

**Deccan Education Society's
FERGUSON COLLEGE, PUNE
(AUTONOMOUS)**

SYLLABUS UNDER AUTONOMY

THIRD YEAR B.Sc. BOTANY

SEMESTER - V

Academic Year 2018-2019

**Deccan Education Society's
FERGUSSON COLLEGE (AUTONOMOUS), PUNE 411004
Scheme of Course Structure (Faculty of Science)
2018-2019
T. Y. B. Sc. - Botany**

Semester	Course Code	Title	Paper No.	Credits	Exam (I / E)	Marks (50 / 50)
V	BOT3501	Cryptogamic Botany	I	3	I / E	50 / 50
	BOT3502	Cell Biology	II	3	I / E	50 / 50
	BOT3503	Genetics and Evolution	III	3	I / E	50 / 50
	BOT3504	Spermatophyta and Palaeobotany	IV	3	I / E	50 / 50
	BOT3505	Horticulture, Floriculture and Gardening	V	3	I / E	50 / 50
	BOT3506	Bio-fertilizers	VI	3	I / E	50 / 50
	BOT3507	Techniques in Plant Sciences and Biostatistics	VII	3	I / E	50 / 50
	BOT3508	Ethnobotany	VIII	3	I / E	50 / 50
	BOT3511	Botany Practical - I	Practical - I	2	I / E	50 / 50
	BOT3512	Botany Practical - II	Practical - II	2	I / E	50 / 50
BOT3513	Botany Practical - III	Practical - III	2	I / E	50 / 50	
VI	BOT3601	Plant Physiology and Biochemistry	I	3	I / E	50 / 50
	BOT3602	Plant Molecular Biology and Biotechnology	II	3	I / E	50 / 50
	BOT3603	Plant Ecology and Biodiversity	III	3	I / E	50 / 50
	BOT3604	Plant Breeding and Seed Technology	IV	3	I / E	50 / 50
	BOT3605	Mycology and Plant Pathology	V	3	I / E	50 / 50
	BOT3606	Mushroom Culture Technology	VI	3	I / E	50 / 50
	BOT3607	Medico-Botany	VII	3	I / E	50 / 50
	BOT3608	Nursery and Gardening	VIII	3	I / E	50 / 50
	BOT3611	Botany Practical - IV	Practical - IV	2	I / E	50 / 50
	BOT3612	Botany Practical - V	Practical - V	2	I / E	50 / 50
	BOT3613	Botany Practical - VI	Practical - VI	2	I / E	50 / 50

T. Y. B.Sc. (BOTANY) SEMESTER - V
BOTANY PAPER - I
TITLE: CRYPTOGAMIC BOTANY
PAPER CODE: BOT3501

[CREDITS - 3]

Learning Objectives:

1. To study diversity of plants.
2. To study classification and comparative account of cryptogams.

Unit - I	<p>CRYPTOGAMS Introduction - Definition, Types: Lower Cryptogams and Higher Cryptogams, brief review with examples. Algae 1.1 General characters, economic importance, role of algae in biofuels and thallus organization 1.2 Recent Classification of algae up to classes. 1.3 Study of life cycle of algae with reference to taxonomic position, occurrence, thallus structure and reproduction of <i>Chlorella</i>, <i>Nostoc</i>, <i>Chara</i>, <i>Sargassum</i> and <i>Batrachospermum</i>. 1.4 Thallus organization in algae.</p>	12
Unit - II	<p>Fungi 2.1 General characters and economic importance. 2.2 Recent Classification of Fungi up to classes. 2.3 Study of life cycle of fungi with reference to taxonomic position, thallus structure 2.4 Reproduction of <i>Rhizopus</i>, <i>Uncinulla</i>, <i>Puccinia</i> and <i>Cercospora</i>.</p>	12
Unit - III	<p>Bryophytes 3.1 General characters and economic importance 3.2 Recent Classification of Bryophytes up to classes, on basis of Database of Chromosomes. 3.3 Study of life cycle of Bryophytes with reference to taxonomic position, thallus structure (Morphology and anatomy), reproduction and sporophyte structure of 3.4 <i>Plagiochasma or Targionia</i> 3.5 <i>Anthoceros</i> 3.6 <i>Funaria</i>.</p>	12
Unit - IV	<p>Pteridophytes 4.1 General characters and economic importance 4.2 Classification of pteridophytes recent up to classes. 4.3 Study of life cycle of Pteridophytes with reference to taxonomic position, Morphology, anatomy, reproduction, gametophytes and sporophyte of 4.4 <i>Psilotum</i>, 4.5 <i>Selaginella</i> 4.6 <i>Marsilea</i>. (Development of sex organs and sporophyte are not expected.)</p>	12
References:		

1. Vashishta, B. R., Botany for degree students - Algae
2. Das, Datta and Gangulee - College Botany Vol. I
3. Sharma, O. P. - Algae
4. Vashishta, B. R., 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. Vashishta, B. R., Botany for degree students: Bryophytes - Vol. - III
10. Parihar, N. S. (1991). Bryophyta. Central Book Depot, Allahabad.
11. Puri, P. (1980), Bryophytes, Atma Ram and Sons, Delhi.
12. Alexopoulos, C. J., Mims, C. W. and Blackwell, M. I. (1996). Introductory Mycology, John Wiley and Sons Inc.
13. Kumar, H. D. (1988), Introductory Phycology, Affiliated East - West Press Ltd., New Delhi.
14. Sporne, K. R. (1991). The Morphology of Pteridophytes, B. I. Publishing Pvt. Ltd., Bombay.

T. Y. B.Sc. (BOTANY) SEMESTER - V
BOTANY PAPER - II
TITLE: CELL AND MOLECULAR BIOLOGY
PAPER CODE: BOT3502

[CREDITS - 3]

Learning Objectives:		
1. To understand the fundamentals of cell and its organelles.		
2. To impart knowledge of basic concepts in Molecular Biology.		
	Title and Contents	No. of Lectures
Unit - I	Cell Biology Introduction of Cell Biology 1.1 Definition and brief history. 1.2 Units of measurement of cell. 1.3 Prokaryotic and Eukaryotic cell. 1.4 Advances and scope.	4
Unit - II	Cytoplasmic Matrix 2.1 Physical nature of cytoplasmic matrix. 2.2 Chemical organization - organic and inorganic compounds of cytoplasmic matrix.	3
Unit - III	Plant Cell Wall and Cell Membrane 3.1 Ultrastructure and function of plant cell wall. 3.2 Overview of models of plasma membrane structure. 3.3 Ultrastructure and functions of cell membrane.	5
Unit - IV	Cell Organelles Structural organization and functions of Mitochondria, Chloroplast, Endoplasmic Reticulum, Golgi apparatus, Lysosomes, Microbodies and Vacuoles.	9
Unit - V	Plant Cell - Nucleus and Chromosomes 5.1 Nucleus - Morphology, ultrastructure, nuclear pore complex, nucleoplasm, nucleolus, function. 5.2 Chromosome - Number, morphology, structure, karyotype and ideogram. 5.3 Chromosome - Chemical composition, Euchromatin and Heterochromatin, Giant chromosomes.	5
Unit - VI	Cell Division 6.1 Phases of cell cycle. 6.2 Mitosis. 6.3 Meiosis. 6.4 Significance of cell cycle.	4
Unit - VII	Molecular Biology 6.1 Definition and History. 6.2 Scope and Importance. 6.3 Central Dogma of Molecular Biology. 6.4 Model organism used.	5
Unit - VIII	Nature of Genetic Material 7.1 Different types of genetic materials. 7.2 Physical and Biological evidences to prove DNA and RNA as genetic material. 7.3 Franklin and Wilkin's work on DNA structure, Chargoff's law. 7.4 Watson and Cricks Model of DNA 7.5 Forms of DNA - A, B and Z	4
Unit - IX	DNA Replication 8.1 Introduction and types 8.2 Messelson and Stahl's Experiment 8.3 Molecular mechanism of DNA replication	3

