Anekant Education Society's

Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati

(Autonomous)

Four B. Sc. Degree Program in Botany

(Faculty of Science and Technology)

CBCS Syllabus

T. Y. B. Sc. (Botany) Semester -V

Program Outcomes (Pos) for B. Sc. Program

PO1	**Disciplinary Knowledge:** Demonstrate comprehensive knowledge of the disciplines that form a part of a graduate programme. Execute strong theoretical and practical understanding generated from the specific graduate programme in the area of work.
PO2	**Critical Thinking and Problem solving:** Exhibit the skills of analysis, inference, interpretation and problem-solving by observing the situation closely and design the solutions.
PO3	**Social competence:** Display the understanding, behavioural skills needed for successful social adaptation , work in groups, exhibit thoughts and ideas effectively in writing and orally
PO4	**Research-related skills and Scientific temper :** Develop the working knowledge and applications of instrumentation and laboratory techniques. Able to apply skills to design and conduct independent experiments, interpret, establish hypothesis and inquisitiveness towards research.
PO5	**Trans-disciplinary knowledge:** Integrate different disciplines to uplift the domains of cognitive abilities and transcend beyond discipline-specific approaches to address a common problem
PO6	**Personal and professional competence:** Performing dependently and also collaboratively as a part of a team to meet defined objectives and carry out work across interdisciplinary fields. Execute interpersonal relationships, self-motivation and adaptability skills and commit to professional ethics.
PO7	**Effective Citizenship and Ethics:** Demonstrate empathetic social concern and equity centred national development, and ability to act with an informed awareness of moral and ethical issues and commit to professional ethics and responsibility.
PO8	**Environment and Sustainability:** Understand the impact of the scientific solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.
PO9	**Self-directed and Life-long learning:** Acquire the ability to engage in independent and life-long learning in the broadest context of socio-technological changes.

Anekant Education of Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati
Autonomous

SYLLABUS (CBCS) FOR T. Y. B. Sc. BOTANY (w.e. from June, 2020)

Semester	Paper	Title of Paper	Credits
V	BOT3501	Cryptogamic Botany (Algae, Fungi, Bryophytes and Pteridophytes)	03
	BOT3502	Spermatophyta and Palaeobotany	03
	BOT3503	Cell and Molecular Biology	03
	BOT3504	Industrial Botany	03
	BOT3505	Biostatistics	03
	BOT3506	Research Methodology	03
	BOT3507	Practical based on BOT3501 and BOT3503	02
	BOT3508	Practical based on BOT3502	02
	BOT3509	Practical based on BOT3504 to BOT3506	02
VI	BOT3601	Plant Physiology and Biochemistry	03
	BOT3602	Plant Biotechnology	03
	BOT3603	Genetics and Plant Breeding	03
	BOT3604	Plant Pathology	03
	BOT3605	Pharmacognosy	03
	BOT3606	Botanical Techniques	03
	BOT3607	Practical based on BOT3601 to BOT3603	02
	BOT3608	Practical based on BOT3604 to BOT3606	02
	BOT3609	Project	02

Class : **T. Y. B. Sc. (Semester - V)**
Paper Code : **BOT 3501**
Paper : **I** Title of Paper : **Cryptogamic Botany**
(Algae, Fungi, Bryophytes and Pteridophytes)
Credit : **3** No. of lectures : 48

A) Learning Objectives:

1) To study the diversity in algae, fungi, bryophytes and pteridophytes.
2) To understand the taxonomy, morphology, anatomy, mode of nutrition and reproduction in cryptogams.
3) To know the agricultural, ecological, medicinal, horticultural and industrial significance of lower plants.

B) Course Outcome:

CO1. Students can be experts in identification of lower plants.
CO2. Students can be start their own business based on applications of cryptogams.
CO3. Identify, describe and study in detail life cycle of cryptogams.
CO4. Provide plant description; describe the morphology and reproductive structure of cryptogams.
CO5. Gain the proficiency in the identification of cryptogams.

CO6. Knowledge of comparison between cryptogams and other plant groups.
CO7. Students get basic idea and comparative study of cryptogams.

Credit - I (24 L)
Unit – 1
Algae

1. General characters, classification (Chapman and Chapman, 1973) up to classes and economic importance. (2L)
2. Study of distinguishing characters of following divisions and life cycle pattern of algae with reference to taxonomic position, occurrence, thallus structure and reproduction : (10L)
   a) Cyanophyta : *Oscillatora*
   b) Rhodophyta : *Batrachospermum*
   c) Chlorophyta *Volvox*
   d) Xanthophyta : *Voucheria*
   e) Phaeophyta : *Laminaria*

Fungi

3. General characters, classification up to classes (Ainsworth, 1973) and economic importance. (2L)
4. Study of distinguishing characters of following groups and life cycle pattern of fungi with reference to taxonomic position, occurrence, thallus structure and reproduction (10L)
   a) Myxomycota : *Stemonitis*
   b) Mastigomycotina : *Pythium*
   c) Zygomycotina : *Mucor*
   d) Ascomycotina : *Unicinula*
   e) Basidiomycotina : *Agaricus*
   f) Deuteromycotina : *Alternaria*

Credit - II (12 L)
Unit – 2
Bryophytes

1. General characters, classification up to classes (G.M. Smith, 1955) and economic importance. (3L)
2. Study of distinguishing characters of following classes and life cycle pattern of bryophytes wrt. taxonomic position, occurrence, thallus structure (morphology and anatomy), reproduction and sporophyte structure (9L)
   a) Hepaticopsida : *Marchantia* and *Porella*
   b) Anthocerotopsida : *Anthoceros* and *Notothylas*
   c) Bryopsida : *Bryum* and *Polytrichum*

Credit - III (12 L)
Unit – 3
Pteridophytes (12L)

1. General characters, classification up to classes (K.R.Sporne, 1975) and economic importance (04L)
2. Study of distinguishing characters of following classes and life cycle pattern of pteridophytes wrt. taxonomic position, occurrence, morphology, anatomy, reproduction, gametophyte and sporophyte structure. (8L)
   a) Psiloptopsida : *Psilotum*

b) Lycopsida : *Selaginella*
c) Sphenopsida : *Equisetum*
d) Pteropsida : *Salvinia*

Reference Books :

Algae:

