



**Deccan Education. Society's**  
**Fergusson College (Autonomous), Pune**

Department of Botany

Syllabus  
for  
**T. Y. B. Sc. (Botany)**

[Pattern 2019]  
*(B.Sc. Semester-V and VI)*

**To be implemented**

From Academic Year  
**2021-22**

**Deccan Education Society's  
Fergusson College (Autonomous), Pune  
Scheme of Course Structure (Faculty of Science)  
2020-2021  
T. Y. B.Sc.- Botany**

<b>Semester</b>	<b>Paper No.</b>	<b>Course Code</b>	<b>Title</b>	<b>Paper No.</b>	<b>Credits</b>	<b>Exam (I / E)</b>	<b>Marks (50 / 50)</b>
V	DSE-1A	BOT3501	Cryptogamic Botany	I	2	I / E	50 / 50
	DSE-1B	BOT3502	Ethnobotany	II	2	I / E	50 / 50
	DSE-2A	BOT3503	Genetics and Evolution	III	2	I / E	50 / 50
	DSE-2B	BOT3504	Spermatophyta and Paleobotany	IV	2	I / E	50 / 50
	DSE-3A	BOT3505	Horticulture and Floriculture	V	2	I / E	50 / 50
	DSE-3B	BOT3506	Cell Biology and Molecular Biology	VI	2	I / E	50 / 50
	DSE-1	BOT3507	Practical - I	Practical - I	2	I / E	50 / 50
	DSE-2	BOT3508	Practical - II	Practical - II	2	I / E	50 / 50
	DSE-3	BOT3509	Practical –III	Practical - III	2	I / E	50 / 50
	SEC-1*	BOT3511	Bio-fertilizers	VII	2	I / E	50 / 50
	SEC-2*	BOT3512	Techniques in Plant Sciences and Biostatistics	VIII	2	I / E	50 / 50

<b>Semester</b>	<b>Paper No.</b>	<b>Course Code</b>	<b>Title</b>	<b>Paper No.</b>	<b>Credits</b>	<b>Exam (I / E)</b>	<b>Marks (50 / 50)</b>
VI	DSE-4A	BOT3601	Plant Physiology and Biochemistry	I	2	I / E	50 / 50
	DSE-4B	BOT3602	Nursery and Gardening	II	2	I / E	50 / 50
	DSE-5A	BOT3603	Plant Ecology and Biodiversity	III	2	I / E	50 / 50
	DSE-5B	BOT3604	Plant Breeding and Seed Technology	IV	2	I / E	50 / 50
	DSE-6A	BOT3605	Mycology and Plant Pathology	V	2	I / E	50 / 50
	DSE-6B	BOT3606	Plant Molecular Biology and Biotechnology	VI	2	I / E	50 / 50
	DSE-4	BOT3607	Practical – IV	Practical - IV	2	I / E	50 / 50
	DSE-5	BOT3608	Practical – V	Practical - V	2	I / E	50 / 50
	DSE-6	BOT3609	Practical - VI	Practical - VI	2	I / E	50 / 50
	SEC-3*	BOT-3611	Medico-Botany	VI	2	I / E	50 / 50
	SEC-4*	BOT-3612	Mushroom Culture Technology	VIII	2	I / E	50 / 50

<b>T. Y. B.Sc. Semester V</b>		
<b>Title of the Course and Course Code</b>	<b>CRYPTOGAMIC BOTANY BOT 3501</b>	<b>Number of Credits :2</b>
<b>Course Outcomes (COs)</b> <b>On completion of the course, the students will be able to:</b>		
CO1	Describe lower and higher cryptogams.	
CO2	Compare different plant forms based on characteristic features and distinguish them from their respective group.	
CO3	Outline the group and differentiate the taxonomic forms.	
CO4	Analyze life cycle patterns of different groups.	
CO5	Review various groups of cryptogams and differentiate each other using salient features.	
CO6	Specify economic and ecological significance of different groups.	

<b>Unit No.</b>	<b>Title of Unit and Contents</b>	<b>No. Of lectures</b>
<b>I</b>	<b>Introduction</b> Cryptogams, Comparative study of - Lower Cryptogams and Higher Cryptogams, brief review with examples.	<b>2</b>
<b>II</b>	<b>Algae</b> Algae: General characters, Thallus organization in algae, Methods of reproduction, Outline classification according to Lee (1999) up to classes with reasons and examples, Role of algae in industry and agriculture, Life cycle of <i>Nostoc</i> and <i>Sargassum</i> .	<b>7</b>
<b>III</b>	<b>Fungi</b> Fungi: General characters, Methods of reproduction, Outline classification according to Alexopolous et.al (1962) up to classes with reasons and examples, Role of fungi in industry and agriculture, Life cycle of <i>Rhizopus</i> and <i>Puccinia</i> .	<b>7</b>
<b>IV</b>	<b>Bryophyta</b> Bryophytes: General characters, Outline classification according to Parihar (1965) up to classes with reasons and examples, Economic and ecological significance, Life cycle of <i>Anthoceros</i> and <i>Funaria</i> .	<b>7</b>
<b>V</b>	<b>Pteridophyta</b> Pteridophytes: General characters, Outline classification according to Parihar up to classes with reasons and examples Economic importance, Life cycle of <i>Selaginella</i> and <i>Marsilea</i> .	<b>7</b>
<b>(Development of sex organs and sporophyte are not expected.)</b>		

**References:**

1. **Vashistha B. R. et al.**, Botany for degree Students-Algae
2. **Das, Datta and Gangulee**-College Botany Vol I
3. **Sharma, O.P.** -Algae
4. **Vashishta B.R. et al.**, Botany for degree students- Fungi
5. **Sharma, P.D.**-The Fungi
6. **Sharma, O.P.**-Fungi
7. **Chopra G.L. and Yadav D.L.**A Text book of Bryophytes.
8. **Parihar, N.S.** An introduction to Embryophyta: Bryophyte-I
9. **Puri Prem.** Brayophytes, Atmaram and Sons. Delhi.
10. **Vashishta B.R.** Botany for degree students Bryophytes- Vol-III
11. **Parihar N.S.** 1991. Bryophyta. Central Book Depot, Allahabad.
12. **Puri P.** 1980. Bryophytes. Atma Ram and Sons, Delhi.
13. **Alexopoulos C.J, Mims C.W. and Blacwel M.I** 1996. Introductory Mycology. John Wiley and Sons Inc.
14. **Kumar H.D.** 1988. Introductory Phycology. Affiliated East-West Press Ltd., New Delhi.
15. **Sporne K.R.** 1991. The Morphology of Pteridophytes. B.I Publishing Pvt. Ltd. Bombay.

**DSE 1 Practical's based on CRYPTOGAMIC BOTANY**

1	Study of Algae with respect to systematic position, thallus structure and reproduction of <i>Nosotc</i> and <i>Sargassum</i> .
2	Study of Fungi respect to systematic position, thallus structure and reproduction of <i>Rhizopus</i> and <i>Puccinia</i> .
3	Study of Bryophytes with respect to systematic position, thallus structure and reproduction of <i>Anthoceros</i> and <i>Funaria</i> .
4	Study of Pteridophytes with respect to systematic position, sporophyte - morphology and anatomy, reproductive structures of <i>Selaginella</i> .
5	Study of Pteridophytes with respect to systematic position, sporophyte - morphology and anatomy, reproductive structures of <i>Marsilea</i> .
6	Excursion tour and submission of 5 digital herbarium or specimens from each group.

Title of the Course and Course Code	<b>ETHNOBOTANY BOT 3502</b>	Number of Credits :2
<b>Course Outcomes (COs)</b> <b>On completion of the course, the students will be able to:</b>		
CO1	Describe concepts, scope and objectives of ethnobotany.	
CO2	Explain the role of ethnobotany in plant conservation.	
CO3	Apply ethnobotany as a tool to protect interests of ethnic groups.	
CO4	Analyze the significance of the medicinal plants in ethno-botanical practices.	
CO5	Determine different methodologies of ethnobotanical studies.	
CO6	Prepare a report on ethnobotanical visits.	

Unit. No.	Title of Unit and Contents	No. of Lectures
<b>I</b>	<b>Introduction to Ethnobotany</b> Introduction, concept, scope and objectives, Ethnobotany as an interdisciplinary science. The relevance of Ethnobotany in the present context, Major and minor Ethnic groups or tribals of India and their lifestyles, Plants used by the tribals: Food plants, Intoxicants and Beverages, Resins and oils, Miscellaneous uses.	<b>6</b>
<b>II</b>	<b>Role of Ethnobotany</b> Role of Ethnobotany in modern medicine, Medico and ethno-botanical sources in India, Significance of the following plants in ethno-botanical practices along with their habitat and morphology: <i>Azadirachta indica</i> , <i>Ocimum sanctum</i> , <i>Vitex negundo</i> , <i>Gloriosa superba</i> , <i>Tribulus terrestris</i> , <i>Pongamia pinnata</i> , <i>Cassia auriculata</i> , <i>Indigofera tinctoria</i> , Role of Ethnobotany in modern medicine with special examples: <i>Rauvolfia serpentina</i> , <i>Trichopus zeylanicus</i> , <i>Artemisia</i> , <i>Withania</i> , Role of ethnic groups in conservation of plant genetic resources. Endangered taxa and forest management (participatory forest management)	<b>10</b>
<b>III</b>	<b>Ethnobotany and legal aspects</b> Ethnobotany as a tool to protect interests of ethnic groups. Sharing of wealth concept with few examples from India. Biopiracy, Intellectual Property Rights and Traditional Knowledge.	<b>8</b>

<b>IV</b>	<b>Methodologies of Ethnobotanical Studies</b> Field Work, Herbarium, Ancient Literature, Archaeological findings, Temples and sacred places	<b>6</b>
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**References:**

1. Jain, S. K., 1995, Manual of Ethnobotany, Scientific Publishers, Jodhpur
2. Jain S. K., 1981, Glimpses of Indian Ethnobotany, Oxford and IBH, New Delhi.
3. Jain S. K., 1989, Methods and Approaches in Ethnobotany, Society
4. Jain, S. K., 1990, Contributions of Indian Ethnobotany, Scientific Publishers, Jodhpur.
5. Colton, C. M., 1997, Ethnobotany - Principles and Applications, John Wiley and Sons, Chichester.
6. Rama Ro, N. and Henry, A. N., 1996, The Ethnobotany of Eastern Ghats in Andhra Pradesh, India, Botanical Survey of India, Howrah.
7. Rajiv K. Sinha, 1996, Ethnobotany, The Renaissance of Traditional Herbal Medicine - INA - SHREE Publishers, Jaipur.