Unit - X	DNA Damage and Repair 9.1 Introduction 9.2 Causes, types and effects 9.3 DNA repair system - Photo reactivation, Dark excision repair	3
Unit - XI	Gene Organisation 10.1 Promoter - Structure and function in Prokaryotes and Eukaryotes 10.2 Terminators 10.3 Split genes and jumping genes	3
<p>References:</p> <ol style="list-style-type: none"> 1. S. C. Rastogi, Cell and Molecular Biology 2. T. S. Verma and V. K. Agarwal, Cytology 3. C. B. Pawar, Cell Biology 4. P. K. Gupta, Cell and Molecular Biology 5. Veer Bala Rastogi, Fundamentals of Molecular Biology 6. G. K. Pal and Ghaskadabi, Fundamentals of Molecular Biology 7. Text book of Molecular Biology, Verma and Agarwal 8. Robertis and DeRobertis, Cell and Molecular Biology 9. Buchanan B. B., Biochemistry and Molecular Biology of Plants 10. Wolfe S.L., Molecular and Cell Biology <p>E-Books:</p> <ol style="list-style-type: none"> 1. R. M., Thyman, Advanced Molecular Biology, Garland Science 2. B. Alberts, Molecular Biology of the Cell, Garland Science 3. Clark and Pazdernik, Molecular Biology, Elsevier and Academic Press 4. James D. Watson, Molecular Biology of the Gene - 7th edition. 		

T. Y. B.Sc. (BOTANY) SEMESTER - V
BOTANY PAPER - III
TITLE: GENETICS AND EVOLUTION
PAPER CODE: BOT3503

[CREDITS - 3]

Learning Objectives:

1. To study heredity, linkage, crossing over and multiple alleles.
2. To study sex determination and sex linked inheritance in plants and insects.
3. To understand Genetics and Evolution of plants.

	Title and Contents	No. of Lectures
Unit - I	Introduction to Genetics Heredity 1.1 Genetical terminology 1.2 Brief life history of Mendel 1.3 Laws of Inheritance: Law of dominance, Law of segregation and Law of independent assortment 1.4 Monohybrid cross, Dihybrid cross, Trihybrid cross, Back cross and Test cross 1.5 Modified Mendelian Ratios: Complementary Genes (9:7), Duplicate Genes (15:1), Masking Genes (12:3:1), Supplementary Genes (9:3:4), Inhibitory Genes (13:3), Lethal Genes (2:1)	8
Unit - II	Linkage 2.1 History of Linkage - Sutton - Boveri Chromosome theory of heredity 2.2 Bateson and Punnett's Coupling and Repulsion Hypothesis 2.3 Types of Linkages - Complete and Incomplete Linkage 2.4 Linkage maps based on two point test cross and three point test cross 2.5 Chromosome theory of Linkage 2.6 Significance of Linkage	5
Unit - III	Crossing Over 3.1 Types of crossing over somatic and meiotic crossing over 3.2 Mechanism of meiotic crossing over 3.3 Cytological detection of crossing over 3.4 Significance of crossing over	5
Unit - IV	Multiple Allele 4.1 Character of multiple alleles 4.2 Examples of multiple alleles Coat colour in Rabbit and ABO blood series in Humans 4.3 Eye colour in <i>Drosophila</i> 4.4 Self Sterility in plants	5
Unit - V	Sex determination and Sex linked Inheritance 5.1 Genetically controlled sex determining mechanisms 5.2 Sex chromosomal mechanism of sex determination 5.3 Sex determination in man and plants 5.4 Inheritance of X-linked (sex-linked) genes for eye colour in <i>Drosophila</i> 5.5 Inheritance of X-linked (sex-linked) genes in Humans 5.6 Inheritance of Y-linked or Holandric genes in Humans 5.7 Sex influenced genes - baldness in Humans	7

Unit - VI	Quantitative Inheritance 6.1 Concept and Characters of multiple genes 6.2 Multiple factor Hypothesis - Kernel colour in Wheat 6.3 Inheritance of quantitative trait in Maize (Cob length) 6.4 Cytoplasmic inheritance - Definition and concept 6.5 Chloroplast - Variegation in Four O'clock plants	6
Unit - VII	Introduction to Evolution 7.1 Definition, inorganic and chemical or molecular evolution and organic life 7.2 Organic and biological evolution and origin of species 7.3 Fact of evolution and compared with ancient history 7.4 Misconception of evolutionary biology and significance	2
Unit - VIII	Development of the Idea of Organic Evolution 8.1 Period of Obscurity 8.2 Period of ancient Greek and Romans 8.3 Pre-Darwinian Period 8.4 Darwinian Period 8.5 Post-Darwinian Period 8.6 Present status of evolution	2
Unit - IX	Direct Evidences of Evolution - Fossils 9.1 Paleontological evidences 9.2 Branches of Palaeontology 9.3 Condition of Fossilisation, formation of rock 9.4 Determination of age of rock and fossils 9.5 Nature and types of fossils 9.6 Significance of fossils	2
Unit - X	Indirect Evidences of Evolution 10.1 Evidences from taxonomy, anatomy and embryology 10.2 Evidences from comparative physiology and biochemistry 10.3 Evidences from comparative cytology and genetics 10.4 Evidences from bio-geographical relations	3
Unit - XI	Theories of Organic Evolution 11.1 Theory of inheritance of acquired characters (Lamarckism) 11.2 Theory of Natural selection (Darwinism) 11.3 Darwin-Wallace theory of Natural selection 11.4 Modern synthetic theory 11.5 Weismann's germplasm theory 11.6 Mutation theory	3
References:		
<ol style="list-style-type: none"> Gardner E. J., Simmons M. J., Snustad D. P. (2008). Principles of Genetics. Snustad, D. P. and Simmons, M. J. (2010). Principles of Genetics. Klug W. S., Cummings M. R., Spencer, C., Palladino, M. (2011). Concepts of Genetics. Griffiths, A. J. F., Wessler, S. R., Carroll, S. B., Doebley, J. (2010). Introduction to Genetic Analysis. Pierce B. A. (2011) Genetics: A Conceptual Approach, 4th edition, Macmillan Higher Education Learning. Singh, B. D. (2005). Plant Breeding: Principles and Methods. Chaudhari, H. K. (1984). Elementary Principles of Plant Breeding. P. S. Verma and V. K. Agarwal (2010). Cell Biology, Genetics, Molecular Biology, Evolution and Ecology. 		

T. Y. B.Sc. (BOTANY) SEMESTER - V
BOTANY PAPER - IV
TITLE: SPERMATOPHYTA AND PALAEOBOTANY
PAPER CODE: BOT3504

[CREDITS - 3]

Learning Objectives:

1. To study Gymnospermic plants and their classification.
2. To study Angiospermic plants with respect to their classification and identification.
3. To study Paleobotany in detail.