1 Brodie J. and Lewis J. (2007). (Ed.) Unravelling the algae: the past, present and future of algal systematics. CRC press, New York, pp 335.
2 Bellinger E.G. and Sigee D.C. (2010). Freshwater algae: Identification and use as bioindicators, Willey-Blackwell, UK, pp. 271.
3 Cole K.M. and Sheath R.G. (1990). Biology of the red algae. Cambridge University Press.USA. pp. 503.
4 Desikachary T.V. (1959). Cyanophyta. ICAR, New Delhi.
5 Graham L.E. and Wilcox L.W. (2000). Algae.Penticce-Hall,Inc, pp. 640
6 Krishnamurthy V. (2000). Algae of India and neighboring countries I.Chlorophycota, Oxford & IBH, New Delhi.
7 Lee R.E. (2008). Phycology. Cambridge University Press, pp.547.
8 Misra J.N. (1996). Phaeophyceae in India. ICAR, New Delhi.
9 Prescott G.W. (1969). The algae.
10 Smith G.M. (1950). The fresh water algae of the United States, Mc-graw Hill NewYork. 11. Srinivasan K.S. (1969). Phycologia India.Vol.I & II, BSI, Calcutta.
11 Das Dutta and Gangulee.College Botany Vol I, Central Book Depot.
12 Vashista B.R, Sinha A.K and Singh V.P. (2005). Botany for degree students – Algae, S. Chand's Publication.
13 Sharma O.P. Algae

Fungi :

1 Ainsworth, Sussman and Sparrow (1973). The fungi. Vol IV A & IV B. Academic Press. 2. Alexopolous C.J., Minms C.W. and Blackwell M. (1999). (4th edn) Introductory Mycology. Willey, New York, Alford
2 R.A.Deacon J.W. (2006). Fungal Biology (4thEd.) Blackwell Publishing, ISBN. 1405130660.
3 Kendrick B. (1994). The fifth kingdom (paperback), North America, New York Publisher: 3rd edn, ISBN- 10: 1585100226.
4 Kirk et al. (2001). Dictionary of fungi, 9th edn, Wallingford: CABI, ISBN: 085199377X. 6. Mehrotra R.S. and Aneja K.R. (1990). An introduction to mycology. New Age Publishers, ISBN 8122400892.
5 Miguel U., Richard H., and Samuel A. (2000). Illustrated dictionary of the Mycology.Elvira Aguirre Acosta, Publisher: St. Paul, Minn: APS press, ISBN 0890542570. 8. Webster J. and Rpland W. (2007). Introduction to fungi (3rd Edn) Cambridge UniversityPress,978-0-521-80739-5.

Bryophytes:

1 Cavers F. (1976). The interrelationships of the Bryophytes. S.R. Technic, Ashok Rajpath, Patana.
2 Chopra R.N. and Kumar P.K. (1988).Biology of Bryophytes. John Wiley & Sons, New York, NY.
3 Kashyap S.R. (1929). Liverworts of the Western Himalayas and the Punjab Plain.Part 1, ChronicaBotanica, New Delhi.
4 Kashyap S.R. (1932). Liverworts of the Western Himalayas and the Punjab Plain (illustrated): Part 2. ChronicaBotanica, New Delhi.

5 Parihar N.S. (1980). Bryophytes: An Introduction to Embryophyta. Vol I. CentralBook Depot, Allahabad.
6 PremPuri(1981). Bryophytes: Morphology, Growth and Differentiation. Atma Ram and Sons, New Delhi.
7 Udar R. (1975). Bryology in India.ChronicaBotanica, New Delhi.
8 Udar R. (1970). Introduction to Bryophytes.ShashidharMalaviyaPrakashan. Lucknow.
9 Watson E.V. (1971). Structure and Life of Bryophytes.3rd Edn. Hutchinson University Library, London.
10 Vashista B.R., Sinha A.K., Kumar A. (2008). Botany for degree students – Bryophyta, S.Chands Publication.

Pteridophytes :

1. Rashid A (1999) An introduction to Pteridophyta. Vikas Publishing house Pvt.Ltd. New Delhi.
2. Sharma OP (1990) textbook of Pteridophyta. Mac Millan India Ltd. Delhi.
3. Smith GM (1955) Cryptogamic Botany Vol. II Mc Grew Hill.
4. Sporne KR (1986) The morphology of Pteridophytes. Hutchinson University Press. London.
5. SundaraRajan S. (1999) Introduction to Pteridophyta. New Age International Publishers,
   New Delhi.
6. Surange KR (1966) Indian fossil Pteridophytes. Council of Scientific and Industrial
   research.
7. Parihar NS (1976) Biology and morphology of the Pteridophytes. Central Book Depot.
8. Trivedi, A. N. (2002) - Advances in Pteridology
9. Bierhorst, D.W.(1971) - Morphology of Vascular plants
10. Eames, A. J. and E. M. Giffard (1950) - Comparative morphology of vascular plants
11. Rashid, A. (1978) - An introduction of Peridophytes
12. Sporne, K.R. (1966) - Morphology of Ptseridophytes
13. Bower, F. O. (1963) - The Ferns
14. Jermy, A. G. (1973) - The Phylogeny and Classification of ferns.
15. Vashishta, B.R. (1996) - Botany for degree students – Pteridophytes
16. Parihar, N.S. (1959) - An Introduction to Pteridophyta

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Choice Based Credit System Syllabus (2019 Pattern)

Mapping of Program Outcomes with Course Outcomes

Class: T.Y. B. Sc. (Sem. V) **Subject**: Botany

Course: Cryptogamic Botany **Course Code**: BOT 3501

Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

	Programme Outcomes (POs)								
Course Outcomes	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9

CO 1				3					
CO 2		2				3			
CO 3	3								
CO 4	3								
CO 5						3			
CO 6	3	3							
CO 7	3								

Justification for the mapping

PO1: Disciplinary Knowledge

CO3. Identify, describe and study in detail life cycle of cryptogams.

CO4. Provide plant description, describe the morphology and reproductive structure of cryptogams.

CO6. Knowledge of comparison between cryptogams and other plant groups.

CO7.Students gets basic idea and comparative study of cryptogams.

PO2: Critical Thinking and Problem Solving

CO2. Identify, describe and study in detail life cycle of Phanerogams.

CO6. Knowledge of comparison between cryptogams and other plant groups.

PO 4: Research-related skills and Scientific temper

CO1. Students can be experts in identification of lower plants.

PO6: Personal and Professional Competence

CO2.Students can be start their own business based on applications of cryptogams.

CO5. Gain the proficiency in the identification of cryptogams.

Class : T. Y. B. Sc. (Semester - V)
Paper Code : **BOT3502**
Paper : **II** Title of Paper : **Spermatophyta and Palaeobotany**
Credit : 3 No. of lectures: 48

A) Learning Objectives:

1. To know and understand the concepts of gymnosperms, angiosperm and palaeobotany.
2. To study the details in families taxonomy and classification systems.
3. To study plant identification keys.