**DSE 3 Practicals based on ETHNOBOTANY**

<b>1.The plants used by tribals as-</b> Food, Beverages, Resins and Oil
<b>2.Role of plants in Ethno botanical practices with their Habit, and Morphology.</b> <i>Azadiractha indica, Ocimum sanctum, Pongamia Pinnata, Vitex nigundo</i>
<b>3.Role of plants in modern medicines.</b> <i>Rauwolfia sepentina, Withania somnifera, Artemisia</i>
4. Herbarium Preparation and submission of five plants used as traditional medicinal uses
5. Visit and report of Sacred groves/Temple/Herbal Garden.
6. Visit and report of Ayush institute.

Title of the Course and Course Code	<b>GENETICS AND EVOLUTION BOT3503</b>	Number of Credits :2
<b>Course Outcomes (COs)</b> <b>On completion of the course, the students will be able to:</b>		
CO1	Describe Mendel's law and its importance.	
CO2	Explain Coupling, Repulsion Hypothesis of Bateson, Punnet and its significance.	
CO3	Examine character of multiple alleles and genetically controlled sex determining mechanisms.	
CO4	Analyze different colours of phenotypes.	
CO5	Determine age of rock and fossils by evolutionary evidence.	
CO6	Collect evidence from comparative cytology and genetics.	

Unit. No.	Title of Unit and Contents	No. of Lectures
<b>I</b>	<b>Introduction to Genetics</b> <b>Heredity</b> Genetical terminology, Brief life history of Mendel, Mendel's Laws of Inheritance: Law of dominance, Law of segregation and Law of independent assortment, Monohybrid cross, Dihybrid cross, Trihybrid cross, Back cross and Test cross Interactions of genes :Non-epistatic genetic interactions- Complementary genes (9:7), Duplicate genes (15:1), Epistatic genetic interactions- Masking genes (12:3:1), Supplementary genes (9:3:4), Inhibitory genes (13:3), Lethal genes (2:1)	<b>6</b>
<b>II</b>	<b>Linkage and Crossing over</b> <b>Linkage</b> Definition, Types of linkages - Complete and Incomplete Construction of linkage maps based on two-point test cross and three-point test cross <b>Crossing Over</b> Definition, Types of crossing over-- somatic and meiotic crossing over	<b>4</b>
<b>III</b>	<b>Multiple Alleles</b> Definition, Concept, Characters of multiple alleles, Examples of multiple alleles – Inheritance of blood group in human, Eye colour in <i>Drosophila</i> , self-incompatibility in <i>Nicotiana</i>	<b>4</b>
<b>IV</b>	<b>Quantitative and Cytoplasmic Inheritance</b> <b>Quantitative Inheritance</b> Concept of quantitative inheritance Difference between qualitative and quantitative traits, Inheritance of quantitative trait in Maize (Cob length) <b>Cytoplasmic inheritance</b> Definition and concept of cytoplasmic inheritance, Chloroplast- Variegation in Four O'clock plants, Mitochondria- Petite mutants in yeast	<b>4</b>
<b>V</b>	<b>Sex Linked Inheritance</b> Concept of sex chromosomes and autosomes, Inheritance of X- linked genes – Eye colour in <i>Drosophila</i> 5.3 Inheritance of colour blindness in humans, Inheritance of Y-linked genes - Holandric genes in humans, Sex influenced genes – baldness in humans, Sex-limited genes - feathering in domestic fowl	<b>6</b>
<b>VI</b>	<b>Introduction to Evolution</b> Definition, inorganic, chemical and molecular evolution and organic life, Concept of organic and biological evolution and origin of species	<b>2</b>



<b>VII</b>	<b>Theories of Evolution</b> The concept of organic evolution, Theory of Inheritance of acquired characters (Lamarck's and Pre-Darwinian theories), Theory of Natural Selection (Darwinism), Darwin-Wallace theory of Natural Selection, Modern synthetic theory (Post-Darwinism), Mutation theory	<b>4</b>
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**References:**

1. Gardner E. J., Simmons M. J., Snustad D. P. (2008). Principles of Genetics.
2. Snustad, D. P. and Simmons, M. J. (2010). Principles of Genetics.
3. Klug W. S., Cummings M. R., Spencer, C., Palladino, M. (2011). Concepts of Genetics.
4. Griffiths, A. J. F., Wessler, S. R., Carroll, S. B., Doebley, J. (2010). Introduction to Genetic Analysis.
5. Pierce B. A. (2011) Genetics: A Conceptual Approach, 4<sup>th</sup> edition, Macmillan Higher Education Learning.
6. Singh, B. D. (2005). Plant Breeding: Principles and Methods.
7. Chaudhari, H. K. (1984). Elementary Principles of Plant Breeding.
8. P.S. Verma and V. K. Agarwal (2010). Cell Biology, Genetics, Molecular Biology, Evolution and Ecology.

**DSE-2 Practical based on GENETICS AND EVOLUTION**

1. Study the incomplete dominance and gene interaction through following seed ratios (9:7, 9:6:1, 13:3, 15:1, 12:3:1, 9:3:4).
2. Study of monohybrid cross, dihybrid cross, and trihybrid cross with suitable example.
3. Construct the linkage maps based on two-point test cross and three-point test crosses.
4. Study of inheritance of Y-linked or holandric genes in Humans
5. Study of sex influenced genes - baldness in Humans
6. Study of chloroplast – variegate

Title of the Course and Course Code	<b>SPERMATOPHYTA AND PALAEOBOTANY BOT3504</b>	Number of Credits :2
<b>Course Outcomes (COs)</b> <b>On completion of the course, the students will be able to:</b>		
CO1	Outline the position of gymnosperms, angiosperms in the latest classification system. List the morphological and anatomical characters of the group.	
CO2	Classify the groups and differentiate the taxonomic forms.	
CO3	Interpret the life cycles of gymnosperms and angiosperms.	
CO4	Distinguish different families with reference to systematic position, characters and their economic importance.	
CO5	Determine fossil plant groups along with the formations of fossils.	
CO6	Prepare indent bracketed and artificial keys along with tools of taxonomy for plant identification and authentication.	

<b>Unit. No.</b>	<b>Title of Unit and Contents</b>	<b>No of Lectures</b>
<b>I</b>	<b>Introduction to Gymnosperms</b> Introduction and general characters, Economic importance, Classification of Gymnosperms up till order	<b>2</b>
<b>II</b>	<b>Study of life cycle of <i>Pinus</i></b> Distribution, morphology and anatomy, Reproduction, Gametophyte and Sporophyte, Seed Structure, Alternation of Generations	<b>3</b>
<b>III</b>	<b>Study of Life Cycle of <i>Gnetum</i></b> Distribution, morphology and anatomy, Reproduction, Gametophyte and Sporophyte , Seed Structure, Alternation of Generations	<b>3</b>
<b>IV</b>	<b>Introduction of Angiosperms</b> Origin with reference to time, place and ancestry, Pteridosperms theory Bennettitalean theory, Gentleman theory	<b>2</b>
<b>V</b>	<b>Systems of Classification</b> Review of artificial , natural and phylogenetic systems (General account ) Hutchinson System – Outline and assumptions , merits and limitations, Advanced Angiospermic Phylogenetic Group System -5 ( APG – 4 ) – Outline and assumptions, merits and limitations	<b>2</b>
<b>VI</b>	<b>Study of Families</b> Introduction, Study of families with reference to systematic position, Distinguishing characters, economic importance, General floral formula, floral diagram of following, Families: Magnoliaceae, Capparidaceae, Leguminosae, (Caesalpinaceae), Acanthaceae, Lamiaceae, Bignoniaceas Verbenaceae, Convolvulaceae, Rubiaceae, Nyctaginaceae, Orchidaceae and Cannaceae	<b>6</b>
<b>VII</b>	<b>Tools of Taxonomy</b> Floras, Herbarium Technique, Importance of Botanical Gardens, Role of Botanical Survey of India (BSI)	<b>2</b>
<b>VIII</b>	<b>Plants Identification</b> Latin Diagnosis, Practicing indented and bracketed keys, Plant authentication	<b>2</b>
<b>IX</b>	<b>Palaeobotany</b> Geological time scale, form, genera, concept and nomenclature	<b>1</b>
<b>X</b>	<b>Fossils</b> Definition and process of fossil formation, Conditions favourable for fossilization, Types of fossils – Impression, Compression, Petrification, Pith cast and Coal ball, Amber, Chemical Fossil, Pseudofossil and Microfossil.	<b>2</b>

<b>XI</b>	<b>Study of Fossil Plant Groups</b> Psilopsida - Salient features of order Psilophytales, External and internal morphology of <u>Rhynia</u> , Lycopsidea -Salient features of order Lepidodendrales, external and internal morphology of <u>Lepidodendron</u> , Sphenopsida -Salient features of Calamitales, External and internal morphology of <u>Calamities</u> , Pteridosperms-External and internal morphology of <u>Lyginopterisoldhamia</u> , Pentoxylae - Salient features, external and, Internal morphology of stem (Pentoxylon). Leaf ( <u>Nipanionphyllum</u> )	<b>5</b>
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### References:

1. Sporne, K.R. (1965). The Morphology of Gymnosperms London.
2. Chamberlain. C. J. (1934) Gymnosperms-Structure and Evolution, Chicago.
3. Coulter. J. M. and Chamberlain. C. J. (1917). Morphology of Gymnosperms. S. Chicago.
4. Vashishta. P.C. Sinha. A.R. Anil Kumar. (2006). Gymnosperms. S. Chand and Co.
5. Vashishta P. C., (2006). Pteridophytes S.Chand and Co.
6. Parihar N.S. (1996). Biology and Morphology of Pteridophytes. Central Book Depot. Allahabad.
7. Cronquist, A. (1968). The Evolution and Classification of Flowering Plants. Thomas Nel and Sons, Ltd., London.
8. Lawrence, G.H. M. (1955). An Introduction to Plant Taxonomy.
9. Pande. B. P. (1997). Taxonomy of Angiosperms. S. Chand and Co.
10. Naik, V. N. (1985). Taxonomy of Angiosperms.
11. Yadav. S. R. and Sardesai M. R. (2000) Flora of Kolhapur District.
12. Theodore Cooke. (1903). The Flora of the Presidency of Bombay – Vol. I, II and III.
13. Arnold, C. R. (1990). An Introduction to Palaeobotany.
14. Shukla. A. C. and Mishra. S. P. (1995). Essentials of Palaeobotany.