	Title and Contents	No. of Lectures
Unit - I	Introduction to Gymnosperms 1.1 Introduction and general characters 1.2 Economic importance 1.3 Classification of Gymnosperms upto order	2
Unit - II	Study of life cycle of <i>Pinus</i> 2.1 Distribution, morphology and anatomy 2.2 Reproduction, Gametophyte and Sporophyte 2.3 Seed Structure 2.4 Alternation of generations	5
Unit - III	Study of life cycle of <i>Gnetum</i> 3.1 Distribution, morphology and anatomy 3.2 Reproduction, Gametophyte and Sporophyte 3.3 Seed Structure 3.4 Alternation of generations	5
Unit - IV	Introduction to Angiosperms 4.1 Origin with reference to time, place and ancestry 4.2 Pteridosperms theory 4.3 Bennettitalean theory 4.4 Gnetalean theory	3
Unit - V	Systems of Classification 5.1 Review of artificial, natural and phylogenetic systems (General account) 5.2 Hutchinson System - Outline and assumptions, merits and limitations 5.3 Advanced Angiospermic Phylogenetic Group System - IV (APG - IV) - Outline and assumptions, merits and limitations	4
Unit - VI	Study of Families 6.1 Bentham and Hooker's system of classification 6.2 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, Bignoniaceae, Verbenaceae, Convolvulaceae, Rubiaceae, Nyctaginaceae, Orchidaceae and Cannaceae	12
Unit - VII	Tools of Taxonomy 7.1 Floras 7.2 Herbarium techniques	2

	7.3 Importance of Botanical Gardens 7.4 Role of Botanical Survey of India (BSI)	
Unit - VIII	Plant Identification 8.1 Latin diagnosis 8.2 Practicing indented and bracketed keys 8.3 Preparation of artificial keys 8.4 Plant authentication	3
Unit - IX	Palaeobotany Geological time scale, form, genera, concept and nomenclature	1
Unit - X	Fossils 10.1 Definition and process of fossil formation 10.2 Conditions favourable for fossilization 10.3 Types of fossils - Impression, Compression, Petrification, Pith cast and Coal ball, Amber, Chemical Fossil, Pseudofossil and Microfossil.	3
Unit - XI	Study of Fossil Plant Groups 11.1 Psilopsida - Salient features of order Psilophytales, external and internal morphology of <i>Rhynia</i> 11.2 Lycopsidea - Salient features of order Lepidodendrales, external and internal morphology of <i>Lepidodendron</i> 11.3 Sphenopsida - Salient features of Calamitales, external and internal morphology of <i>Calamites</i> 11.4 Pteridosperms - External and internal morphology of <i>Lyginopteris oldhamia</i> . 11.5 Pentoxylae - Salient features, external and internal morphology of stem (<i>Pentoxylon</i>), Leaf (<i>Nipaniophyllum</i>).	8
References:		
<ol style="list-style-type: none"> 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, 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. 		

T. Y. B.Sc. (BOTANY) SEMESTER - V
BOTANY PAPER - V
TITLE: HORTICULTURE, FLORICULTURE AND GARDENING
PAPER CODE: BOT3505

[CREDITS - 3]

Learning Objectives:

1. To study about the types of gardening.
2. To study importance and cultivation of wild plants in laboratory conditions.
3. To know about the cultivation of cut flowers by using green house technology.
4. To know about the methods of drying plant material, their arrangements and preservations.

	Title and Contents	No. of Lectures
Unit - I	Introduction to Horticulture: 1.1 Definition and branches 1.2 Scope and economic importance of Horticultural crops 1.3 Export and import potential of Horticultural crops 1.4 Horticultural zones of India and Maharashtra 1.5 Global and National Scenario of Horticulture	2
Unit - II	Horticultural Plants 2.1 Nutritive value of fruits and vegetables 2.2 Classification of Horticultural crops 2.3 Classification of Vegetables, Fruits, Ornamental plants, Spices and Flowers	2
Unit - III	Special Practices in Horticulture 3.1 Training and Pruning - Objectives, types, systems of trainings 3.2 Fruit crops - Special practices like Bahar treatment, Girdling, Notching, Ringing, Bending 3.3 Vegetable crops special practices - Earthing up, Staking, Blanching	4
Unit - IV	Introduction to Fruits and Vegetables Production Technology 4.1 Soil and climate requirements 4.2 Commercial varieties 4.3 Harvesting and post harvesting management 4.4 Plant protection methods 4.5 Fruits - Banana and Mango 4.6 Vegetables - Tomato, Grapes and <i>Sterculia</i>	8
Unit - V	Introduction to Gardening and Landscaping Gardening 5.1 Introduction of wild plants as garden plants 5.2 Successful stories of cultivation of 25 wild plants of ornamental value from Western Ghats. 5.3 Landscaping Places of public importance 5.4 Landscaping highways and educational institutions	8
Unit - VI	Principles of Garden Designs 6.1 Types of Gardens - Botanical Garden, Medicinal Garden and Nakshatra Garden, English, Italian, French, Persian, Mughal and Japanese Gardens 6.2 Features of Garden - Garden wall, Fencing, Steps, Hedge, Edging, Lawn, Flower beds, Shrubbery, Borders	8

	<p>and Water Garden.</p> <p>6.3 Some famous gardens of India. (Vrindavan Garden, Lalbagh Garden, Lucknow Botanical Garden and National Botanical Garden, Kolkata.</p> <p>6.4 Vertical Garden and Oxygen Park</p>	
Unit - VII	<p>Introduction to Floriculture</p> <p>7.1 Definition and Concept</p> <p>7.2 Scope and Importance of Floriculture</p> <p>7.3 Important Floriculture crops</p> <p>7.4 Methods of cultivation for cultivation of - <i>Gerbera</i>, <i>Gladiolus</i>, Orchids, Carnation and Lily, use of Green House Technology for cultivation of flowers</p>	8
Unit - VIII	<p>Flower Industry</p> <p>8.1 Dry Flowers</p> <p>i. Introduction</p> <p>ii. Indian market of dry flowers, selection of material</p> <p>iii. Techniques of drying - Air drying, sun drying, press drying, desiccants, oven and microwave drying methods.</p> <p>iv. Preservation methods, bleaching, dyeing and painting</p> <p>v. Storage, care of dried flowers etc.</p> <p>vi. Dry flower arrangement and drift wood arrangement</p> <p>8.2 Cut Flowers</p> <p>i. Introduction</p> <p>ii. Species and cultivars of Orchids, <i>Anthuriums</i> and <i>Heliconias</i></p> <p>iii. Harvesting techniques</p> <p>iv. Mode of harvesting</p> <p>v. Post harvest handling - Conditioning, precooling, pulsing and impregnation, grading, bunching, wrapping, packing and cold storage, transport of cut flowers</p> <p>vi. Indian market of cut flowers</p>	8

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.
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10. Gurcharan Singh, Randhawa and Amitabha Mukhopadhyay, Floriculture in India, Allied Publishers.
11. Debashish Sengupta and Raj Kamal, Floriculture Marketing in India, (Excel Books).