B) Course Outcomes:

CO1. Understanding the concepts of gymnosperms, angiosperm and palaeobotany.
CO2. Knowledge of different families and classification systems.
CO3. Understanding the tools of taxonomy and fossil types.
CO4. Learn the basic concepts, principles and techniques in plant biotechnology.
CO5. Knowledge acquired students will be able to apply techniques in other branches such as biological, medical, agricultural etc.
CO6. Use of bio techniques to explore plant to its molecular level.
CO7. Understand the local flora with respect to Phanerogams.

Credit-I (16 L)
Unit-I
GYMNOSPERMS

1. Introduction, general characters, and outline, classification according to Chamberlain (1934) Raizda and Sahani (1960) and economic importance (4L).
2. Study of life cycle of *Pinus* and *Gnetum* with reference to distribution, morphology, anatomy, reproduction, gametophyte, sporophyte, seed structure and alternation of generation. (Developmental stages of sex organs are not expected) (12 L).

Credit-II (22 L)
Unit-II
ANGIOSPERMS

1. **Origin of angiosperms :** Origin with reference to time, place and ancestry-Pteridosperms theory, Bennettitalean theory and Gnetalean theory (4L**).**
2. **Classification of angiosperms :** Review of artificial, natural andphylogenetic systems (general account), Hutchinson systems with reference to outline and assumptions, merits and limitations, Advanced Phylogenetic Group system-III (APG-III) (4 L).
3. **Study of following families according to Bentham and Hooker's System:** With reference to systematic position, distinguishing characters, economic importance, general floral formula, floral diagram of following families: Magnoliaceae,Capparidaceae, Rhamnaceae, Rutaceae, Fabaceae , Asteraceae, Acanthaceae, Lamiaceae, Nyctaginaceae, Orchidaceae, Cannaceae and Poaceae (12 L).
4. **Plant identification and QR (Quick Response) :** Latin diagnosis and recent trends, use of flora, Preparation of artificial keys, practicing Indented and bracketed keys, Plant authentication QR Code (2 L)

Credit-III (10 L)
Unit-III
PALAEOBOTANY

1. Geological time scale, Contribution of Indian Paleobotanist (02L)
2. Fossil- Definition, process of fossil formation, types of fossils - Impression,Compression, Petrifaction, Coal ball. (02L)
3. Study of following fossil groups (06 L)
   a) Psilopsida - Salient features of order Psilophytales, external and internal morphology of *Rhynia*.
   b) Lycopsida - Salient features of order Lepidodendrales, external and internal morphology of *Lepidodendron.*
   c) Sphenopsida - Salient features of Calamitales, external and internal morphology of *Calamites.*
   d) Pentoxylae - Salient feature, external and internal morphology of stem [*Pentoxylon*], Leaf [*Nipaniophyllum*].

References:

1. Sporne K.R. 1991. The Morphology of Pteridophytes. B.I Publishing Pvt. Ltd.Bombay.
2. Stewart W.N. and Rathwell G.W. 1993. Paleobotany and the Evolution of plants.Cambridge University Press.
3. Bhatnagar S.P and MoitraAlok 1996. Gymnosperms. New Age International Pvt. Ltd. Publishers, New Delhi, 470 pp.
4. Biswas C and Johari B.M 2004. The Gymnosperms Narosa Publishing House, New Delhi.
5. Sporne K.R 1965. The Morphology of Gymnosperms London, pp. 216.
6. Bierhorst D.W. 1971. Morphology of Vascular Plants. New York and London.
7. Chamberlain C.J 1934. Gymnosperms-Structure and Evolution, Chicago.
8. Coulter J.M. and Chamberlain C.J. 1917. Morphology of Gymnosperms, Chicago.
9. Foster A.S and Gifford E.M 1959. Comparative Morphology of Vascular Plants.
10. Maheshwari P. and Vasil, Vimla 1961. Gnetum, Delhi.
11. Vashishta P.C., A.R. Sinha, Anil Kumar. 2006. Gymnosperms. S.Chand.
12. Vashishta P.C. 2006. Pteridophytes. S. Chand.
13. Parihar N.S. 1996. Biology and Morphology of Pteridophytes. Central Book Depot, Allahabad.
14. Arnold C.R.-An Introduction to Palaeobotany
15. E.H.N.Andrews-Studies in Palaeobotany (Botany for Degree Students Vol.-V)
16. Shukla A.C. and Mishra S.P.- Essentials of Palaeobotany.
17. Stewart W.N. and Rathwell G.W. 1993. Paleobotany and the Evolution of plants. Cambridge University Press.
18. Davis P. H. and V. H. Heywood 1963. Principles of Angiosperm Taxonomy. Oliver and Boyd London.
19. Heywood V.H 1967. Plant Taxonomy, London.
20. Lawrence, G.H.M 1951. Taxonomy of Vascular Plants.
21. Lawrence G. H. M 1955. An Introduction to Plant Taxonomy
22. Rendle A.B. 1925. The Classification of flowering plants. 2 Vols. London.
23. Santapau H. 1953. The Flora of Khandala on the Western Ghats of India.
24. Singh V. & D.K Jain, 1981 Taxonomy of Angiosperms. Rastogi Pub. Meerut.

25. Swingle D.B. 1946. A Text book of Systematic Botany. McGraw Hill Book Co. New York.
26. Takhtajan A. 1969. Flowering Plants; Origin and Disposal.
27. Pande B.P 1997. Taxonomy of Angiosperms. S.Chand Publication
28. Gurucharan Singh 2005- Plant systematics
29. Naik V.N. - Taxonomy of Angiosperms.
30. Yadav S.R. and Sardesai M.R.- Flora of Kolhapur District.
31. Bhagat R.B., Shimpale V.B. and Deshmukh R.B. Flora of Baramati
32. Shivrajan V.V. -Introduction to Principles plant taxonomy
33. Sharma O.P. Plant Taxonomy Tata McGraw-Hill Education
34. Botanical Journal of the Linnean Society, 2009, 161, 105–121.
35. http://www.mobot.org/MOBOT/research/APweb

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Choice Based Credit System Syllabus (2019 Pattern)

Mapping of Program Outcomes with Course Outcomes

Class: T.Y.B. Sc. (Sem. V) **Subject**: Botany

Course: Spermatophyta and Palaeobotany **Course Code**: BOT 3502

Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

	Programme Outcomes (POs)								
Course Outcomes	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9
CO 1	3								
CO 2	3								
CO 3				2					
CO 4				3	3				
CO 5									
CO 6	3							3	
CO 7	3		3						3

Justification for the mapping

PO1: Disciplinary Knowledge

CO1. Understanding the concepts of gymnosperms, angiosperm and palaeobotany.
CO2. Knowledge of different families and classification systems.
CO6. Use of bio techniques to explore plant to its molecular level.
CO7. Understand the local flora with respect to Phanerogams.