Sr.no.	Title of practical
1	Study of families: Magnoliaceae, Rubiaceae
2	Study of families: Bignoniaceae, Lamiaceae
3	Study of families: Nycaginaceae, Orchidiaceae
4	a) Identification of plants with help of flora (Genus and Species). b) Preparation of artificial key based on Vegetative and reproductive characters.
5	Study of <i>Pinus</i> and <i>Gnetum</i> .
6	Study of the following with help of slides and specimens. Impression, Compression, Petrification, Coal balls, Rhynia, Lyginopteris Pentoxylon, Botanical excursion and Herbarium submission of ten specimens.

Title of the Course and Course Code	<b>HORTICULTURE AND FLORICULTURE BOT 3505</b>	Number of Credits :2
<b>Course Outcomes (COs)</b> <b>On completion of the course, the students will be able to:</b>		
CO1	Describe concepts of horticulture and floriculture.	
CO2	Classify the horticultural crops and discuss their nutritive values.	
CO3	Examine the importance of conservation and cultivation of wild plants in landscape gardening. Apply the knowledge of drying plant material and discuss their applications.	
CO4	Analyze different practices in horticulture and explain their applications with respect to different crops.	
CO5	Evaluate the methods of cultivation of cut flowers using greenhouse technology.	
CO6	Specify different cultivation practices followed for fruits and vegetables.	

Unit. No.	Title of Unit and Contents	No of Lectures
<b>I</b>	<b>Introduction to Horticulture</b> Definition and branches, Scope and economic importance of horticultural crops, Export and import potential of horticultural crops, Horticultural zones of India and Maharashtra, Global and National Scenario of horticulture	<b>2</b>
<b>II</b>	<b>Horticultural Plants-</b> Nutritive value of fruits and vegetables, Classification of horticultural crops, Classification of Vegetables, Fruits, Ornamental plants, Spices and Flowers	<b>3</b>
<b>III</b>	<b>Special Practices in Horticulture</b> Training and Pruning - Objectives, types, systems of trainings Fruit crops - Special practices like Bahar treatment, Girdling, Notching, Ringing, Bending, Vegetable crops special practices - Earthing up, Staking and Blanching	<b>3</b>
<b>IV</b>	<b>Introduction to Fruits and Vegetables Production Technology</b> Soil and climate requirements, Commercial varieties, Harvesting and post harvesting management, Plant protection methods, Fruits - Banana and Mango, Vegetables – Root – Raddish, Stem- Navacol and Leafy vegetables-- <i>Moringa</i>	<b>5</b>
<b>V</b>	<b>V Introduction to ornamentals and Landscaping Gardening</b> Introduction of wild plants as garden plants, Successful stories of cultivation of 25 wild plants of ornamental value from Western Ghats, Landscaping Places of public importance, Landscaping highways and educational institutions	<b>5</b>

<b>VI</b>	<b>Introduction to Floriculture- 5</b> Definition and Concept, Scope and Importance of Floriculture Important floriculture crops, Methods of cultivation for cultivation of - Gerbera, Gladiolus, Orchids, Carnation and lily, use of Green, House Technology for cultivation of flowers	<b>6</b>
<b>VII</b>	<b>Flower Industry- 5</b> Dry Flowers. Introduction, Indian market of dry flowers, selection of material, Techniques of drying - Air drying, sun drying, Press drying, desiccants, oven and microwave drying methods, Preservation methods, bleaching, dyeing and painting, Storage, care of dried flowers etc. Dry flower arrangement and drift wood arrangement Cut Flowers. Introduction, Species and cultivars of Orchids, <i>Anthuriums</i> and <i>Heliconias</i> , Harvesting techniques, Mode of harvesting, Post-harvest handling - Conditioning, precooling, pulsing and impregnation, grading, bunching, wrapping, packing and cold storage, transport of cut flowers, Indian market of cut flowers	<b>6</b>

### References:

1. Sheela, V. L., Horticulture, MJP Publications.
2. Hartmann and Koster's Plant Propagation, Principles and Practices
3. Kunte, Y. N., Kawathalkar M. P. and Yawalkar, K. S., Principles of Horticulture and Fruit Growing, Agri-Horticultural Publication House, Nagpur.
4. Arora, J. S., Introductory Ornamental Horticulture, Kalyani Publications.
5. Bose, T. K. and Yadav, L. P., Commercial Flowers, Naya Prakashan
6. Singh, B. D., Plant Breeding, Kalyani Publications.
7. Chadha, K. L. and Pareek, O. P., Advances in Horticulture, Vol. IV, Malhotra Publications.
8. Sudheer, K. P. and Indira V, Post-Harvest Technology of Horticultural Crops, New Delhi Publications.
9. Adams, C. R., Principles of Horticulture, Elsevier Publication, 4th edition, 2004.
10. Gurcharan Singh, Randhawa and Amitabha Mukhopadhyay, Floriculture in India, Allied Publishers.
11. Debashish Sengupta and Raj Kamal, Floriculture Marketing in India, (Excel Books).

### DSE 3 Practicals based on Horticulture and Floriculture

1	Study of wild ornamentals (Any5)
2	Study of Technique - Training and Pruning
3	Methods of harvesting of cut flowers and their preservation methods.
4	Methods of making dry flowers.
5	Submission of five plants suited for oxygen path / Landscaping of public importance.
6.	To identify various cut and loose flower crops based on primary morphological characters.

Title of the Course and Course Code	<b>CELL BIOLOGY AND MOLECULAR BIOLOGY BOT 3506</b>	Number of Credits :2
<b>Course Outcomes (COs)</b> <b>On completion of the course, the students will be able to:</b>		
CO1	Describe the basic concepts of cell and molecular biology. Interpret the significance of the past evidence to prove that DNA is the genetic material in cells.	
CO2	Discuss the structural organization and functions of the cell organelles. Illustrate the assembly of chromosomes. Infer the ultrastructure of plant cell wall and plasma membrane.	
CO3	Outline the structural details of nucleic acids and clarify the concept of genes.	
CO4	Explain the cell division processes within the cell. Differentiate between the intricacies of the mitotic and meiotic divisions.	
CO5	Review the significance of the cell biology, the molecular mechanisms of the cells including replication and DNA repair.	
CO6	Assemble the cellular processes and support the fundamental functions of plant specific cell organelles.	

Unit. No.	Title of Unit and Contents	No of Lectures
<b>I</b>	<b>Cell as a unit of life with molecular processes</b> What is a cell? Difference in prokaryotic and eukaryotic cells Central Dogma of Molecular Biology, Model organism used, Definition and scope of cell biology and molecular biology.	<b>2</b>
<b>II</b>	<b>Plant Cell wall and cell membrane</b> Ultrastructure and function of plant cell wall, Ultra-structure (with respect to Fluid Mosaic model) and functions of cell membrane.	<b>3</b>
<b>III</b>	<b>Cell organelles</b> Structural organization and functions of Mitochondria and chloroplast with respect to Maize and <i>Spirogyra</i> , Structure of Endoplasmic Reticulum, Golgi apparatus, Peroxisomes, Glyoxysomes and Vacuoles in insectivorous plants, Nucleus- Morphology, ultrastructure, nuclear pore complex, function with respect to <i>Oedogonium</i> and <i>Acetabularia</i> , Structure of chromosome, chemical composition, euchromatin and heterochromatin, Giant chromosomes (Eg- <i>Coprinus</i> ).	<b>8</b>
<b>IV</b>	<b>Cell Division</b> Phases of cell cycle, Mitosis, Meiosis, Variations in cell division, Karyotype and ideogram	<b>5</b>
<b>V</b>	<b>Molecular Biology</b> Biological evidences to prove DNA and RNA as genetic material, Watson and Cricks Model of DNA, Forms of DNA- A, B and Z, C-value, Concept of gene with respect to Split gene.	<b>6</b>

<b>VI</b>	<b>DNA Replication</b> Introduction and types, Meselson and Stahl's Experiment Molecular mechanism of DNA replication	<b>4</b>
<b>VII</b>	<b>DNA Damage and Repair</b> Introduction, Types and effects of DNA damage, DNA repair system- Photo reactivation, Dark excision repair	<b>3</b>

**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. Text book of Molecular Biology, Verma and Agarwal
8. Cell and Molecular Biology, Robertis and DeRobertis
9. Biochemistry and Molecular Biology of Plants, Buchanan B. B.
10. Molecular and Cell Biology, Wolfe S.L.