T. Y. B.Sc. (BOTANY) SEMESTER - V
BOTANY PAPER - V
TITLE: BIO-FERTILIZERS
PAPER CODE: BOT3506

[CREDITS - 3]

Learning Objectives:

1. To study about the types of bio-fertilizers.
2. To study mass cultivation of bio-fertilizers.
3. To visit and prepare the project on the topic.

	Title and Contents	No. of Lectures
Unit - I	1.1 General account about the microbes used as Biofertilizer and <i>Rhizobium</i> isolation. 1.2 Identification, mass multiplication, carrier based inoculants, Actinorrhizal symbiosis.	4
Unit - II	2.1 <i>Azospirillum</i> : Isolation and mass multiplication carrier based inoculant, associative effect of different micro-organisms. 2.2 <i>Azotobacter</i> : Classification, characteristics - crop response to <i>Azotobacter</i> inoculum 2.3 Maintenance and mass multiplication.	8
Unit - III	3.1 Cyanobacteria (blue green algae), <i>Azolla</i> and <i>Anabaena Azollae</i> association 3.2 Nitrogen fixation, factors affecting growth, blue green algae and <i>Azolla</i> in rice cultivation.	4
Unit - IV	4.1 Mycorrhizal association, types of mycorrhizal association 4.2 Taxonomy, occurrence and distribution 4.3 Effect of phosphorus nutrition on growth and yield 4.4 Colonization of VAM - isolation and inoculum production of VAM and its influence on growth and yield of crop plants.	8
Unit - V	5.1 Organic Farming - Green manuring and organic fertilizers 5.2 Recycling of biodegradable municipal, agricultural and industrial wastes 5.3 Bio-compost making methods, types and methods of vermicomposting 5.4 Field applications.	6
Unit - VI	6.1 Field Visit 6.2 Project Report	15

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 Jothi Prakash, E., 2004, Outlines of Plant Biotechnology, Emkay Publication, New Delhi.
4. Sathe, T. V., 2004, Vermiculture and Organic Farming, Daya Publishers.
5. Subha Rao, 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.

T. Y. B.Sc. (BOTANY) SEMESTER - V
BOTANY PAPER - VI
TITLE: TECHNIQUES IN PLANT SCIENCES AND BIOSTATISTICS
PAPER CODE: BOT3507

[CREDITS - 3]

Learning Objectives:

1. To study botanical techniques and their applications in research.
2. To understand basics of biostatistics and its application.

	Title and Contents	No. of Lectures
Unit - I	Microscopes 1.1 Introduction - History and purpose of microscopic examination 1.2 Types of microscopes - Dissecting, stereoscopic-optic principle and uses 1.3 Compound microscopes - Construction, parts, working, optic principle and uses	4
Unit - II	Image Documentation 2.1 Camera lucida - Principle and types 2.2 Photomicrography - Principle and uses of SLR cameras	3
Unit - III	Micrometry 3.1 Introduction - Principle, Micrometer types, Eye piece - Reticle / Inserts and Stage micrometer 3.2 Calibration of ocular scale and microscope	3
Unit - IV	Chromatography 4.1 Introduction - Definition and concept of partition coefficient 4.2 Paper Chromatography - Principle, method and advantages 4.3 Thin Layer Chromatography - Principle, method and advantages	5
Unit - V	Spectrophotometry 5.1 Definition - General principle, Beer and Lambert's law and mechanics of measurement 5.2 Working and Application of Spectrophotometer	4
Unit - VI	Centrifugation 6.1 Definition and factors affecting rate of sedimentation 6.2 Types of Centrifugation	2
Unit - VII	Electrochemical Techniques 7.1 Principle - pH meter, reference electrode, indicator electrode and oxygen electrode 7.2 Calibration of pH meter 7.3 Applications of Electrochemical Techniques	3
Unit - VIII	Introduction to Biostatistics 8.1 Definition 8.2 Statistical terms - Population, sample, primary and secondary data, qualitative and quantitative data, variables, discrete and continuous variables and statistical error.	2

Unit - IX	Sampling Techniques 9.1 Introduction 9.2 Methods of Sampling - Serial Random Sampling and Stratified Sampling	2
Unit - X	Diagrammatic and Graphic Representation of Data 10.1 Introduction 10.2 Diagrammatic representation of data - Bar diagram and Pie diagram	3
Unit - XI	Measures of Central Tendency 11.1 Introduction 11.2 Calculation of arithmetic mean, median and mode in an ungrouped data	3
Unit - XII	Measures of Dispersion 12.1 Introduction 12.2 Methods of measuring dispersion A. Range - Characteristic of Range and coefficient of range B. Variance and Standard Deviation - Calculation of Standard Deviation and coefficient of Variation	3
Unit - XIII	Test of Significance 13.1 Introduction 13.2 Laying down of hypothesis - Null hypothesis, Alternative hypothesis and level of significance 13.3 Test based on normal distribution [Large sample test] • Testing one population mean • Testing equality of two population mean 13.3 Student's t-test [Small sample test] • Testing one population mean • Testing equality of two population mean • Paired t-test 13.4 Chi-Square test as a test of goodness of fit and its significance	11

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, Soloman 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. (BOTANY) SEMESTER - V
BOTANY PAPER - VI
TITLE: ETHNOBOTANY
PAPER CODE: BOT3508

[CREDITS - 3]

Learning Objectives:

1. To study the Traditional Botany.
2. To know the tribal societies and related plants.
3. To know the tribal medicines.

	Title and Contents	No. of Lectures
Unit - I	<p>Introduction to Ethnobotany</p> <p>1.1 Introduction, concept, scope and objectives</p> <p>1.2 Ethnobotany as an interdisciplinary science. The relevance of Ethnobotany in the present context</p> <p>1.3 Major and minor Ethnic groups or Tribals of India and their life styles.</p> <p>1.4 Plants used by the Tribals:</p> <p>(a) Food plants</p> <p>(b) Intoxicants and Beverages</p> <p>(c) Resins and oils</p> <p>(d) Miscellaneous uses</p>	6
Unit - II	<p>Role of Ethnobotany</p> <p>2.1 Role of Ethnobotany in modern medicine</p> <p>2.2 Medico and ethno-botanical sources in India</p> <p>2.3 Significance of the following plants in ethno-botanical practices along with their habitat and morphology:</p> <p>(a) <i>Azadiractha indica</i></p> <p>(b) <i>Ocimum sanctum</i></p> <p>(c) <i>Vitex negundo</i></p> <p>(d) <i>Gloriosa superba</i></p> <p>(e) <i>Tribulus terrestris</i></p> <p>(f) <i>Pongamia pinnata</i></p> <p>(g) <i>Cassia auriculata</i></p> <p>(h) <i>Indigofera tinctoria</i></p> <p>2.4 Role of Ethnobotany in modern medicine with special examples:</p> <p>(a) <i>Rauwolfia serpentina</i></p> <p>(b) <i>Trichopus zeylanicus</i></p> <p>(c) <i>Artemisia</i></p> <p>(d) <i>Withania</i></p> <p>2.5 Role of ethnic groups in conservation of plant genetic resources. Endangered taxa and forest management (participatory forest management)</p>	10
Unit - III	<p>Ethnobotany and legal aspects</p> <p>3.1 Ethnobotany as a tool to protect interests of ethnic groups.</p> <p>3.2 Sharing of wealth concept with few examples from India.</p> <p>3.3 Biopiracy, Intellectual Property Rights and Traditional Knowledge.</p>	8
Unit - IV	<p>Methodologies of Ethnobotanical Studies</p> <p>4.1 (a) Field Work</p>	6

