes (four each),	04
13	Study of biotic interactions of the following: Stem parasite (*Cuscuta*), Root parasite (*Orobanche*) Epiphytes, Predation (Insectivorous plants),	04

14	Quantitative analysis of herbaceous vegetation for density and abundance and frequency and comparison with Raunkiaer's frequency distribution law in the college campus.	04
15	Field visit to familiarize students with ecology of different sites.	04

References:

- CSIR- Central Institute of Medicinal and Aromatic Plants, Lucknow (2016), Aush Gyanya : Handbook of Medicinal and Aromatic Plant Cultivation.
- Kochhar, S.L. (2016), Economic Botany: A Comprehensive Study. 5th Edition. Cambridge
- Sambamurty, AVSS and Subrahmanyam, N.S. (2008), A Textbook of Modern Economic Botany. 1st Edition, Paperback CBS Publishers & Distributors Pvt.Ltd
- Wickens, G.E. (2001), Economic Botany: Principles & Practices. Kluwer Academic Publishers, The Netherlands.
- Odum, E.P. (2005), Fundamentals of ecology 5th edition Cengage Learning India Pvt. Ltd., New Delhi.
- Singh, J.S., Singh, S.P., Gupta, S. (2006), Ecology Environment and Resource Conservation. Anamaya Publications, New Delhi, India.
- Wilkinson, D.M. (2007), Fundamental Processes in Ecology: An Earth Systems Approach. Oxford University Press. U.S.A.
- Kormondy, E.J. (1996), Concepts of ecology 4th edition PHI Learning Pvt. Ltd., Delhi, India.

Methods of Teaching:

- Laboratory method, Lecture cum demonstration methods

T.Y. B.Sc. (Botany): Semester V
Discipline Specific Core (DSC) Course
BOT-369: Practical course Based on Theory Paper BOT-365 and BOT-366

Total Hours: 60 **Credits: 02**

Course objectives:

- To analyze seed processing in various plants
- To examine seed testing methods
- To know seed production method in different plants
- To study morphology, botanical and chemical characterization and analytical methods of crude drugs.
- To prepare Ayurvedic recipes.
- To make student aware about biopiracy and legislation about medicinal Plants.

Course outcomes:

Students will be able to:

- Analyze the different ways of seed processing in different plants
- Examine the various methods of Seed testing
- Understand the method of seed production in different plants
- Understand Scope and importance of Medico Botany and Pharmacognosy.
- Analyze the different types of plant drug processing.
- Examine the chemical and analytical characterization of crud drugs.
- Understand biopiracy and legislation of medicinal plants.

Sr. No.	Topic Particular	Hours
1	Seed viability testing	04
2	Physical purity test	04
3	Seed moisture analysis	04
4	Seed priming for seed dormency	04
5 & 6	Seed germination studies; monocots, dicots	08
7	Detection of seed microflora.	04
8	Seed processing, grading, packing	04
9	Demonstration and cultural practices for seed / vegetative / clonally propagated medicinal plants (*Mentha arvensis*, Satavar, *Artemisia*, *Aloe vera*, *Stevia*, Ashwagandha),	04
10	Harvesting, drying, storage (Stevia, Kalmegh and Satavar)	04
11 & 12	Harvesting and distillation of Mints, Basil	08
13 & 14	Extraction of alkaloids / Withanaloids (*Belladona*, Ashwagandha)	08
15	Preparation of Triphala Churna	04

References:

- Agrawal, P. K., (2010), Principles of Seed Technology. Indian Council of Agricultural Research, New Delhi.
- Agrawal, R.L. (2015), Seed Technology. Oxford & Ibh Publishing Co Pvt Ltd.
- Basra, A. (2006), Handbook of Seed Science and Technology. CRC Press.
- Khare, D. and Bhale, M. S. (2014), Seed Technology 2nd Revision, Jain Book Agency.

- AYUSH (www.indianmedicine.nic.in), About the systems—An overview of Ayurveda,
- CSIR- Central Institute of Medicinal and Aromatic Plants, Lucknow (2016), Aush Gyanya: Handbook of Medicinal and Aromatic Plant Cultivation.
- Evans, W.C. (2009), Trease and Evans Pharmacognosy, 16th edn. Philadelphia, PA: Elsevier Saunders Ltd.
- Jain, S.K. and Jain, Vartika. (eds.) (2017), Methods and Approaches in Ethnobotany: Concepts, Practices and Prospects. Deep Publications, Delhi
- Kapoor, L. D. (2001), Handbook of Ayurvedic medicinal plants. Boca Raton, FL: CRC Press.
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Methods of Teaching:

- Laboratory method, Lecture cum demonstration methods

Skills acquired and Job prospects for the Botany students

Courses after B.Sc. botany might just be one of the most preferred careers in India and abroad. After dully completing their bachelor's education in Botany, a candidate can look forward to being a part of the industry by working as a technician, whereas, a candidate after completing his/her master's education can look forward to working with some industry giants or being a part of good research teams.

With increasing advancements in science and technology, the field of Botany has gained a tremendous impetus. A lot of students are showing their desire to explore the varied range of careers available in Botany.

Equally, there are prestigious companies in the globe offering lucrative job prospects and a plethora of options to students having a degree in Botany.

There are environmental organizations, Government companies, park rangers as well as top scientific-based research centers hiring Botanists on a good package.

The amount of diversity in the field of Botany gives it students to choose their specializations as per their choice, aptitude and interests.

There is a huge scope of being a part of this industry merely keeping in mind the amount of diversity it has to offer. One can be a part of any reputed organization as a plant explorer, conservationist, ecologist, environment consultant, horticulturist, plant biochemist, nursery manager, genetics, molecular biologist, taxonomist, plant pathologist, environmental consultant, and farming consultant.

Moreover, the application of plant sciences improves the yield and supply of medicines, foods, fibers, building materials and other plant products. The knowledge of plant sciences is essential for the development and management of forests, parks, wastelands, sea wealth, etc.