PO 3: Social competence

CO7. Understand the local flora with respect to Phanerogams.

PO 4: Research-related skills and Scientific temper

CO3. Understanding the tools of taxonomy and fossil types.

CO4. Learn the basic concepts, principles and techniques in plant biotechnology.

PO5: Trans-disciplinary Knowledge

CO5. Knowledge acquired students will be able to apply techniques in other branches such as biological, medical, agricultural etc.

PO 8: Environment and Sustainability

CO6. Use of bio techniques to explore plant to its molecular level.

PO 9: Self-directed and Life-long Learning

CO7. Understand the local flora with respect to Phanerogams.

Class : **T. Y. B. Sc. (Semester - V)**
Paper Code : **BOT 3503**
Paper : **III** Title of Paper : **Cell and Molecular Biology**
Credit : 3 No. of lectures: 48

A) Learning Objectives:

1. To study structure of cell organelles and their functions.
2. To pertain knowledge of different cytological techniques.
3. To give knowledge about nucleic acid structure, role and synthesis of protein.

B) Learning Outcome:

CO1. The main outcome of this course is to acquaint students with some cytological techniques.
CO2. Experts required in future for genetic library of plants.
CO3. Acquaint the students with synthesis of nucleic acids and PCR technique.
CO4. Expert with some cytological techniques.
CO5. Understand current findings in cell biology.
CO6. Demonstrate and explain different phases of cell cycle.
CO7. Get knowledge of different types of cell communication.

Credit - I (20 L)
Unit - I

1. **Cell Biology: An Introduction (2L)**
   1 Definition and brief history
   2. Units of measurement of cell
   3. Prokaryotic and Eukaryotic Cell
   4. Physical nature of cytoplasmic matrix
   5. Chemical organisation- organic and inorganic compounds of cytoplasmic Matrix.

2. **Plant Cell - Cytoplasmic Constituents (14L)**
   Morphology, Ultrastructure, Chemical composition, Functions of Cell wall, Plasma membrane, Endoplasmic Reticulum, Golgi apparatus, Lysosomes, Microbodies, Mitochondria, Plastids, Vacuoles, Ribosomes

3. **Plant Cell - Nucleus and Chromosomes (4L)**
   Nucleus- Morphology, Ultrastructure, Nucleoplasm, Nucleolus, Functions
   Chromosome- Number, Morphology, Structure, Karyotype and ideogram, Chemical composition, Euchromatin and Heterochromatin, Giant Chromosomes

Credit - II (12 L)
Unit - II

1. **Molecular Biology – Introduction (2L)**
   Definition, History, Scope and Importance, Central Dogma of Molecular Biology
2. **Nature of Genetic Material (4L)**
   Characteristics of genetic material, Physical and Biological evidences to prove DNA as genetic material, Watson and Cricks Model of DNA, Forms

of DNA - A, B and Z, C -Value Parodox, RNA as genetic material -TMV

3. **DNA Replication (3L)**
   Introduction and types, Messelson and Stahl's Experiment

4. **DNA Damage and Repair (3L)**
   Introduction, Causes and types, DNA repair system - Photoreactivation, Dark excision repair

Credit - III (16 L)
Unit – III

1. **Gene Organization (2L)**
   Promoter-structure and function in prokaryotes and eukaryotes, Terminators, Units of Gene, Enhancers, Split genes, jumping genes
2. **Transcription (4L)**
   Structure and role of m-RNA, r-RNA, t-RNA, Transcription apparatus, Mechanism of Transcription in Prokaryotes
3. **Genetic Code and Translation (6L)**
   Genetic Code - Definition, Concept, Work of Nirenburg and Khorana, Properties of Genetic code
   Translation - Definition, Mechanism of translation - Initiation, Elongation and Termination
4. **Gene Action and Regulation (4L)**
   Relation of Gene and Enzymes - One gene one enzyme hypothesis, regulation of metabolism, Inducible and Repressible enzymes, Gene regulation - in prokaryotes (Lac Operon Model) and eukaryotes (Britten and Davidson's Model)

References :

1. Cell and Molecular Biology , S. C. Rastogi
2. Cytology, T. S. Verma and V. K. Agarwal
3. Cell Biology, C. B. Pawar
4. Cell and Molecular Biology, P. K. Gupta
5. Fundamentals of Molecular Biology, Veer Bala Rastogi
6. Fundamentals of Molecular Biology, G. K. Pal and Ghaskadabi
7. Cell Biology, Molecular Biology, Genetic, Evolution and Ecology, Verma and Agarwal
8. Cell and Molecular Biology, Robertis and DeRobertis
9. Molecular Cell Biology, 4th Edition, Lodish S. Baltimore
10. Molecular Biology of Gene, Watson J. D.
11. Biochemistry and Molecular Biology of Plants, Buchanan B. B.
12. Molecular and Cell Biology, Wolfe S.L.
13. Fundamentals of Molecular Biology, J.K.Pal and S.S.Ghaskadabi

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Choice Based Credit System Syllabus (2019 Pattern)
Mapping of Program Outcomes with Course Outcomes

Class: T.Y.B. Sc. (Sem. V) **Subject**: Botany

Course: Cell and Molecular Biology **Course Code**: BOT 3503

Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

	Programme Outcomes (POs)								
Course Outcomes	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9
CO 1				2					
CO 2			3						
CO 3				3					
CO 4						3			
CO 5	3								
CO 6	3								
CO 7	3								

Justification for the mapping

PO1: Disciplinary Knowledge

CO5. Understand current findings in cell biology.
CO6. Demonstrate and explain different phases of cell cycle.
CO7. Get knowledge of different types of cell communication.

PO 3: Social competence

CO2. Experts required in future for genetic library of plants.

PO 4: Research-related skills and Scientific temper

CO1. The main outcome of this course is to acquaint students with some cytological techniques.
CO3. Acquaint the students with synthesis of nucleic acids and PCR technique.

PO6: Personal and Professional Competence

CO4. Expert with some cytological techniques.