	(b) Herbarium (c) Ancient Literature (d) Archaeological findings (e) Temples and sacred places	
Unit - V	5.1 Field Visit 5.2 Project Report	15

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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 of Ethnobotanists, Lucknow, India.
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T. Y. B.Sc. (BOTANY) SEMESTER - V
BOTANY PRACTICAL - I
PAPER CODE: BOT3511

[CREDITS - 2]

Sr. No.	Title of Practical
1.	Study of Algae with respect to systematic position, thallus structure and reproduction of <i>Nostoc</i> , <i>Chara</i> , <i>Sargassum</i> and <i>Batrachospermum</i> .
2.	Study of Fungi respect to systematic position, thallus structure and reproduction of <i>Rhizopus</i> , <i>Saccharomyces</i> and <i>Puccinia</i> .
3.	Study of Bryophytes with respect to systematic position, thallus structure and reproduction of <i>Marchantia</i> , <i>Anthoceros</i> and <i>Polytrichum</i> .
4.	Study of Pteridophytes with respect to systematic position, sporophyte - morphology and anatomy, reproductive structures of <i>Psilotum</i> , <i>Selaginella</i> and <i>Marsilea</i> .
5.	Demonstration of protoplasmic streaming.
6.	Study of C metaphase (from colchicines pretreated Onion root tip cells)
7.	Study of various stages of meiosis
8.	Study of polytene chromosome from <i>Chironomus</i> larvae
9.	Plant Genomic DNA extraction from Cauliflower
10.	Estimation of Plant DNA by DPA Method and estimation of RNA by Orcinol Method

Note:

Submission of ten specimens from Cryptogams.

T. Y. B.Sc. (BOTANY) SEMESTER - V
BOTANY PRACTICAL - II
PAPER CODE: BOT3512

[CREDITS - 2]

Sr. No.	Title of Practical
1.	Genetic problems based on Dihybrid and Trihybrid cross.
2.	Genetic problems based on linkage map using three point test cross data.
3.	Cytoplasmic inheritance in <i>Mirabilis jalapa</i> .
4.	Study of families: Magnoliaceae, Rubiaceae
5.	Study of families: Bignoniaceae, Lamiaceae
6.	Study of families: Nyctaginaceae, Orchidaceae
7.	i. Identification of plants with the help of suitable flora (Genus and Species) ii. Preparation of artificial key based on vegetative and reproductive characters.
8.	Study of <i>Pinus</i>
9.	Study of <i>Gnetum</i>
10.	Study the following with the help of slides / specimens: i. Impression ii. Compression iii. Petrification iv. Coal Ball v. <i>Rhynia</i> vi. <i>Lyginopteris</i> vii. <i>Pentoxylon</i>

Note:

Herbarium submission of ten correctly identified wild flowering plants.

T. Y. B.Sc. (BOTANY) SEMESTER - V
BOTANY PRACTICAL - III
PAPER CODE: BOT3513

[CREDITS - 2]

Sr. No.	Title of Practical
1.	A. Study of garden tools and implements - Sprayer, Duster, Pruning Knife, Sprinkler and Micro-irrigation system. A. Study of garden containers and Plantation (Any One) - Fruit, Vegetable and Flowering plants.
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.
6.	Computation of mean, mode and median from the given data.
7.	Computation of variance and standard deviation from the given data.
8.	Statistical problem solving based on Chi-Square (χ^2) test
9.	Image documentation of suitable botanical microscopic preparation by using Camera Lucida and Digital Camera.
10.	Demonstration - TLC Chromatogram.

Notes:

- i. Visit to any one Nursery unit / Commercial Orchards / Fruit Market / Floriculture Industry.
- ii. Submission of ten digital photographs of wild plants of ornamental value.

**Deccan Education Society's
FERGUSSON COLLEGE, PUNE
(AUTONOMOUS)**

**SYLLABUS UNDER AUTONOMY
THIRD YEAR B.Sc. BOTANY
SEMESTER - VI**

Academic Year 2018-2019

T. Y. B.Sc. (BOTANY) SEMESTER - VI
BOTANY PAPER - I
TITLE: PLANT PHYSIOLOGY AND BIOCHEMISTRY
PAPER CODE: BOT3601

[CREDITS - 3]

Learning Objectives:		
1. To understand physiological processes in the plant cell.		
2. To study biochemical constituents of plants in detail.		
	Title and Contents	No. of Lectures
PLANT PHYSIOLOGY		
Unit - I	Photosynthesis 1.1 Ultra structure of chloroplast 1.2 Accessory pigments and their role in photosynthesis 1.3 Light reaction 1.4 Electron transport chain 1.5 Light harvesting complexes 1.6 Calvin cycle and its regulation 1.7 Photorespiration and its significance 1.8 HSK and CAM pathways 1.9 Bacterial photosynthesis	8
Unit - II	Respiration 2.1 Ultra structure of mitochondria 2.2 Types of respiration 2.3 Glycolysis - EMP and PPP 2.4 TCA cycle and its regulation 2.5 Mitochondrial ETS 2.6 Chemiosmotic theory of ATP synthesis 2.7 Balance sheet of ATPs in aerobic and anaerobic respiration 2.8 Complexes of respiratory chain 2.9 Gluconeogenesis	8
Unit - III	Translocation in Phloem 3.1 Composition of phloem sap 3.2 Girdling experiment 3.3 Pressure flow model - a passive mechanism for phloem transport 3.4 Phloem loading - symplast and apoplast pathways 3.5 Unloading - source to sink transition	4
Unit - IV	Stress Physiology 4.1 Concept of Biotic stress 4.2 Types of Biotic stress - Bacterial, fungal, insect herbivory and animal herbivory 4.3 Concept of Abiotic and Xenobiotic stress 4.4 Types of Abiotic stress - Salinity, drought, heavy metals and allelobiogenesis.	4
BIOCHEMISTRY		
Unit - V	Carbohydrates 5.1 Classification of carbohydrates - monosaccharides, disaccharides and polysaccharides 5.2 Structure and properties of carbohydrates 5.3 Synthesis and breakdown of starch and cellulose	4

Unit - VI	Lipids 6.1 General classification of lipids 6.2 Structures, functions and properties of lipids 6.3 β -oxidation mechanism	4
Unit - VII	Amino Acids and Proteins 7.1 Structure of amino acids 7.2 Non protein amino acids and amino acids coding for proteins 7.3 Classification of protein coding amino acids 7.4 Structure of Proteins - primary, secondary, tertiary and quaternary structure 7.5 Role of amino acids and proteins in plants with examples	8
Unit - VIII	Metabolic Pool and Secondary Metabolites 8.1 Introduction and types of secondary metabolites with examples - Terpenes, Phenolic compounds and Alkaloids 8.2 Concept of Metabolic pool 8.3 Production of secondary metabolites through - malonic, mevalonic, shikimic acid and Acetyl CoA 8.4 Role of secondary metabolites in plant defense.	8

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1. Buchanan B. B., Gruissem W. and Jones R. L. (2000). Biochemistry and Molecular Biology of Plants. American Society of Plant Physiologists, Maryland, USA.
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T. Y. B.Sc. (BOTANY) SEMESTER - VI
BOTANY PAPER - II
TITLE: PLANT MOLECULAR BIOLOGY AND BIOTECHNOLOGY
PAPER CODE: BOT3602

[CREDITS - 3]

Learning Objectives:

1. To understand the molecular processes of transcription and translation in plant cells.
2. To get acquaintance with techniques involved in Genetic Engineering.
3. To acquire knowledge of plant tissue culture.
4. To know application of Plant Genetic Engineering in crop improvement.