**E-Books**

1. Advanced molecular biology, R.M. Twyman, Garland Science
2. Molecular biology of the cell, B. Alberts, Garland Science
3. Molecular biology, Clark and Pazdernik, Elsevier and academic press
4. Molecular biology of the gene- 7<sup>th</sup> ed, James Watson
5. Pearson education, Molecular cell biology, Lodish Darnell -5<sup>th</sup> ed, W H freeman

**DSE- 1 Practical based on CELL AND MOLECULAR BIOLOGY**

1	Study of various stages of meiosis
2	Study of C metaphase (from colchicine pre-treated onion root tip cells)
3.	Demonstration of karyotype/ideogram.
4	Plant genomic DNA extraction from cauliflower
5	Estimation of Plant DNA by DPA Method
6.	Estimation of RNA by Orcinol method

Title of the Course and Course Code	<b>BOTANY PRACTICAL Based on BOT 3501 and BOT 3502 BOT 3507</b>	Number of Credits :2
<b>Course Outcomes (COs)</b> <b>On completion of the course, the students will be able to:</b>		
CO1	List and describe the different representatives of algae, fungi, bryophytes and pteridophytes.	
CO2	Classify the different plant forms to its respective groups based on their thallus structure and reproduction.	
CO3	Examine different ethnobotanical plants based on its morphological characters.	
CO4	Compare and categorize different techniques of herbarium preparations. Analyze different phytochemical tests of secondary metabolites.	
CO5	Justify the life cycles of cryptogamic representatives with respect to their scientific classification.	
CO6	Write a tour report, collect the specimens and organize the preserved specimens and herbarium sheets according to their evolutionary features.	

Sr. No.	Title of Practical
1	Study of Algae with respect to systematic position thallus structure and reproduction of <i>Nostoc</i> and <i>Sargassum</i>
2	Study of Fungi respect to systematic position thallus structure and reproduction of <i>Rhizopus</i> and <i>Puccinia</i> .
3	Study of Bryophytes with respect to systematic position thallus structure and reproduction of <i>Anthoceros</i> and <i>Funaria</i> .
4	Study of Pteridophytes with respect to systematic position, sporophyte - morphology and anatomy, reproductive structures of <i>Selaginella</i> .
5	Study of Pteridophytes with respect to systematic position, sporophyte - morphology and anatomy, reproductive structures of <i>Marsilea</i> .
6	Excursion tour and submission of 5 digital herbarium or specimens from each group
7	The plants used by tribals (Two examples) for, Food, Beverages, Resins and Oil
8	Role of plants in Ethno botanical practices with their Habit and Morphology. <i>Azadiractha indica</i> , <i>Ocimum sanctum</i> , <i>Pongamia Pinnata</i> , <i>Vitex Nigundo</i>
9	Role of plants in modern medicines. <i>Rauwolfia sepentina</i> , <i>Withania somnifera</i> , <i>Artemisia</i>
10	Herbarium Preparation and submission of five traditionally used medicinal plants.
11	Visit and report of Sacred groves/Temple/Herbal garden.
12	Visit and report of Ayush institute.



Title of the Course and Course Code	<b>BOTANY PRACTICAL Based on BOT 3503, BOT 3504 and BOT 3508</b>	Number of Credits :2
<b>Course Outcomes (COs)</b> <b>On completion of the course, the students will be able to:</b>		
CO1	Describe the process of fossilisation.	
CO2	Explain the life cycle <i>Pinus</i> and <i>Gnetum</i> .	
CO3	Solve genetic problems based on linkage map using three-point test cross data. Interpret Dihybrid and Trihybrid cross.	
CO4	Identify and classify the families.	
CO5	Review cytoplasmic inheritance in <i>Mirabilis jalapa</i> .	
CO6	Prepare, construct artificial keys of genus and species.	

Sr. No.	Title of Practical
1	Incomplete dominance and gene interaction through seed ratios (9:7, 9:6:1, 13:3, 15:1, 12:3:1, 9:3:4).
2	Study of monohybrid cross, dihybrid cross, and trihybrid cross with suitable example
3	Chromosome mapping using point test cross data.
4	Study of Inheritance of Y-linked or Holandric genes in humans
5.	Study of Sex influenced genes
6.	Study of Chloroplast - Variegation in Four O'clock plants
7	Study of families Magnoliaceae, Rubiaceae
8	Study of families Bignoniaceae, Lamiaceae
9	Study of families Nyctaginaceae, Orchidaceae
10	a) Identification of plants with the help of suitable flora (Genus and Species) b) Preparation of artificial key based on vegetative and reproductive characters.
11	Study of <i>Pinus</i> Study of <i>Gnetum</i>
12	Study of the following with the help of slides and/ or specimens. i) Impression, ii) Compression, iii) Petrification, iv) Coal ball, v) <i>Rhynia</i> , vii) <i>Lyginopteris</i> , viii) <i>Pentoxylon</i>

**Note-** Herbarium submission of ten correctly identified wild flowering plants

Title of the Course and Course Code	<b>DSE -3 BOTANY PRACTICAL Based on BOT 3505, BOT 3506 and BOT 3509</b>	Number of Credits :2
<b>Course Outcomes (COs)</b> <b>On completion of the course, the students will be able to:</b>		
CO1	Describe different tools used for gardening.	
CO2	Predict the amount of DNA in cauliflower. Infer the technique for RNA estimation.	
CO3	Examine different types of cut flower harvesting and its preservation.	
CO4	Detect the C metaphase chromosomes of onion root tips and explain the karyotype of chromosomes.	
CO5	Evaluate different methods of dry flower preservation and ointment preparation.	
CO6	Write a tour report and propose the importance of oxygen path plants.	

Sr. No.	Title of Practical
1	Study of wild ornamentals (Any 5)
2	Study of Technique - Training and Pruning
3	Methods of harvesting of cut flowers and their preservation methods.
4	Methods of making dry flowers.
5	To identify various cut and loose flower crops based on primary morphological characters.
6	Submission of five plants suited for oxygen path / Landscaping of public importance.
7	Study of various stages of meiosis
8	Study of C metaphase (from colchicines pre-treated onion root tip cells)
9	Demonstration of karyotype / ideogram.
10	Plant genomic DNA extraction from Cauliflower
11.	Estimation of Plant DNA by DPA Method
12.	Estimation of RNA by orcinol method

Title of the Course and Course Code	<b>BIO-FERTILIZERS BOT 3511</b>	Number of Credits :2
<b>Course Outcomes (COs)</b> <b>On completion of the course, the students will be able to:</b>		
CO1	State and recall the microbes used as biofertilizer.	
CO2	Summarize the method of isolation and mass multiplication of <i>Rhizobium</i> , <i>Azospirillum</i> and <i>Azotobacter</i> carrier-based inoculants.	
CO3	Examine the role of blue green algae- <i>Azolla</i> , <i>Anabaena azollae</i> in nitrogen fixation, outline the factors affecting their growth and use of <i>Azolla</i> in rice cultivation.	
CO4	Distinguish types of mycorrhizal associations. Explain the isolation and inoculum production of VAM and its influence on growth and yield of crop plants.	
CO5	Assess the methods of organic farming, recommend recycling of biodegradable municipal, agricultural and industrial wastes.	
CO6	Design and develop the methods for making bio-compost, vermicompost and their field applications.	

Unit. No.	Title of Unit and Contents	No. of Lectures
<b>I</b>	General account about the microbes used as Biofertilizer and <i>Rhizobium</i> isolation, Identification, mass multiplication, carrier based inoculants, Actinorrhizal symbiosis.	<b>3</b>
<b>II</b>	<i>Azospirillum</i> : Isolation and mass multiplication carrier based inoculant, associative effect of different micro-organisms. <i>Azotobacter</i> : Classification, characteristics - crop response to <i>Azotobacter</i> inoculum, Maintenance and mass multiplication.	<b>7</b>
<b>III</b>	Cyanobacteria (blue green algae), <i>Azolla</i> and <i>Anabaena Azollae</i> association, Nitrogen fixation, factors affecting growth, blue green algae and <i>Azolla</i> in rice cultivation.	<b>6</b>
<b>IV</b>	Mycorrhiza association, types of mycorrhizal association, Taxonomy, occurrence and distribution, Effect of phosphorus nutrition on growth and yield, Colonization of VAM - isolation and inoculum production of VAM and its influence on growth and yield of crop plants.	<b>6</b>
<b>V</b>	Organic Farming -Green manuring and organic fertilizers, Recycling of biodegradable municipal, agricultural and industrial wastes, Bio-compost making methods, types and methods of vermicomposting, Field applications.	<b>8</b>

**References:**

1. Dubey, R. C., 2005, A Text book of Biotechnology, S. Chand & Co., New Delhi.
2. Kumaresan, V., 2005, Biotechnology, Saras Publications, New Delhi.
3. John JothiPrakash, E., 2004, Outlines of Plant Biotechnology, Emkay Publication, NewDelhi.
4. Sathe, T. V., 2004, Vermiculture and Organic Farming, Daya Publishers.
5. SubhaRao, N. S., 2000, Soil Microbiology, Oxford & IBH Publishers, New Delhi.
6. Vyas, S. C., Vyas, S. and Modi, H. A., 1998, Bio-fertilizers and Organic Farming, Akta.