Class : **T. Y. B. Sc (Semester –V)**
Paper Code : **BOT 3504**
Paper: **IV** Title of paper: **Industrial Botany**
Credit : 3 No. of Lectures: 48

A) Learning Objectives

1. Use of recent techniques.
2. Sustainable uses of techniques.
3. Industrial applications of techniques

B) Course Outcome:

CO1. Preparation of different garden at personal level and to encourage people
CO2. Hands on techniques of packaging, harvesting and hydroponics.
CO3. Students can start their own business in cold storage, packing of flowers and fruits.
CO4. Develop plant tissue culture industry.
CO5. Get expertise to develop agro based industries.
CO6. Get expertise in field of Industrial Botany.
CO7. Understand basics of plant resource based industries

Credit - I (16 L)
Unit - I
Hydroponics

1. History and origin of soil less Culture, its advantages and disadvantages, Nutrient Film Technique (NFT) 1L
2. Techniques :static solution culture, Continous :flow solution culture 2L
3. Aeroponics, Passive sub-irrigation, Ebb and flow or flood and drain irrigation, Run to waste, Deep water culture, Bubbleponics. 5L
4. Media used for Hydroponics: Ex-clay, Rock wool, Coir, Perlite, Pumice, Vermiculite, Sand, Gravel, Brick shards, Polystyrene packing peanuts, wood fibre. 5L
5. Nutrient Solutions – Major and Minor nutrients, role of nutrients. Commercial Aspects, Advancements 3L

Credit – II (16L)
Unit – II
Gardening

1. Definition, Principles, objectives and scope of garden designing 2L
2. Different types of gardening – roof / terrace / vertical/ guerrilla/ rock garden/ water gardens and sunken garden/ bottle / circular garden 7L
3. Indoor gardening: Bonsai, Terrarium, dish, Kokedama, Hugelkultur 5L
4. Aesthetic value of Gardens, Famous gardens of India. 2L

Credit - III (16 L)
Unit- III
Post-Harvest Technology

1. Introduction to post harvest technology of agricultural produce; Status of Production, Losses, Need, Scope and Importance 3L
2. Introduction to various post harvest operations such as Primary Processing Operation Vs. Secondary Operation, Operations like Harvesting, Handling

cleaning, grading, sorting, drying, storage, milling, size reduction, expelling, extraction, blending, heat treatment, separation, material handling (transportation, conveying, elevating),washing; their functions and use in the post harvest processing. 8L

3. Post harvest treatment to increase shelf life i.e. freezing, chilling, dehydration, canning, thermal processing 3L
4. Introduction to Packaging of fruits and vegetables and types of packaging. Concept of modified atmosphere packaging. 2L

References :

1. Post-harvest handling of tropical fruit, B R Champ, E Highley& G I Johnson (eds), Australian Centre for International Agricultural Research
2. Post-harvest technology of fruits and vegetables: Handling, processing, fermentation and waste management, L R Verma and V K Joshi, Indus Publishing Company.
3. Postharvest biology and technology of tropical and subtropical fruits: Volume 1: Fundamental issues, Edited by E Yahia, Universidad Autónoma de Querétaro, Mexico, Woodhead Publishing Series in Food Science, Technology and Nutrition No. 206
4. Processing of Fruits and Vegetables for Value Addition, Vijay Sethi, B.C. Dekka, Vijay Sethi, ShrutiSethai, ShrutiSethi, Indus Publishing.
5. Post Harvest Technology of fruits & Vegetables, Thompson, CBS Publishers and Distributors
6. Handbook of Fruits and Fruit Processing, Y.H. Hui, John Wiley & Sons.
7. Advances in Fruit Processing Technologies, Sueli Rodrigues, Fabiano Andre NarcisoFernandes, CRC Press.
8. Quality Control in Fruit and Vegetable Processing, Issue 39, Food & Agriculture Org.
9. Small Scale Food Processing: A Guide to Appropriate Equipment, Peter Fellows, Ann Hampton, Intermediate Technology Publications.
10. Hand book of horticulture, ICAR, New Delhi
11. Floriculture in India, Randhawa and Mukhopaddhay
12. Gardening in India, Bose and Mukherjee, Oxford
13. Introductory ornamental horticulture, Arora, Kalyani publishers
14. Forest Management in India, Vasant Desai, Himalaya Publications
15. Forest and Forestry, K P. Sagreiya, National Book Trust
16. Gardening in India , Bose T.K. & Mukherjee, D., 1972, , Oxford & IBH Publishing Co., New Delhi.

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Choice Based Credit System Syllabus (2019 Pattern)

Mapping of Program Outcomes with Course Outcomes

Class: T.Y.B. Sc. (Sem. V) **Subject**: Botany

Course: Industrial Botany **Course Code**: BOT 3504

Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

	Programme Outcomes (POs)								
Course Outcomes	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9
CO 1			3						
CO 2						3			
CO 3						3			
CO 4	3								3
CO 5	3								3
CO 6	3								3
CO 7	3								

Justification for the mapping

PO1: Disciplinary Knowledge

CO4. Develop plant tissue culture industry.
CO5. Get expertise to develop agro based industries.
CO6. Get expertise in field of Industrial Botany.
CO7. Understand basics of plant resource based industries.

PO 3: Social competence

CO1. Preparation of different garden at personal level and to encourage people.

PO6: Personal and Professional Competence

CO2. Hands on techniques of packaging, harvesting and hydroponics.
CO3. Students can start their own business in cold storage, packing of flowers and fruits.

PO 9: Self-directed and Life-long Learning

CO4. Develop plant tissue culture industry.
CO5. Get expertise to develop agro based industries.
CO6. Get expertise in field of Industrial Botany.

Class	:	**T. Y. B. Sc. (Semester- V)**		
Paper Code	:	**BOT 3505**		
Paper	:	V	Title of Paper:	**Biostatistics**
Credit	:	**3**	No. of lectures:	48

A) Learning Objectives:

1) To study the computer Techniques.
2) To study the various statistical techniques.
3) To understand basic concepts of computer and statistics useful for botany.

B) Course Outcome:

CO1. Students will be expert in use of computer to solve biological problems.
CO2. Students can be master in solving biological problems with the help of statistics.
CO3. Students will apply their knowledge in various branches of biology.
CO4. Students will be expert in use of computer to solve biological problems.
CO5. Students can be master in solving biological problems with the help of statistics.
CO6. Students will apply their knowledge in various branches of biology.
CO7. Students' expertise in microscopic techniques.