	Title and Contents	No. of Lectures
Unit - I	Transcription 1.1 Structure and role of m-RNA, r-RNA, t-RNA and Ribosomes, introduction to mi-RNA 1.2 Transcription apparatus 1.3 Overview of mechanism of Transcription	5
Unit - II	Genetic Code and Translation 2.1 Definition and concept of genetic code 2.2 Properties of Genetic code 2.3 Translation - Definition, Mechanism of translation - Initiation, Elongation and Termination	5
Unit - III	Gene Action and Regulation 3.1 Relation of Gene and Enzymes - One gene one enzyme hypothesis 3.2 Regulation of Metabolism 3.3 Inducible and Repressible enzymes	3
Unit - IV	Techniques in Molecular Biology 4.1 Introduction 4.2 Agarose Gel Electrophoresis 4.3 DNA probes 4.4 Nucleic Acid Hybridisation 4.5 Polymerase Chain Reaction using molecular markers	7
Unit - V	Bioinformatics 5.1 Introduction, scope and types (Genomics, Transcriptomics, Proteomics, Metabolomics) 5.2 NCBI 5.3 Use of Bioinformatics Tools in Analysis	4
Unit - VI	Plant Tissue Culture 6.1 Historical perspective of plant tissue culture 6.2 Composition of media; requirements of Plant Tissue Culture, Role of Vitamins and Hormones 6.3 Totipotency, Organogenesis, Embryogenesis (Somatic and Zygotic) 6.4 Somaclonal variations 6.5 Protoplast isolation, culture and fusion, somatic hybrids, use of markers for selection of hybrid cells, Cybrids 6.6 Applications of Plant Tissue Culture: Micropropagation, synthetic seeds, Androgenesis, Virus elimination, haploids, embryo rescue and triploids 6.7 Germplasm - Conservation and Cryopreservation	12

Unit - VII	Secondary Metabolite Production 7.1 Hairy root culture 7.2 Elicitation 7.3 Biotransformation	3
Unit - VIII	Biotechnology of Biofertilizers 8.1 Algal (BGA, <i>Azolla</i> - <i>Anabaena</i>) 8.2 Fungal (<i>Mycorrhiza</i>) 8.3 Phosphate solubilizing and mobilizing bacteria 8.4 Organic fertilizers	3
Unit - IX	Applications of Biotechnology 9.1 Pest resistant (Bt-cotton) 9.2 Herbicide Resistant Plants (Round Up Ready Soyabean) 9.3 Transgenic crops with improved quality traits (Flavr Savr Tomato and Golden Rice) 9.4 Role of Transgenic in edible Vaccines 9.5 Bio safety concerns	6

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3. Kalyan Kumar De - Plant Tissue Culture
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T. Y. B. Sc. (BOTANY) SEMESTER - VI
BOTANY PAPER - III
TITLE: PLANT ECOLOGY AND BIODIVERSITY
PAPER CODE: BOT3603

[CREDITS - 3]

Learning Objectives:

1. To acquire knowledge of components of ecosystem with reference to biotic and abiotic components along with human impact.
2. To acquire knowledge of biodiversity and hotspots with its conservation.

	Title and Contents	No. of Lectures
Unit - I	Introduction to Plant Ecology and Biodeversity 1.1 Basic concepts in Ecology, levels of organization. 1.2 Inter-relationships between the living world and the environment, the components and dynamism 1.3 Homeostasis	4
Unit - II	Soil 2.1 Importance of soil 2.2 Physical and Chemical properties of soil, Biological components of soil 2.3 Soil profile	4
Unit - III	Water 3.1 Importance: States of water in the environment 3.2 Precipitation types (Rain, Fog, Snow, Hail, Dew) 3.3 Hydrological Cycle; Water in soil; Water table	4
Unit - IV	Plant Communities 4.1 Habitat and niche 4.2 Characters: Analytical and synthetic 4.3 Ecotone and edge effects	4
Unit - V	Functional Aspects of Ecosystem 5.1 Biogeochemical cycles 5.2 Carbon cycle, Nitrogen cycle and Phosphorus cycle	4
Unit - VI	Remote Sensing 6.1 Definition and basic principles of remote sensing 6.2 Process of data acquisition and interpretation 6.3 Global positioning system 6.4 Application of Remote Sensing in Ecology	4
Unit - VII	Biodiversity 7.1 Introduction and Concept of Biodiversity 7.2 Aims and Objectives 7.3 Scope and Values of Biodiversity	2
Unit - VIII	Characterization of Biodiversity 8.1 Introduction and need for characterization of Biodiversity 8.2 Various levels of Biodiversity - Genetics, Species and Ecosystem. 8.3 Concept of Endemism 8.4 Biodiversity hot spots in world.	5
Unit - IX	Biodiversity Crisis 9.1 Loss of Species and Genetic Diversity - Introduction, Factors causing loss of species and Genetic Diversity	3

	9.2 Founder Effects 9.3 Genetic Drift 9.4 Inbreeding Depression 9.5 IUCN Categories (RET Plants)	
Unit - X	Conservation of Biodiversity 10.1 Current Practices in Conservation 10.2 In-situ Conservation - International efforts and Indian initiatives, protected areas in India, concept of Biosphere Reserves, National Parks and Biodiversity Park 10.3 Ex-situ Conservation - Germplasm collections, Botanical Gardens - Lead Botanical Gardens, Seed bank, Gene bank, Pollen bank and DNA bank, Wetlands, Mangroves and Coral Reefs. 10.4 Enlist National Agencies playing role in conservation (BSI, NBPGR, ICAR, CSIR, DBT, Ministry of Environment and Forest)	10
Unit - XI	Social Approach to Biodiversity Conservation 11.1 Sacred Groves 11.2 Sthalavrikshas 11.3 Chipko Movement 11.4 Role of Universities and other Educational Institutions in Biodiversity Conservation	4

References:

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T. Y. B.Sc. (BOTANY) SEMESTER - VI
BOTANY PAPER - IV
TITLE: PLANT BREEDING AND SEED TECHNOLOGY
PAPER CODE: BOT3604

[CREDITS - 3]

Learning Objectives:

1. To understand plant breeding and seed technology in plants.
2. To study hybridization techniques.

	Title and Contents	No. of Lectures
Unit - I	Introduction to Plant Breeding 1.1 Introduction to plant breeding 1.2 Scope and importance 1.3 Objective of plant breeding 1.4 Breeding systems: modes of reproduction in crop plants 1.5 Important achievements and undesirable consequences of plant breeding	4
Unit - II	Plant Introduction and Acclimatization 2.1 Introduction 2.2 Types of plant introduction - primary and secondary 2.3 Objectives of plant introduction 2.4 Advantages, disadvantages and achievements 2.5 Acclimatization - definition and importance	4
Unit - III	Methods and Practices of Breeding 3.1 Introduction to selection methods 3.2 Types of selections - mass selection, pure line selection, pedigree selection, bulk selection, back cross selection, single seed descent method, advantages and disadvantages, achievements 3.3 Method - Clonal Crops Clonal selection, advantages and disadvantages, achievements 3.4 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 3.5 Principles - Cross Pollinated Crops Heterosis and hybrid vigour, Dominance hypothesis and Over dominance hypothesis	8
Unit - IV	Mutation in Crop Improvement 4.1 Introduction and concept 4.2 Types of mutations - spontaneous and induced mutations 4.3 Molecular basis of gene mutations 4.4 Types of mutagens - chemical and physical mutagens 4.5 Mechanism of action of chemical and physical mutagens 4.6 Applications of mutations breeding	5
Unit - V	Polyploidy in Crop Improvement 5.1 Numerical changes in chromosomes - Euploidy and Aneuploidy 5.2 Monoploidy - Origin and production, morphology and uses	8

	<p>5.3 Polyploidy - Concept and characteristics of polyploidy</p> <p>5.4 Autopolyploidy - Origin and production, effects of autopolyploidy and uses</p> <p>5.5 Allopolyploidy - Concept, synthesized allopolyploidy (wheat and cotton)</p> <p>5.6 Aneuploidy - Monosomy and nullisomy - origin and cytology, Trisomy in <i>Datura</i></p> <p>5.7 Evolutionary significance of polyploidy</p>	
Unit - VI	<p>Breeding for Stress Tolerance</p> <p>6.1 Breeding for resistance to Abiotic stresses - Drought resistance, Mineral stresses - salinity, mineral deficiency and mineral toxicity, heat and cold resistance</p> <p>6.2 Breeding for resistance to biotic stresses - Diseases resistance, Insect resistance</p> <p>6.3 Advantages of breeding for diseases and insect resistance</p>	5
Unit - VII	<p>Introduction to Seed Technology</p> <p>7.1 Development of seed industry in India</p> <p>7.2 Indian Seed Act - 1966</p>	1
Unit - VIII	<p>Types of Improved Seeds</p> <p>8.1 Definition of seed</p> <p>8.2 Stages of seed production</p> <p>8.3 Types of seeds - nucleus seed, breeder seed, certified seed and foundation seed</p>	2
Unit - IX	<p>Operation in Seed Industry</p> <p>9.1 Breeding of new variety</p> <p>9.2 Seed multiplication</p> <p>9.3 Seed processing and storage</p> <p>9.4 Seed marketing and distribution</p> <p>9.5 Seed certification and publicity</p>	3
Unit - X	<p>Quality Seed Production and Seed Processing</p> <p>10.1 Isolation of seed</p> <p>10.2 Seed crop cultivation-Land requirement, culture practices, plant protection, weed control, rouging, harvesting and drying</p> <p>10.3 Cleaning and grading</p> <p>10.4 Testing and treating</p> <p>10.5 Bagging and labelling</p>	3
Unit - XI	<p>Process of Seed Certification</p> <p>11.1 Field Inspection</p> <p>11.2 Inspection during seed processing</p> <p>11.3 Seed tests - sampling, purity test, cultivar purity test, seed viability, real value seed, moisture content</p> <p>11.4 Maintenance of improved seed</p>	2
Unit - XII	<p>Seed Production Organizations</p> <p>12.1 National Seed Corporation</p> <p>12.2 State Seed Corporation</p> <p>12.3 State Seed Certification Agencies</p> <p>12.4 Private Seed Companies</p>	1

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T. Y. B. Sc. (BOTANY) SEMESTER - VI
BOTANY PAPER - V
TITLE: MYCOLOGY AND PLANT PATHOLOGY
PAPER CODE: BOT3605

[CREDITS - 3]

Learning Objectives:

1. To study the basic classification of fungi and their life cycles with respect to their diseases caused.
2. To acquire knowledge of Plant Pathology and their causal organisms.
3. To know about the defense mechanisms of host and pathogens at structural and biochemical levels.
4. To study Epidemiology and disease forecasting system.

	Title and Contents	No. of Lectures
Unit - I	Introduction to Mycology 1.1 Introduction 1.2 Outline of the recent classification up to classes with examples. 1.3 Mode of nutrition in fungi 1.4 Habitat 1.5 Reproduction 1.6 Ecological significance	8
Unit - II	Class - Phycomycetes 2.1 Introduction 2.2 Occurrence 2.3 Economic Importance 2.4 Reproduction 2.5 Life cycle Pattern 2.6 Classification 2.7 Life cycle of any one form - <i>Synchytrium, Plasmapara, Pythium and Phytophthora</i>	4
Unit - III	Class - Ascomycetes 3.1 Introduction 3.2 Occurrence 3.3 Economic Importance 3.4 Reproduction 3.5 Life cycle Pattern 3.6 Classification 3.7 Life cycle of any one form - <i>Penicillium, Claviceps purpurea and Xylaria</i>	4
Unit - IV	Class - Basidiomycetes 4.1 Introduction 4.2 Occurrence 4.3 Economic Importance 4.4 Reproduction 4.5 Life cycle pattern 4.6 Classification 4.7 Life cycle of any one form - <i>Ustilago and Polyporus</i>	4
Unit - V	Class - Deuteromycetes 5.1 Introduction 5.2 Occurrence 5.3 Economic Importance	4

	5.4 Reproduction 5.5 Classification 5.6 Life cycle of any one form - <i>Sclerotium, Alternaria, and Fusarium</i>	
Unit - VI	Fundamentals of Plant Pathology 6.1 Introduction - Definition, branches, scope and economic importance 6.2 Important Terminology - Incitants, Host, Parasite, Pathogen, Inoculum, Penetration, Infection, Incubation, Disease, Disease development, Symptoms, Sign, Endophyte, Predisposition, Suscept, Resistance, Epidemic, Etiology, Pathogenecity 6.3 Inanimate and Animate diseases 6.3 Economic importance of plant diseases	2
Unit - VII	Disease Development 7.1 Concept of disease cycle, Inoculation, Prepenetration, Penetration, Infection, Dissemination 7.2 Epidemics - Forms, Decline, Exponential model. Disease forecasting, Measurement of plant disease and yield loss 7.3 Computer simulation of epidemics	3
Unit - VIII	Defense Mechanisms 8.1 Concept and Definition 8.2 Types - Pre-existing - Structural and chemical 8.3 Induced - Structural and biochemical	3
Unit - IX	Methods of Studying Plant Diseases 9.1 Study of Macroscopic and Microscopic characters 9.2. Koch's postulates 9.3 Culture technique, types of media and preparation 9.4 Pure culture methods - streak plate, pour plate, spread plate and serial dilution	3
Unit - X	Fungal Plant Diseases 10.1 Characteristics of plant pathogenic fungi 10.2 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	3
Unit - XI	Bacterial Plant Diseases 11.1 Characteristics of plant pathogenic Bacteria 11.2 Study of Diseases with reference to causal organism, symptoms and signs, disease cycle and control measures - Citrus Canker and Black arm of Cotton	2
Unit - XII	Mycoplasma Plant Diseases 12.1 Characteristics of plant pathogenic Mycoplasma 12.2 Study of Diseases with reference to causal organism, symptoms and signs, disease cycle and control measures - Grassy shoot disease of sugarcane and Little leaf of Brinjal	2
Unit - XIII	Nematodal Plant Diseases 13.1 Characteristics of plant pathogenic Nematodes 13.2 Study of Diseases with reference to causal organism, symptoms and signs, disease cycle and control measures	2