Title of the Course and Course Code	<b>TECHNIQUES IN PLANT SCIENCES AND BIOSTATISTICS BOT3512</b>	Number of Credits :2
<b>Course Outcomes (COs)</b> <b>On completion of the course, the students will be able to:</b>		
CO1	Describe the types of microscopy and micrometry	
CO2	Categorize different types of lab techniques with respect to its applications. Summarize the various dimensions of scientific data with respect to central tendency and dispersion.	
CO3	Interpret the applications of spectrophotometry and electrochemical techniques in lab experiments.	
CO4	Differentiate the various methods of sampling and representation of data.	
CO5	Review separation techniques with respect to chromatography and centrifugation	
CO6	Design statistically valid experiments with appropriate tests of significance	

Unit. No	Title of Unit and Contents	No. of Lectures
<b>I</b>	<b>Microscopes</b> Introduction - History and purpose of microscopic examination Types of microscopes - Dissecting, stereoscopic-optic principle anduses, Compound microscopes - Construction, parts, working, optic principle anduses	2
<b>II</b>	<b>Image Documentation</b> Camera lucida - Principle and types, Photomicrography - Principle and uses of SLRcameras	3
<b>III</b>	<b>Micrometry</b> Introduction - Principle, Micrometer types, Eye piece - Reticle / Inserts and Stagemicrometer, Calibration of ocular scale andmicroscope	2
<b>IV</b>	<b>Chromatography</b> Introduction-Definition and concept of partition coefficient, Paper Chromatography -Principle, method and advantages Thin Layer Chromatography - Principle, method and advantages	3

<b>V</b>	<b>Spectrophotometry</b> Definition - General principle, Beer and Lambert's law and mechanics of measurement Working and Application of Spectrophotometer	2
<b>VI</b>	<b>Centrifugation</b> Definition and factors affecting rate of sedimentation, Types of Centrifugation	2
<b>VII</b>	<b>Electrochemical Techniques</b> Principle - pH meter, reference electrode, indicator electrode and oxygen electrode Calibration of pH meter Applications of Electrochemical Techniques	3
<b>VIII</b>	<b>Introduction to Biostatistics</b> Definition Statistical terms - Population, sample, primary and secondary data, qualitative and quantitative data, variables, discrete and continuous variables and statistical error.	2
<b>IX</b>	<b>Sampling Techniques</b> Introduction, Methods of Sampling - Serial Random Sampling and Stratified Sampling	2
<b>X</b>	<b>Diagrammatic and Graphic Representation of Data</b> Introduction, Diagrammatic representation of data - Bar diagram and Pie diagram	2
<b>XI</b>	<b>Measures of Central Tendency</b> Introduction, Calculation of arithmetic mean, median and mode in an ungrouped data	1
<b>XII</b>	<b>Measures of Dispersion</b> Introduction, Methods of measuring dispersion Range - Characteristic of Range and coefficient of range, Variance and Standard Deviation -Calculation of Standard Deviation and coefficient of Variation	2
<b>XIII</b>	<b>Test of Significance</b> Introduction Laying down of Hypothesis-Null hypothesis, Alternative hypothesis and level of significance Test based on normal distribution [Large sample test], Testing one population mean. Testing equality of two population mean, Student's t-test [Small sample test], Testing one population mean, Testing equality of two population mean, Paired t-test Chi-Square test as a test of goodness of fit and its significance	4

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**References:**

1. Bisen, P. S. and Shruti Mathur, Life Science in Tools and Techniques.
2. Marimuthu, R., Microscopy and Microtechnique.
3. Sharma, V.K., Techniques in Microscopy and Cell Biology.
4. Prasad and Prasad, Outlines of Microtechnique.
5. Srivastava, Sharad and Singhal. Vineeta, Laboratory Methods in Microbiology.
6. Annie and Arumugam, Biochemistry and Biophysics.
7. Sass, John E., Botanical Microtechnique.
8. Pranab Kumar Banerjee, Introduction to Biostatistics.
9. Khan and Khanum, Fundamentals of Biostatistics.
10. Mahajan, B. K., Methods in Biostatistics for medical students and research workers.
11. Parikh, M. N. and Nithya Gogtay, ABC of Research Methodology and Applied Biostatistics.
12. K. Viswesara Rao, Biostatistics in Brief.
13. Wayne W. Daniel, Biostatistics - Basic Concepts and Methodology for the Health Sciences.
14. Agarwal, B. L., Basic Statistics.
15. B. Antonisamy, Solomon Chrostopher and P. Prasanna Samuel, Biostatistics - Principle and Practice
16. Sundar Rao, P.S.S. and Richards J, Introduction to Biostatistics and Research Methods.
17. Neil A. Weiss, Introductory Statistics

## T. Y. B.Sc. Semester VI

Title of the Course and Course Code	PLANT PHYSIOLOGY AND BIOCHEMISTRY BOT3601	Number of Credits :2
<b>Course Outcomes (COs)</b> <b>On completion of the course, the students will be able to:</b>		
CO1	Describe various physiological processes in plants and biochemical constituents of plants.	
CO2	Associate different physiological processes in plant cells and classify biomolecules.	
CO3	Illustrate structure of biomolecules.	
CO4	Analyze the properties of biomolecules in plants.	
CO5	Review plant metabolisms and pathways of production of metabolites.	
CO6	Specify role of metabolites in plants.	

Unit. No.	Title of Unit and Contents	No. of Lectures
<b>I</b>	<b>Photosynthesis</b> Ultra structure of chloroplast, Accessory pigments and their role in photosynthesis, Photosystem, Light reaction, Electron transport chain, Cyclic and Noncyclic photophosphorylation, Calvin cycle, HSK and CAM pathways, Photorespiration Bacterial Photosynthesis.	<b>7</b>
<b>II</b>	<b>Respiration</b> Ultra structure of mitochondria, Types of respiration, Glycolysis –EMP, TCA cycle, Mitochondrial ETS, Balance sheet of ATPs in aerobic and anaerobic respiration.	<b>5</b>
<b>III</b>	<b>Translocation in Phloem</b> Path of translocation Evidences for phloem transport - Girdling experiment, Mechanism of translocation – Pressure flow theory Phloem loading and unloading, Source to sink relationship.	<b>3</b>
<b>IV</b>	<b>Carbohydrates</b> Classification of carbohydrates - monosaccharides, disaccharides and polysaccharides, Structure and properties of carbohydrates, Biosynthesis and degradation of starch and cellulose.	<b>4</b>
<b>V</b>	<b>Lipids</b> General classification of lipids, Structures, functions and properties of lipids, $\beta$ -oxidation mechanism.	<b>3</b>
<b>VI</b>	<b>Proteins</b> Structure of amino acids, Classification of protein, Structure of Proteins - Primary, Secondary, Tertiary and Quaternary structure.	<b>3</b>
<b>VII</b>	<b>Secondary Metabolites</b> Introduction, Types of secondary metabolites, Pathways for production of secondary metabolites through - malonic, mevalonic, shikimic acid and Acetyl CoA, Role of secondary metabolites.	<b>5</b>

**References:**

1. Buchanan B. B., Gruissem W. and Jones R. L. - Biochemistry and Molecular Biology of Plants.
2. Salisbury F. B. and Ross C. W. - Plant Physiology
3. William G. Hopkins - Introduction to Plant Physiology,
4. Lincoln Taiz and Eduardo Zeiger - Plant Physiology
5. R. G. S. Bidwell - Plant Physiology.
6. Verma S. K. and Verma Mohit - A. T. B. of Plant Physiology, Biochemistry and
7. Biotechnology.
8. Leninger A. C. - Principles of Biochemistry,
9. Moore T. C. - Biochemistry and Physiology of Plant Hormones,
10. Singhal G. S., Renger G., Sopory S. K., Irrgang K. D. and Govindjee - Concept in
11. Photobiology, Photosynthesis and Photomorphogenesis.
12. Taiz L. and Zeiger E. – Plant Physiology.

**DSE 4 Practicals based on Plant Physiology and Biochemistry**

1	Estimation of chlorophyll-a and chlorophyll-b by Spectrometric method
2	Separation of photosynthetic pigments by Paper Chromatography
3	To determine diurnal fluctuation in TAN values of CAM plants.
4	Estimation of soluble proteins by Bradford method.
5	Separation of amino acids by paper chromatography.
6	Demonstration of: Ringing experiment for path of solute translocation, Qualitative tests for alkaloids, tannins, starch and proteins

NURSERY AND GARDENING		
Title of the Course and Course Code	NURSERY AND GARDENING BOT3602	Number of Credits :2
<b>Course Outcomes (COs)</b>		
<b>On completion of the course, the students will be able to:</b>		
CO1	Define objectives and scope of nursery and gardening.	
CO2	Illustrate types, dormancy, storage and production technology of seed.	
CO3	Examine different types of gardens and their operations.	
CO4	Analyze different methods of vegetative propagation.	
CO5	Review methods of seedling raising and cultivation of vegetables.	
CO6	Prepare a project report of the field visit.	



<b>Unit. No.</b>	<b>Title of Unit and Contents</b>	<b>No. of Lectures</b>
<b>I</b>	<b>Nursery</b> Definition, objectives and scope of nursery, Building up of infrastructure for nursery, Planning and seasonal activities, Planting - Direct Seeding and Transplants.	<b>4</b>
<b>II</b>	<b>Seed</b> Structure and types of seeds, Seed dormancy, causes and methods of breaking dormancy, Seed storage: Seed banks, factors affecting seed viability, genetic erosion, Seed Production Technology - seed testing and certification	<b>6</b>
<b>III</b>	<b>Vegetative Propagation</b> Methods: Air-layering, cutting, selection of cutting, collecting season, treatment of cutting, rooting medium and planting of cuttings, Hardening of plants - green house - mist chamber, shed root, shade house and glass house.	<b>6</b>
<b>IV</b>	<b>Gardening</b> Definition, objectives and scope - different types of Gardening, Landscape and Home Gardening, Parks and its components, plant materials and design, Computer applications in landscaping Gardening operations: soil laying, manuring, watering, Management of pests and diseases and harvesting.	<b>8</b>
<b>V</b>	Sowing/raising of seeds and seedlings - Transplanting of seedlings, Study of cultivation of different vegetables-cabbage, brinjal, lady's finger, onion, garlic, tomatoes and carrots, Storage and marketing procedures.	<b>6</b>

#### **References:**

1. Bose, T. K. & Mukherjee, D., 1972, Gardening in India, Oxford & IBH Publishing Co., New Delhi.
2. Sandhu, M. K., 1989, Plant Propagation, Wile Eastern Ltd., Bangalore, Madras.
3. Kumar, N., 1997, Introduction to Horticulture, Raja Lakshmi Publications, Nagercoil.
4. Edmond Musser & Andres, Fundamentals of Horticulture, McGraw Hill Book Co., New Delhi.
5. Agrawal, P. K., 1993, Hand Book of Seed Technology, Dept. of Agriculture and Corporation, National Seed Corporation Ltd., New Delhi.
6. Janick Jules, 1979, Horticultural Science, (3<sup>rd</sup> Ed.), W. H. Freeman and Co., San Francisco, USA.
7. Dubey, R. C., 2005, A Text Book of Biotechnology, S. Chand & Co., New Delhi.
8. Kumaresan, V., 2005, Biotechnology, Saras Publications, New Delhi.
9. John Jothi Prakash, E. 2004. Outlines of Plant Biotechnology, Emkay Publication, New Delhi.
10. Sathe, T. V. 2004, Vermiculture and Organic Farming, Daya Publishers.
11. Subha Rao, N. S., 2000, Soil Microbiology, Oxford & IBH Publishers, New Delhi.
12. Vyas, S. C, Vyas, S. and Modi, H. A., 1998, Bio-fertilizers and Organic Farming, AktaPrakashan, Nadiad.