Credit - I (16L)

Unit - 1

1. Introduction to Biostatistics **3L**

a) Definition
b) Statistical terms: Population, sample, primary and secondary data, qualitative and quantitative data, parameter and statistics, attributes, variables, discrete and continuous variables, statistical error, linear and non-linear functions of statistics, frequency, and its distribution
c) Scope, applications, Limitations and uses of biostatistics

2. Sample and sampling **4L**

a) Definition
b) Sampling unit, sample and population
c) Types of sampling
    i. Random sampling – with replicates, without replicates, systematics sampling, stratified sampling.
    ii. Non-random sampling- Purpose, quota sampling
d) Need of randomness
e) Achieving randomness
    i. Lottery methods
    ii. Use of random number table
f) Merits and demerits of sampling

3. Collection and representation of data **5L**

a) Classification of data
    i. Meaning and need of classification
    ii. Objectives of classification
    iii. Classification according to class interval
    iv. Overlapping and non-overlapping frequency table
b) Methods of representation of statistical data

i. Essential features of tabular presentation
ii. Advantages of tabular presentation
iii. Graphic representation of data and its advantages
iv. Types of graphic representation
- Histogram
- Frequency polygon
- Frequency curve
- Scatter or dot diagram

i. Merits and limitations of graphic representation
ii. Diagrammatic representation of data
- Line diagram
- Bar diagram
- Pie diagram

4. Measures of central tendency of grouped and ungrouped data **4L**

a) Simple arithmetic mean, its merits and demerits
b) Averages of position: Median and mode, their merits and demerits

Credit - II (16 L)
Unit- 2

5. Measures of dispersion **4L**

a. Meaning of dispersion
i. Range:Computation in individual, discrete and continuous series, coefficient of range, Merits and limitations
ii. Mean deviation and standard deviation: computation for grouped and ungrouped data,Merits and limitation
iii. Variance: Definition, coefficient of variance
iv. Skewness and Kurtosis

6. Correlation and regression **4L**

a) Definition and types of correlation
b) Coefficient of correlation and its properties
c) Methods of studying correlation: Scatter diagram and Karl Pearson's Coefficient of Correlation
d) Coefficient of determination (r^2)
e) Regression analysis
   i. Definition and types of regression
   ii. Linear regression
f) Similarities and dissimilarities of correlation and regression

7**. Probability and types of theoretical probability distribution** **4L**

a) Concept of probability
b) Binomial distribution
c) Poisson distribution
d) Normal distribution
   i. Normal distribution curve
   ii. Relationship between normal curve area and standard deviation
   iii. Properties of normal distribution curve.

8. Tests of significance of mean **4L**

a) Introduction
b) Statistic and its standard error
c) Meaning of statistical hypothesis, level of significance, null hypothesis and alternative hypothesis
d) Student's 't' test: unpaired and paired test
e) chi Square test as a test of goodness of fit and its significance

Credit - III (16L)
Unit - 3

9. Computation of seed testing and plant growth indices 10L

a) Seed germination and early seedling growth.
   i. Germination percentage
   ii. Mean germination time (MGT)
   iii. Germination index (GI)
   iv. Germination speed (GS)
   v. Vigor index (VI).
b) Seed germination and early seedling growth under stress
   i. Promptness index (PI)
   ii. Germination stress tolerance index (GSI),
   iii. Plant height stress tolerance index (PHSI)
   iv. Root length stress tolerance index (RLSI)
   v. Dry matter stress tolerance index (DMSI)
c) Plant growth indices
   i. Absolute Growth Rate (AGR)
   ii. Crop Growth Rate (CGR)
   iii. Relative Growth Rate (RGR)
   iv. Leaf Area Index (LAI)

10. Analysis of data on vegetation studies 6L

a) Data obtained from quadrates and transects methods
   i. Frequency
   ii. Percent frequency
   iii. Relative frequency
   iv. Density
   v. Relative density
   vi. Abundance
   vii. Dominance
b) Computation of crop/vegetation biomass using satellite data
   i. Simple Ratio (SR) or Ratio Vegetation Index (RVI)
   ii. Difference Vegetation Index (DVI),
   iii. Normalised Difference Vegetation index (NDVI) or greenness index

NOTE – For Biostatistics, emphasis be given on methodology and numerical problem solving rather than derivations and proofs.

References:

1. Introduction to biostatistics, Pranab Kumar Banerjee.
2. Fundamentals of biostatistics, Khan and Khanum
3. Methods in Biostatistics for medical students and research workers, B K Mahajan

4. ABC of Research Methodology and Applied Biostatistics, M N Parikh and Nithya Gogtay
5. Biostatistics in brief, K Viswesara Rao
6. Introduction to Biometry, S G Purohit, V D Ranade and A V Dusane
7. Biostatistics-Basic Concepts and Methodology for the Health Sciences, Wayne W Daniel
8. Basic statistics, B L Agarwal
9. Biostatistics – Principle and Practice, B Antonisamy, Soloman Chrostopher and P Prasanna Samuel
10. Introduction to biostatistics and research methods, PSS Sundar Rao and J Richards

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Choice Based Credit System Syllabus (2019 Pattern)

Mapping of Program Outcomes with Course Outcomes

Class: T.Y.B. Sc. (Sem. V) **Subject**: Botany

Course: Biostatistics **Course Code**: BOT 3505

Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

	Programme Outcomes (POs)								
Course Outcomes	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9
CO 1		3		3					
CO 2		3							
CO 3	3								
CO 4						3			
CO 5									3
CO 6	3								
CO 7					2				

Justification for the mapping

PO1: Disciplinary Knowledge

CO3. Students will apply their knowledge in various branches of biology.
CO6. Students will apply their knowledge in various branches of biology.

PO2: Critical Thinking and Problem Solving

CO1. Students will be expert in use of computer to solve biological problems.
CO2. Students can be master in solving biological problems with the help of statistics.

PO 4: Research-related skills and Scientific temper

CO1. Students will be expert in use of computer to solve biological problems.

PO5: Trans-disciplinary Knowledge

CO7. Students' expertise in microscopic techniques.

PO6: Personal and Professional Competence

CO4. Students will be expert in use of computer to solve biological problems.

PO 9: Self-directed and Life-long Learning

CO5. Students can be master in solving biological problems with the help of statistics.

Class: **T. Y. B. Sc. (Semester - V)**
Paper Code: **BOT 3506**
Paper: **VI** Title of Paper: **Research Methodology**
Credit: **3** No. of lectures: 48

A) Learning Objectives:

1. To understand the research
2. To give idea about research work
3. To aware the students about the research methodologies.

B) Course Outcome:

CO1. Comprehensive knowledge in research areas.
CO2. Knowledge of preparation of Manuscript, Review article and Project Report.
CO3. Students will understand the basics of research.
CO4. Data analyzer will be expert to conclude the significance of biological experiments
CO5. Students will be expert in use of computer to solve biological problems.
CO6. Students can be master in solving biological problems with the help of statistics.
CO7. Students will apply their knowledge in various branches of biology.

Credit - I (16 L)

Unit – 1

1. Introduction to Research Methodology: Meaning of Research, Objectives of Research, Motivations in Research, types of Research, Research Approaches, Significance of Research, Criteria of Good Research. (8 L)
2. Defining the Research Problem: Concept and need, Identification of Research problem, defining and delimiting Research problem. (6 L)
3. Characteristics of research: Qualitative and Quantitative (2 L)

Credit - II (16 L)

Unit – 1I

4. Research Questions and Hypothesis: Variables and their linkages, characteristics of good Hypothesis. Basis for hypotheses, formulation of hypotheses-directional and non-directional hypotheses. (8 L)
5. Research design: Meaning, Need, Features of Good Design, Concepts, Types, Basic principles of Experimental Design, various methods of Research: Survey, Philosophical, Historical, Experimental, Case Studies. (8 L)

Credit - III (16 L)

Unit – III

6. Data Collection: Methods of Data Collections : Observation, Experimental and questionnaire, Primary Data, Secondary Data, Selection of appropriate method for data collection, Case Study, Reliability and validity of Research tools. (8 L)
7. Preparation of Project Report: Data Analysis and Consolidation of Photographs, Illustration, Table and Graphs, Title, Introduction, Review of Literature, Materials and Methods, Results, Discussions, Summary, References, Acknowledgment, Bibliography: Method of Citing And Arrangement of References. (8 L)

References:

1) Ackoff, Russell L., *Scientific Method*, New York: John Wiley & Sons, 1962.

2) Baker, R.P., and Howell, A.C., *The Preparation of Reports*, New York: Ronald Press, 1938.
3) Best and Kahn, Research Methodology, PHI Limited.
4) Berdie, Douglas R., and Anderson, John F., *Questionnaires: Design and Use*, Metuchen N.J.: The Scarecrow Press, Inc., 1974.
5) Gatner, Elliot S.M., and Cordasco, Francesco, *Research and Report Writing*, New York: Barnes & Noble, Inc., 1956.
6) Kothari, C.R. Research Methodology (Methods and Techniques), New Age Publisher.
7) Kerlinger, Foundation of Research.

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Choice Based Credit System Syllabus (2019 Pattern)

Mapping of Program Outcomes with Course Outcomes

Class: T.Y.B. Sc. (Sem. V) **Subject**: Botany

Course: Research Methodology **Course Code**: BOT 3506

Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

	Programme Outcomes (POs)								
Course Outcomes	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9
CO 1	3								
CO 2	3								
CO 3	3								
CO 4		3							
CO 5						2			
CO 6	2								3
CO 7	2				3				

Justification for the mapping

PO1: Disciplinary Knowledge

CO1. Comprehensive knowledge in research areas.
CO2. Knowledge of preparation of Manuscript, Review article and Project Report.
CO3. Students will understand the basics of research.
CO6. Students can be master in solving biological problems with the help of statistics.
CO7. Students will apply their knowledge in various branches of biology.

PO2: Critical Thinking and Problem Solving

CO4. Data analyzer will be expert to conclude the significance of biological experiments.

PO5: Trans-disciplinary Knowledge

CO7. Students will apply their knowledge in various branches of biology

PO6: Personal and Professional Competence

CO5. Students will be expert in use of computer to solve biological problems.

PO 9: Self-directed and Life-long Learning

CO6. Students can be master in solving biological problems with the help of statistics.

Class: **T. Y. B. Sc. Practical-I (Sem.-V)**
Paper Code: **BOT 3507**
Paper: **Practical-I** Title of Paper: **Practical based on BOT3501 and BOT3503**
Credit: 2 No. of Practicals: 12

A) Learning Objectives :

1 To aware the students about lower plants diversity.
2 To enhance the knowledge of students up to the molecular level.
3 To make students expert in molecular biology techniques.

B) Course Outcome :

CO1. To aware the students about lower plants diversity.
CO2. To enhance the knowledge of students up to the molecular level.
CO3. To make students expert in molecular biology techniques.
CO4. It will help to conserve the biodiversity of lower and higher plants.
CO5. Students will get job in gene bank, gene mapping and bioinformatics disciplines.
CO6. Data analyzer will be expert to conclude the significance of biological experiments.
CO7. It will help to conserve the biodiversity of lower plants.

Practical based on BOT3501- Cryptogamic Botany (08 Prac.)

1. Study of **Algae** with respect to systematic position thallus structure and reproduction of *Oscillatora, Batrachospermum* and *Volvox.*
2. Study of **Fungi** respect to systematic position thallus structure and reproduction of *Mucor Unicinula* and *Agaricus.*
3. Study of **Bryophytes** with respect to systematic position thallus structure and reproduction of *Marchantia*, *Anthoceros* and *Polytrichum*.
4. Study of **Pteridophytes** with respect to systematic position, sporophyte - morphology and anatomy, reproductive structures of *Psilotum*, *Selaginella* and *Salvinia*.

   Excursion tour to study cryptogams is compulsory.

Practical based on BOT3503 - Cell and Molecular Biology (04 Prac.)

1. Study of various stages of mitosis.
2. Study of various stages of meiosis.
3. Plant Genomic DNA extraction from Cauliflower.
4. Extraction and estimation of RNA by Orcinol Method.

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Choice Based Credit System Syllabus (2019 Pattern)

Mapping of Program Outcomes with Course Outcomes

Class: T.Y.B. Sc. (Sem. V) **Subject**: Botany

Course: Practical Course I **Course Code**: BOT 3507

Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

	Programme Outcomes (POs)								
Course Outcomes	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9
CO 1	3								
CO 2	3								
CO 3				3					
CO 4								3	
CO 5						2			
CO 6					3				
CO 7	2						2		

Justification for the mapping

PO1: Disciplinary Knowledge

CO1. To aware the students about lower plants diversity.

CO2. To enhance the knowledge of students up to the molecular level.

CO7. It will help to conserve the biodiversity of lower plants.

PO 4: Research-related skills and Scientific temper

CO3. To make students expert in molecular biology techniques.

PO5: Trans-disciplinary Knowledge

CO6. Data analyzer will be expert to conclude the significance of biological experiments.