### DSE 6 Practicals based on NURSERY AND GARDENING

1.	Soil analysis and seed bed preparation
2	Study of nursery techniques- Potting up, Seed identification and seed propagation, Vegetative propagation Cutting, layering and grafting techniques
3	Weed identification (any five), and control measures for Weeds.
4	Bonsai, Dish garden demonstration.
5	Listing of indoor and outdoor plants.
6	Visit and report of Park /Botanical garden.

<b>Title of the Course and Course Code</b>	<b>PLANT ECOLOGY AND BIODIVERSITY BOT3603</b>	<b>Number of Credits :2</b>
<b>Course Outcomes (COs)</b> <b>On completion of the course, the students will be able to:</b>		
CO1	Outline the basic components of ecology and functional aspects of ecosystem.	
CO2	Explain biotic and abiotic components of the ecosystem.	
CO3	Illustrate various levels of Biodiversity.	
CO4	Analyze the need for biodiversity conservation.	
CO5	Determine the role of Universities and other Educational Institutions in Biodiversity Conservation.	
CO6	Generate data for remote sensing applications in ecology.	

<b>Unit. No.</b>	<b>Title of Unit and Contents</b>	<b>No. of Lectures</b>
<b>I</b>	<b>Introduction to Plant Ecology and Biodiversity</b> Basic concept in Ecology, Level of Organization. Inter-relationships between the living world and the, Environment, the components and dynamism, Homeostasis	<b>2</b>
<b>II</b>	<b>Soil</b> Importance of soil, Physical and Chemical properties of soil, Biological Components of soil, Soil profile	<b>3</b>
<b>III</b>	<b>Water</b> Importance: States of water in the environment, Precipitation types (Rain, Fog, Snow, Hail, Dew), Hydrological Cycle; Water in soil; Water table	<b>2</b>
<b>VI</b>	<b>Plant Communities</b> Habitat and niche Characters: Analytical and synthetic, Ecotone and edge effects	<b>3</b>
<b>V</b>	<b>Functional Aspects of Ecosystem</b> Biogeochemical cycles, Carbon cycle, Nitrogen cycle and Phosphorus cycle.	<b>3</b>
<b>VI</b>	<b>Biodiversity</b> Introduction and Concept, Aims and Objectives, Scope and Values	<b>2</b>
<b>VII</b>	<b>Characterization of Biodiversity</b> Introduction and need for characterization of Biodiversity, Various levels of Biodiversity - Genetics, Species and Ecosystem. Concept of Endemism, Biodiversity hot spots in world.	<b>2</b>

<b>VIII</b>	<b>Biodiversity Crisis</b> Loss of Species and Genetic Diversity - Introduction, Factors causing loss of species and Genetic Diversity, Founder Effects, Genetic Drift, Inbreeding Depression IUCN Categories (RTE Plants)	<b>2</b>
<b>IX</b>	<b>Conservation of Biodiversity</b> Current Practices in Conservation, In – situ Conservation - International efforts and Indian initiatives, protected areas in India, concepts Of Biosphere Reserves, National Parks and Biodiversity Park, Ex - situ Conservation - Germplasm collection, Botanical Gardens - Lead Botanical Gardens, Seed Bank, Gene bank, Pollen bank and DNA bank, Wetlands, Mangroves and Coral Reefs, Enlist National Agencies playing role in conservation (BSI, NBPGR, ICAR, CSIR, DBT, Ministry of Environment and Forest)	<b>7</b>
<b>X</b>	<b>Social Approach to Biodiversity Conservation</b> Sacred Groves, Sthalavrikshas , Chipko Movement, Role of University and other Educational Institutions In Biodiversity Conservation.	<b>3</b>

#### References:

1. M. Anji Reddy, Textbook of Remote Sensing and GIS (2006). B. S. Publication, Hyderabad.
2. George Joseph, Fundamentals of Remote Sensing, (2005). Universities Press (India) Private Ltd., Hyderabad.
3. John R. Jensen, Remote Sensing of the Environment (2000). Dorling Kindersley India Pvt. Ltd.
4. Current Science Special Issue Remote Sensing for National Development, Volume 61, Numbers 3 and 4. August 1991.
5. Odum, E. P., (1996). Fundamentals of Ecology. Natraj Publishing House, Dehradun.
6. Daubenmire, R. F., (1974). Plants and Environment – A Textbook of Plant Ecology (3<sup>rd</sup> edition), John Wiley & Sons, New York.
7. Kumar, H. D., (1996). Modern Concepts of Ecology, (3<sup>rd</sup> edition), Vikas Publishing House Pvt. Ltd., Delhi.
8. Kumar, H. D.,(1997). General Ecology, Vikas Publishing Pvt. Ltd.,Delhi.
9. Kermondy, F. J.,(1996). Concepts of Ecology, Prentice Hall Pvt.Ltd., New Delhi.
10. Weaver, J. E. and Clements, S.E.(1996). Plant Ecology, Tata McGraw Publishing Co. Ltd., Bombay
11. Smith. L.R. and Mith, T. M.(1988). Elements of Ecology.(4<sup>th</sup> edition). An imprint of Addison Wesley, Longman Inc., California.
12. Krishnamurthy, K. V. (2003). An Advanced Textbook on Biodiversity - Principles and Practice, Oxford and IBH Publication, New Delhi.
13. Hajra, P. K. and Mudgal, V. (1997). Plant Diversity Hotspots in India - An Overview, BSI.

### DSE 5 Practical's based on Plant Ecology and Biodiversity

1	Study of instruments used to measure microclimatic variables: Soil thermometer, maximum and minimum thermometer, anemometer, psychrometer/hygrometer.
2	Determination of dissolved oxygen of water samples from polluted and unpolluted sources.
3	Study of water holding capacity of soil samples.
4	Quantitative analysis of herbaceous vegetation in the college campus for frequency, density abundance with list count quadrat method and comparison with Raunkiaer's frequency distribution law.
5	Marking of Hot Spots of the World on the world map.
6	Visit to BSI to study biodiversity conservation.

PLANT BREEDING AND SEED TECHNOLOGY		
Title of the Course and Course Code	PLANT BREEDING AND SEED TECHNOLOGY BOT3604	Number of Credits :2
<b>Course Outcomes (COs)</b> <b>On completion of the course, the students will be able to:</b>		
CO1	Describe objectives and importance of plant breeding.	
CO2	Explain different methods of plant breeding.	
CO3	Examine different seed tests for quality seed production and seed processing.	
CO4	Analyze the mechanism of chemical and physical mutagens and characteristics of polyploidy in crop improvement.	
CO5	Determine different operations in the Seed Industry.	
CO6	Prepare a report based on development of seed industry in India, seed marketing and distribution.	

Unit. No.	Title of Unit and Contents	No. of Lectures
<b>I</b>	<b>Introduction to Plant Breeding</b> Introduction to plant breeding, Scope and importance Objective of plant breeding	<b>2</b>
<b>II</b>	<b>Plant Introduction and Acclimatization</b> Introduction, Types of plant introduction - primary and secondary, Objectives of plant introduction, Advantages, disadvantages and achievements Acclimatization - definition and importance	<b>2</b>

<b>III</b>	<b>Methods and Practices of Breeding</b> Introduction to selection methods, Types of selections methods - mass selection, pure line selection and clonal selection, advantages and disadvantages, achievements, Breeding Methods -pedigree method, bulk method, single-seed descent method and <b>backcross</b> method, advantages and disadvantages, achievements, Hybridization, Definition and Concept, difficulties in crop hybridization and precaution to be taken during hybridization, general procedure of hybridization, parent selection in a breeding program, criteria for selecting parents, Principles - Cross Pollinated Crops Heterosis and hybrid vigour, Dominance hypothesis and Over dominance hypothesis	<b>4</b>
<b>IV</b>	<b>Mutation in Crop Improvement</b> Introduction and concept, Types of mutations - spontaneous and induced mutations, Molecular basis of gene mutations, Types of mutagens - chemical and physical mutagens, Mechanism of action of chemical and physical mutagens Applications of mutations breeding	<b>3</b>
<b>V</b>	<b>Polyploidy in Crop Improvement</b> Numerical changes in chromosomes - Euploidy and Aneuploidy, Monoploidy - Origin and production, morphology and uses, Polyploidy - Concept and characteristics of polyploidy, Autopolyploidy - Origin and production, effects of auto polyploidy and uses, Allopolyploidy - Concept, synthesized allopolyploidy (wheat and cotton), Aneuploidy - Monosomy and nullisomy - origin and cytology, Trisomy in <i>Datura</i> , Evolutionary significance of polyploidy	<b>4</b>
	<b>Introduction to Seed Technology</b>	
<b>VI</b>	<b>Types of Improved Seeds</b> Definition of seed, Stages of seed production, Types of seeds - nucleus seed, breeder seed, certified seed and foundation seed	<b>2</b>
<b>VII</b>	<b>Operation in Seed Industry</b> Breeding of new variety, Seed multiplication Seed processing and storage, Seed marketing and distribution Seed certification and publicity	<b>4</b>
<b>VIII</b>	<b>Quality Seed Production and Seed Processing</b> Isolation of seed, Seed crop Cultivation-Land requirement, culture practices, plant protection, weed control, rouging, harvesting and drying, Cleaning and grading, Testing and treating, Bagging and labelling	<b>4</b>
<b>XI</b>	<b>Process of Seed Certification and Seed Production Organizations</b> Field Inspection, Inspection during seed processing, Seed tests - sampling, purity test, cultivar purity test, seed viability, real value seed, moisture content, Maintenance of improved	<b>5</b>

	seed <b>Seed Production Organizations</b> National Seed Corporation, State Seed Corporation, State Seed Certification Agencies, Private Seed Companies	
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### DSE – 5 Practical's based on Plant Breeding and Seed technology

<b>1</b>	Effect of chemical mutagens on seed germination and seedling growth by using suitable seed material.
<b>2</b>	Induction of autopolyploid in <i>Allium cepa</i> by colchicine
<b>3</b>	Demonstration of hybridization techniques by using suitable flower material.
<b>4</b>	Demonstration of seed sampling equipment's with the help of photographs
<b>5</b>	Assessing seed viability by tetrazolium test
<b>6</b>	Visit to seed processing unit to study different instruments / Visit to any one of the following Seed Production Organizations- National Seed Corporation, State Seed Corporation, State Seed Certification Agencies and Private Seed Companies.

MYCOLOGY AND PLANT PATHOLOGY		
Title of the Course and Course Code	<b>MYCOLOGY AND PLANT PATHOLOGY BOT3605</b>	Number of Credits :2
<b>Course Outcomes (COs)</b>		
<b>On completion of the course, the students will be able to:</b>		
CO1	State general characters of fungi and their ecological significance.	
CO2	Explain the basis of classification of fungi and their life cycles.	
CO3	Classify the causal organisms according to the diseases caused by them.	
CO4	Compare the defense mechanism of host and pathogens at structural and biochemical level.	
CO5	Evaluate the methods of epidemiology and disease forecasting systems.	
CO6	Develop the methods of studying plant diseases.	

Unit. No.	Title of Unit and Contents	No. of Lectures
<b>I</b>	<b>Introduction to Mycology</b> Introduction, Mode of nutrition in fungi Habitat, Reproduction, Ecological significance	<b>3</b>
<b>II</b>	Outline of the recent classification up to classes with examples	<b>3</b>
<b>III</b>	<b>Class Ascomycetes</b> Introduction, Occurrence, Economic Importance, Reproduction Life cycle pattern Classification, Life cycle of any one form- <i>Penicillium</i>	<b>3</b>
<b>IV</b>	<b>Class- Basicidiomycetes</b> Introduction, Occurrence, Economic Importance, Reproduction Life cycle pattern, Classification, Life cycle of any one form- <i>Ustilago</i>	<b>3</b>
<b>V</b>	<b>Class- Deuteromycetes</b> Introduction, Occurrence, Economic importance, Reproduction Classification, Life cycle of <i>Alternaria</i>	



<b>VI</b>	<b>Introduction –</b> Definition, branches, scope and economic Importance, Important Terminology - Incitants, Host, Parasite, Pathogen, Inoculum, Penetration, Infection, Incubation, Disease, Disease development, Symptoms, Sign, Endophyte, Predisposition, Suscept, Resistance, Epidemic, Etiology, Pathogenecity, Inanimate and Animate diseases, Economic importance of plant diseases	<b>3</b>
<b>VII</b>	<b>Introduction –</b> Definition, branches, scope and economic Importance, Important Terminology - Incitants, Host, Parasite, Pathogen, Inoculum, Penetration, Infection, Incubation, Disease, Disease development, Symptoms, Sign, Endophyte, Predisposition, Suscept, Resistance, Epidemic, Etiology, Pathogenecity Inanimate and Animate diseases, Economic importance of plant diseases.	<b>3</b>
<b>VIII</b>	<b>Disease Development</b> Concept of disease cycle, Inoculation, Prepenetration, Penetration, Infection, Dissemination, Epidemics - Forms, Decline, Exponential model, Disease forecasting, Measurement of plant disease and yield loss.	<b>3</b>
<b>IX</b>	<b>Defense Mechanisms</b> Concept and Definition, Types - Pre-existing - Structural and chemical, Induced - Structural and biochemical	<b>3</b>
<b>X</b>	<b>Methods of Studying Plant Diseases</b> Study of Macroscopic and Microscopic characters, Koch's postulates, Culture technique, types of media and preparation, Pure culture methods - streak plate, pour plate, spread plate and serial dilution	<b>2</b>
<b>XI</b>	<b>Fungal Plant Diseases</b> Characteristics of plant pathogenic fungi, Study of Diseases with reference to causal organism, symptoms and signs, disease cycle and control measures Club root of Crucifers, Downy mildew of Grapes, Head smut of Jowar, Leaf spot of Turmeric	<b>2</b>
<b>XII</b>	<b>Bacterial Plant Diseases</b> Characteristics of plant pathogenic Bacteria Study of Diseases with reference to causal organism, symptoms and signs, disease cycle and control measures -Citrus Canker and Black arm of Cotton	<b>3</b>

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2. Malhotra, R. S., Plant Pathology
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4. Sharma, P. D., Plant Pathology
5. Singh, R. S., Plant Disease
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### **DSE 6 Practical's based on MYCOLOGY AND PLANT PATHOLOGY**

1	Preparation of any one culture media used for isolation of plant pathogens.
2	Preparation of test tube slants and culture plates.
3	Inoculation Technique for preparation of pure culture - Serial dilution method, Streak plate, Pour plate and Spread plate techniques.
4	<b>Study of following diseases:</b> Fungal Diseases - Head smut of Jowar and Downy mildew of Grapes Bacterial Diseases - Citrus Canker and Black arm of Cotton Mycoplasma Diseases - Grassy shoot of sugarcane and Little leaf of Brinjal Viral Diseases - Tobacco Mosaic Disease and Bunchy top of Banana Non-pathogenic Diseases - Tip burn of Paddy and Black heart of Potato
5	Learn the technique of preparing Bordeaux mixture, Tobacco and Neem decoction.
6.	General Equipment, Their Uses and Precautions in Handling.

Title of the Course and Course Code	<b>Plant Molecular Biology and Biotechnology BOT 3606</b>	Number of Credits :2
<b>Course Outcomes (COs)</b>		
<b>On completion of the course, the students will be able to:</b>		
CO1	Describe the molecular aspects of transcription and translation.	
CO2	Explain different approaches in plant tissue culture.	
CO3	Illustrate the process of polymerase chain reaction with its applications.	
CO4	Differentiate various methods of secondary metabolite production and discuss the concepts of bioinformatics.	
CO5	Determine the applications of biotechnology with respect to transgenic plants and review the biosafety concepts of plant biotechnology.	
CO6	Revise the heterocatalytic activity of DNA and compile the plant tissue culture process and its applications.	

Unit. No.	Title of Unit and Contents	No. of Lectures
<b>I</b>	<b>RNA and Transcription</b> Structure of promoter and terminators Structure and role of m-RNA, brief introduction to mi-RNA, r-RNA, t-RNA and ribosome. Transcription apparatus. Overview of mechanism of transcription.	<b>5</b>
<b>II</b>	<b>Genetic Code and Translation</b> Genetic Code- Definition, Concept, Properties of Genetic code Translation- Definition, Mechanism of translation- Initiation, Elongation and Termination.	<b>4</b>
<b>III</b>	<b>Techniques in molecular Biology</b> Introduction, Agarose Gel electrophoresis, Nucleic Acid Hybridisation, Polymerase chain reaction.	<b>4</b>
<b>IV</b>	<b>Plant Biotechnology</b> Definition, scope and applications, Bioinformatics-NCBI, Use of bioinformatics tools.	<b>2</b>
<b>V</b>	<b>Plant Tissue Culture</b> Totipotency, Media components Organogenesis; Embryogenesis (somatic and zygotic), Somaclonal variations Protoplast isolation, culture and fusion; somatic hybrids, use of markers for selection of hybrid cells, cybrids Tissue culture applications: micro propagation, synthetic seeds, triploids, haploids, Germplasm Conservation and Cryopreservation.	<b>7</b>
<b>VI</b>	<b>Secondary metabolite production</b> Hairy root culture, Elicitation, Biotransformation, Commercial aspects	<b>4</b>
<b>VII</b>	<b>Applications of Biotechnology</b> Pest resistance (Bt-cotton), Herbicide resistant plants (transgenic soybean), Transgenic crops with improved quality traits (Golden rice), Bio safety concerns	<b>4</b>

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2. P.K. Gupta-Elements of Biotechnology
3. Satyanarayana-Biotechnology
4. Kalyan Kumar De-Plant tissue culture
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**DSE-4 Practical's based on Plant molecular biology and biotechnology**

1	Problem solving based on DNA transcription and translation.
2	Demonstration of separation of DNA by agarose gel electrophoresis.
3	Retrieval of data from NCBI.
4	Preparation of MS medium.
5	<i>In vitro</i> sterilization and inoculation methods using zygotic embryo and nodal/leaf explants.
6	Visit to tissue culture laboratory and submission of report.

Title of the Course and Course Code	<b>BOTANY PRACTICAL</b> Based on BOT 3601, BOT 3602 and BOT 3607	Number of Credits :2
<b>Course Outcomes (COs)</b> <b>On completion of the course, the students will be able to:</b>		
CO1	Identify the concept of TAN in CAM plants. Describe the variations produced by tissue culture in plants.	
CO2	Compare the types of pigments in leaves and interpret the chlorophyll content of different leaves.	
CO3	Implement qualitative analysis of Alkaloid, Glycoside and Tannin.	
CO4	Categorize different types of weeds in the field.	
CO5	Discriminate the various nursery techniques with respect to its utility.	
CO6	Write tour report and compile information on various types of gardens.	

Sr. No.	Title of Practical
1	Estimation of chlorophyll-a and chlorophyll-b by spectrometric Method. Describe different tools used for gardening.
2	Separation of photosynthetic pigments by Paper chromatography.
3	To determine diurnal fluctuation in TAN values of CAM plants.
4	Estimation of soluble proteins by Bradford method.
5	Separation of amino acids by paper chromatography
6	Demonstration of - Ringing experiment for path of solute translocation. Qualitative tests for alkaloids, tannins , starch and proteins
7	Soil analysis and seed bed preparation
8	Study of nursery techniques- Potting up, Seed identification and seed propagation, Vegetative propagation Cutting, layering and grafting techniques.
9	Weed identification (any five), and control measures for Weeds.
10	Bonsai, Dish garden demonstration.
11.	Listing of indoor and outdoor plants.
12	Visit and report of Park /Botanical garden.