PO6: Personal and Professional Competence

CO5. Students will get job in gene bank, gene mapping and bioinformatics disciplines.

PO 7: Effective Citizenship and Ethics

CO7. It will help to conserve the biodiversity of lower plants.

PO 8: Environment and Sustainability

CO4. It will help to conserve the biodiversity of lower and higher plants.

Class: **T. Y. B. Sc. Practical-II (Sem.-V)**
Paper Code: **BOT 3508**
Paper: **Practical-II** Title of Paper: **Practical based on BOT3502**
Credit: 2 No. of Practicals: 12

A) Learning Objectives :

1 To aware the students about higher plants diversity.
2 To make expert the students in identification of plants.
3 To make expert the students in advanced techniques in angiosperm taxonomy.

B) Course Outcome :

CO1. It will help to conserve the biodiversity of higher plants.
CO2. Students can expert in evolutionary and advanced characters of plants.
CO3. Students will get the job in the field of plant taxonomy and allied sciences.
CO4. It will help to conserve the biodiversity of lower plants.
CO5. Students will get job in gene bank, gene mapping and bioinformatics disciplines.
CO6. Data analyzer will be expert to conclude the significance of biological experiments
CO7. Use of bio techniques to explore plant to its molecular level.

Practical based on BOT3502 - Spermatophyta and Palaeobotany (12 Prac.)

1. Study of *Pinus* with the help of permanent slides and plant material- i) External morphology, ii) T. S. of stem (Temporary double stained preparation), iii) T. S. of needle (Temporary double stained preparation), iv) Morphology of male cone – T. S. & L. S. Permanent slide, mounting of pollen grains. v) Morphology of female cone – T. S. & L. S. Permanent slide, vi) Mounting of pollen grains. vii) V. S. of mature ovule(Permanent slide) (2 P)
2. Study of *Gnetum* with the help of permanent slides and plant material. i) External morphology, ii) T. S. of stemiii) T. S. of leaf (permanent slide), iv) Morphology of male cone vi) Morphology of female cone vii) V. S. of mature ovule. (2 P)
3. Study of at least any eight families as per theory course (4P)
4. Identification of plants with the help of regional/local/suitable flora. (1 P)
5. Preparation of an artificial key based on multiple characters/ Androecium / Gynoecium/vegetative characters (at least two keys) (1P)
6. Plant identification with the help of QR Code system (1 P)
7. Study of the following with the help of slides and / or specimens. (1P)
   i) Impression ii) Compression iii) Petrifaction iv) Coal ball v) *Rhynia* vi) *Pentoxylon* vii) *Nipaniophyllum* vii) *Lepidodendron*

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Choice Based Credit System Syllabus (2019 Pattern)

Mapping of Program Outcomes with Course Outcomes

Class: T.Y.B. Sc. (Sem. V) **Subject**: Botany

Course: Practical Course II **Course Code**: BOT 3508

Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

	Programme Outcomes (POs)								
Course Outcomes	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9
CO 1								3	
CO 2		2							
CO 3						3			
CO 4			3			3			
CO 5									
CO 6	3								
CO 7	3								

Justification for the mapping

PO1: Disciplinary Knowledge

CO6. Data analyzer will be expert to conclude the significance of biological experiments.

CO7. Use of bio techniques to explore plant to its molecular level.

PO2: Critical Thinking and Problem Solving

CO2. Students can expert in evolutionary and advanced characters of plants.

PO 3: Social competence

CO4. It will help to conserve the biodiversity of lower plants.

PO6: Personal and Professional Competence

CO3. Students will get the job in the field of plant taxonomy and allied sciences.

CO5. Students will get job in gene bank, gene mapping and bioinformatics disciplines.

PO 8: Environment and Sustainability

CO1. It will help to conserve the biodiversity of higher plants.

Class: **T. Y. B. Sc. Practical-III (Sem.-V)**
Paper Code: **BOT 3509**
Paper: **Practical-III** Title of Paper: **Practical based on BOT3504 to BOT3506**
Credit: 2 No. of Practicals: 13

A) Learning Objectives :

1 To aware the students about higher plants diversity.

B) Course Outcome :

By the end of course students will be able to

CO1. Explain basic cell structure.

CO2. Understand basic biological concepts.

CO3.Get acquainted with some cytological techniques.

CO4. Understand basic knowledge about structure of cell organelles.

CO5. Explain mechanism of cells in plant.

CO6. Train in different isolation techniques in cell organelle.

CO7. Interprets cell structure and their function.

Practical based on BOT3504 - Industrial Botany (04 Prac.)

1. Study of Media Required for Hydroponics
2. Study of Hydroponic techonology for Chilli
3. Study of bottle and circular gardening
4. Study of Bonsai Preparation

Visits : Visit to any one Hydroponics Farming unit/ Warehouses/ Packhouses / cold-storage/ hydroponic farming unit

Practical based on BOT3505 – Biostatistics (04 Prac.)

1. Computation of mean, mode, median, variance and standard deviation from the plant sample.
2. Statistical problem solving based on Student's't' test and Chi-square test.
3. Germination of various seed lots and analysis of data with various seed germination indices.
4. Analysis of vegetation data obtained from list count quadrat method for frequency, Density, abundance, relative dominance and importance value index.

Practical based on BOT3506 – Research Methodology (05 Prac.)

1 Witting of introduction and review of literature of research project.
2 Setting of methodology for research project work.
3 Writing of results and discussion of research project.
4 Writing of summary and conclusion of research project.
5 Bibliography

Note : Projects will be allotted for fifth and sixth semester and students will submit project work at sixth semester practical examination.

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Choice Based Credit System Syllabus (2019 Pattern)

Mapping of Program Outcomes with Course Outcomes

Class: T.Y.B. Sc. (Sem. V) **Subject**: Botany

Course: Practical Course III **Course Code**: BOT 3509

Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

	Programme Outcomes (POs)								
Course Outcomes	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9
CO 1	3								
CO 2	3								
CO 3						3			
CO 4	2								
CO 5	2								
CO 6									3
CO 7					3				

Justification for the mapping

PO1: Disciplinary Knowledge

CO1. Explain basic cell structure.
CO2. Understand basic biological concepts.
CO4. Understand basic knowledge about structure of cell organelles.
CO5. Explain mechanism of cells in plant.

PO5: Trans-disciplinary Knowledge

CO7. Interprets cell structure and their function.

PO6: Personal and Professional Competence

CO3.Get acquainted with some cytological techniques.

PO 9: Self-directed and Life-long Learning

CO6. Train in different isolation techniques in cell organelle.