Title of the Course and Course Code	<b>BOTANY PRACTICAL</b> Based on BOT 3603, BOT 3604 and BOT 3608	Number of Credits :2
<b>Course Outcomes (COs)</b> <b>On completion of the course, the students will be able to:</b>		
CO1	Identify the instruments used to measure microclimate variables.	
CO2	Compare different soil samples for their water holding capacity.	
CO3	Use colchicine treated onion root tips to examine tetraploidy. Infer the effect of chemical mutagen on seed germination.	
CO4	Analyze the herbaceous vegetation data of college campuses quantitatively with the list count quadrat method.	
CO5	Compare the hybridization techniques, determine seed viability using tetrazolium test, select Hot Spots of the World on the world map.	
CO6	Perform the experiment to specify the amount of dissolved oxygen from the polluted and unpolluted water samples.	

Sr. No.	Title of Practical
1	Study of instruments used to measure microclimatic variables: Soil thermometer, maximum and minimum thermometer, anemometer, psychrometer/hygrometer.
2	Determination of dissolved oxygen of water samples from polluted and unpolluted sources.
3	Study of water holding capacity of soil samples
4	Quantitative analysis of herbaceous vegetation in the college campus for frequency, density abundance with list count quadrat method and comparison with Raunkiaer's frequency distribution law.
5	Marking of Hot Spots of the World on the world map.
6	Visit to BSI to study biodiversity conservation.
7	Effect of chemical mutagens on seed germination and seedling growth by using suitable seed material.
8	Induction of auto polyploidy in <i>Allium cepa</i> by colchicine.
9	Demonstration of hybridization techniques by using suitable plant material.
10	Demonstration of seed sampling equipment's with the help of photographs.
11	Assessing seed viability by tetrazolium test.
12	Visit to seed processing unit to study different instruments / Visit to any one of the following Seed Production Organizations- National Seed Corporation, State Seed Corporation, State Seed Certification Agencies and Private Seed Companies

Title of the Course and Course Code	<b>BOTANY PRACTICAL</b> Based on BOT 3605, BOT 3606 and BOT 3609	Number of Credits :2
<b>Course Outcomes (COs)</b> <b>On completion of the course, the students will be able to:</b>		
CO1	Identify different plant diseases based on its symptoms.	
CO2	Discuss the techniques of inoculation and isolation of plant pathogens.	
CO3	Implement the bioinformatics tools in retrieval of genetic information from databases. Infer the amount of proteins in seeds.	
CO4	Explain the technique of separation of DNA by agarose gel electrophoresis method.	
CO5	Validate the concept of transcription and translation by solving problems. Assess the results of experiments, calculate the result and interpret it with the help of graphs.	
CO6	Plan and design experiments on plant tissue culture using different types of explants. Compile the results and specify the applications of tissue culture.	

Sr. No.	Title of Practical
1	Preparation of any one culture media used for isolation of plant pathogens.
2	Preparation of test tube slants and culture plates.
3	Inoculation Technique for preparation of pure culture - Serial dilution method, Streak plate, Pour plate and Spread plate techniques.
4	Study of following diseases: i. Fungal Diseases - Head smut of Jowar and Downy mildew of Grapes ii. Bacterial Diseases - Citrus Canker and Black arm of Cotton iii. Mycoplasma Diseases - Grassy shoot of sugarcane and Little leaf of Brinjal iv. Viral Diseases - Tobacco Mosaic Disease and Bunchy top of Banana v. Non-pathogenic Diseases - Tip burn of Paddy and Black heart of Potato
5	Learn the technique of preparing Bordeaux mixture, Tobacco and Neem decoction.
6.	General Equipments, their Uses and Precautions in Handling
7	Problem solving based on DNA transcription and translation.
8	Demonstration of separation of DNA by agarose gel electrophoresis.
9	Retrieval of data from NCBI.
10	Preparation of MS medium.
11	<i>In vitro</i> sterilization and inoculation methods using zygotic embryo and nodal/leaf explants.
12	Visit to tissue culture laboratory and submission of report.

Title of the Course and Course Code	<b>MEDICO-BOTANY BOT3611</b>	Number of Credits :2
<b>Course Outcomes (COs)</b>		
<b>On completion of the course, the students will be able to:</b>		
CO1	List different methods of drug adulteration, extraction and evaluation.	
CO2	Categorize and Classify different natural drugs. Associate active principal of drug plants with its application.	
CO3	Generalize cultivation, collection and processing of herbal drugs.	
CO4	Identify and differentiate medicinally important drugs with respect to plant part used.	
CO5	Compare and review different ayurvedic formulations.	
CO6	Write report on ethnobotany and its economic importance.	

Unit. No.	Title of Unit and Contents	No. of Lectures
<b>I</b>	<b>Introduction to Pharmacognosy</b> Origin, history, definition and scope of Pharmacognosy Methods of classification and their significance in the study of drugs of natural origin with respect to alphabetical, biological, chemical, chemo taxonomical, pharmacological and taxonomical characters.	<b>3</b>
<b>II</b>	<b>Ayurvedic Pharmacy</b> Introduction, Tridosha concept, Humoral, Indigenous systems of medicine - Ayurveda, Siddha, Unani, Tibi, Chinese and Ayusha, Ayurvedic principles - Ras, Guna, Vipaka, Virya, Prabhava, Ayurvedic formulations - Asava, Arishta, Kvatha, Churna, Ksharas, Leha, Guti, Vatika, Taila, Bhasma.	<b>5</b>
<b>III</b>	<b>Analysis of Traditional plant-based products</b> Drug adulteration, Methods of extraction - percolation, maceration and Soxhlet extraction of different classes of phytochemicals of crude drugs, Methods of drug evaluation - Morphological, Microscopic, Chemical and Physical. Methods of analysis of Honey, Keshar and Turmeric.	<b>4</b>
<b>IV</b>	<b>Cultivation, collection and processing of herbal drugs from <i>Mentha</i>, <i>Withania somnifera</i> and <i>Garcenea</i></b> Cultivation – Methods and Factors affecting cultivation, Collection and Processing - Collection, harvesting, drying, garbling, packing and storage of crude drugs.	<b>3</b>



<b>V</b>	<b>Study of Medicinally Important Drugs</b> Study of drugs with respect to occurrence, distribution, cultivation, microscopic characters, constituents and uses of the following plants: Root Rhizome drugs - <i>Glycyrrhiza</i> , Stem drugs - <i>Ephedra</i> , Leaf drugs - <i>Adhatoda</i> , Flower drugs - Clove, Fruit drugs - Amla, Unorganized drugs - Asafoetida and <i>Acacia</i> gum.	<b>5</b>
<b>VI</b>	<b>Applied Medicinal Botany</b> Study of drugs with respect to - Biological source, geographical distribution, common varieties, macro and microscopic characters, chemical constituents and therapeutic uses and adulterants of the following plants / drugs: <i>Strychnos nux vomica</i> - Seeds, <i>Hemidesmus indicus</i> , Concept of active principle and major metabolic Pathway (Carbohydrates and Proteins) leading to the production of therapeutically active chemical constituents of <i>Chilanthus albomarginata</i> and Taxon. Concept, definition and introduction to Biopharmaceutics, Pharmacodynamics and Clinical pharmacokinetics with applications.	<b>5</b>
<b>VII</b>	<b>Ethnobotany and Economic Botany</b> Definition, principles, scope and ethnic societies in India, Introduction to Economic Botany and its scope, Important Botanical Resources - Botanical resources of any five examples of non-wood forest products (NWFPs), such as paper making and Gums, Origin, evolution, source and uses of Rice, <i>Curcuma longa</i> , Safflower, Sugarcane, <i>Butea monosperma</i> / <i>Samanea saman</i> / <i>Sclleichera oleosa</i> and Rose.	<b>5</b>

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- 15 Verma, V. (2009). Textbook of Economic Botany.
- 16 Prajapati, N. D., (2010). A Handbook of Medicinal Plants.

Title of the Course and Course Code	Mushroom Culture Technique BOT3612	Number of Credits :2
<b>Course Outcomes (COs)</b> <b>On completion of the course, the students will be able to:</b>		
CO1	Identify and define types of mushrooms. (Edible and poisonous).	
CO2	Discuss infrastructure, composting technology and other factors affecting cultivation technology.	
CO3	Classify different kinds of substrates for mushroom cultivation and infer the skillset to prepare media for mushroom cultivation from these substrates.	
CO4	Categorize mushroom storage and analyse their nutritional value.	
CO5	Test and evaluate the food prepared at various levels of research centres.	
CO6	Develop knowledge for self-employment such as cost benefit ratio and marketing statistics.	

Unit. No.	Title of Unit and Contents	No. of Lectures
<b>I</b>	<b>Introduction to Mushrooms</b> Introduction, history, nutritional and medicinal value of edible Mushrooms, Poisonous Mushrooms Edible mushrooms available in India: <i>Volvariella volvacea</i> <i>Pleurotus citrinopileatus Agaricus bisporus</i> .	<b>6</b>
<b>II</b>	<b>Cultivation Technology</b> Infrastructure, substrates (locally available), Polythenebags, vessels, inoculation hook, inoculation loop, lowcost stove, sieves, culture rack, mushroom unit (Thatched House), water sprayer, tray, pureculture: Medium, sterilization, preparation of spawn, multiplication, Mushroom bed preparation - paddystraw, sugarcane trash, maize straw, banana leaves, Factors affecting the mushroom bed preparation, Low cost technology, Composting technology in mushroom production.	<b>8</b>

<b>III</b>	<b>Storage and nutrition</b> Short-term storage (Refrigeration - upto 24hours) Long-term storage (canning, pickles, papads), drying, storage in salt solutions, Nutrition - Proteins, aminoacids, mineral elements nutrition, Carbohydrates, Crude fibre contents, Vitamins.	<b>8</b>
<b>IV</b>	<b>Food Preparation</b> Types of foods prepared from mushroom. Research Centres - National level and Regional level, Cost benefit ratio, Marketing in India and abroad, Export Value.	<b>8</b>

**References:**

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