	- Root knot disease of vegetables and Ear cockle of Wheat	
Unit - XIV	Viral Plant Diseases 14.1 Characteristics of plant pathogenic Nematodes 14.2 Transmission of plant viruses, transmission of virus by vegetative propagation - Mechanical transmission of viruses through sap, Seed transmission, Pollen transmission, Insect transmission, Mite transmission, Nematode transmission, Fungus transmission and Dodder transmission 14.3 Study of diseases with reference to causal organism, symptoms and signs, disease cycle and control measures - Tobacco Mosaic Disease and Bunchy top of Banana	2
Unit - XV	Principles of Plant Disease Control 15.1 General account of Quarantine and Eradication 15.2 Cultural control practices 15.3 Biological control, curative measures, chemical control, use of Effective Microorganism Solution (EMS), Microbial Pesticides, IPM	2
References: 1. Mundkur, B. B., Fungi and Plant Diseases 2. Malhotra, R. S., Plant Pathology 3. Singh, R. S., Principles of Plant Pathology 4. Sharma, P. D., Plant Pathology 5. Singh, R. S., Plant Disease 6. Agrios, G. N., Plant Pathology 7. Rangaswamy and Bhagyaraj, Agricultural Microbiology 8. Ravi Chandra, Fundamentals of Plant Pathology 9. Nair, L. N., Methods of Microbial and Plant Biotechnology 10. Dickinson, (2003). Molecular Plant Pathology, Bios Scientific Publication, London, New York.		

T. Y. B. Sc. (BOTANY) SEMESTER - VI
BOTANY PAPER - V
TITLE: MUSHROOM CULTURE TECHNOLOGY
PAPER CODE: BOT3606

[CREDITS - 3]

Learning Objectives:

1. To study the mushroom culture technology.
2. To acquire knowledge of different edible and medicinal mushrooms.
3. To visit the different cultivation centres.

	Title and Contents	No. of Lectures
Unit - I	Introduction to Mushrooms 1.1 Introduction, history, nutritional and medicinal value of edible Mushrooms 1.2 Poisonous Mushrooms 1.3 Edible mushrooms available in India: (a) <i>Volvariella volvacea</i> (b) <i>Pleurotus citrinopileatus</i> (c) <i>Agaricus bisporus</i> .	5
Unit - II	Cultivation Technology 2.1 Infrastructure, substrates (locally available), Polythene bags, vessels, inoculation hook, inoculation loop, low cost stove, sieves, culture rack, mushroom unit (Thatched House), water sprayer, tray, pure culture: Medium, sterilization, preparation of spawn, multiplication. 2.2 Mushroom bed preparation - paddy straw, sugarcane trash, maize straw, banana leaves. 2.3 Factors affecting the mushroom bed preparation 2.4 Low cost technology, Composting technology in mushroom production.	12
Unit - III	Storage and nutrition 3.1 Short-term storage (Refrigeration - upto 24 hours) 3.2 Long-term storage (canning, pickles, papads), drying, storage in salt solutions. 3.3 Nutrition - Proteins, amino acids, mineral elements nutrition, Carbohydrates, Crude fibre contents, Vitamins.	8
Unit - IV	Food Preparation 4.1 Types of foods prepared from mushroom. 4.2 Research Centres - National level and Regional level. 4.3 Cost benefit ratio 4.4 Marketing in India and abroad, Export Value.	5
Unit - V	5.1 Field Visit (Mushroom Cultivation Plant) 5.2 Project Report	15

References:

1. Marimuthu, T., Krishnamoorthy, A. S., Sivaprakasam, K. and Jayarajan, R. (1991), Oyster Mushrooms, Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore.
2. Swaminathan, M. (1990), Food and Nutrition, Bappco, The Bangalore Printing and Publishing Co. Ltd., No. 88, Mysore Road, Bangalore - 560018.
3. Tewari, Pankaj Kapoor, S. C., (1988), Mushroom Cultivation, Mittal Publications, Delhi.
4. Nita Bahl, (1984-1988), Hand Book of Mushrooms, 2nd Edition, Vol. I & Vol. II.

T. Y. B. Sc. (BOTANY) SEMESTER - VI
BOTANY PAPER - VI
TITLE: MEDICO-BOTANY
PAPER CODE: BOT3607

[CREDITS - 3]

Learning Objectives:

1. To understand traditional Botany with medicinal systems.
2. To study cultivation practices of medicinal plants.
3. To estimate qualitative and quantitative evaluation for adulteration of medicinal plants.
4. To study systems of crude drugs classification.

Unit - I	Introduction to Pharmacognosy 1.1 Origin, history, definition and scope of Pharmacognosy 1.2 Methods of classification and their significance in the study of drugs of natural origin with respect to alphabetical, biological, chemical, chemotaxonomical, pharmacological and taxonomical characters.	3
Unit - II	Ayurvedic Pharmacy 2.1 Introduction 2.2 Tridosha concept, Humoral, Indigenous systems of medicine - Ayurveda, Siddha, Unani, Tibi, Chinese and Ayusha. 2.3 Ayurvedic principles - Ras, Guna, Vipaka, Virya, Prabhava. 2.4 Ayurvedic formulations - Asava, Arishta, Kvatha, Churna, Ksharas, Leha, Guti, Vatika, Taila, Bhasma.	9
Unit - III	Analysis of Traditional plant based products 3.1 Drug adulteration 3.2 Methods of extraction - percolation, maceration and Soxhlet extraction of different classes of phytochemicals of crude drugs. 3.3 Methods of drug evaluation - Morphological, Microscopic, Chemical and Physical. 3.4 Methods of analysis of Honey, Keshar and Turmeric.	6
Unit - IV	Cultivation, collection and processing of herbal drugs from Mentha, Withania somnifera and Garcenea 4.1 Cultivation – Methods and Factors affecting cultivation. 4.2 Collection and Processing - Collection, harvesting, drying, garbling, packing and storage of crude drugs.	3
Unit - V	Study of Medicinally Important Drugs 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.	5

Unit - VI	Applied Medicinal Botany 6.1 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> 6.2 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 <i>Taxon</i> . 6.3 Concept, definition and introduction to Biopharmaceutics, Pharmacodynamics and Clinical pharmacokinetics with applications.	10
Unit - VII	Ethnobotany and Economic Botany 7.1 Definition, principles, scope and ethnic societies in India. 7.2 Introduction to Economic Botany and its scope 7.3 Important Botanical Resources - Botanical resources of any five examples of non-wood forest products (NWFPs), such as paper making and Gums 7.3 Origin, evolution, source and uses of Rice, <i>Curcma longa</i> , Safflower, Sugarcane, <i>Butea monosperma</i> / <i>Samanea saman</i> / <i>Scleichera oleosa</i> and Rose.	12
References: 1. A Pharmacognosy and Pharmacobiotechnology. New Age International (P) Limited, Publishers (formerly Wiley Eastern Limited) 2. Bruncton, J.: Pharmacognosy, Phytochemistry, Medicinal Plants: Intercept Limited. 3. Harborne, J. B. (1973). Phytochemical Methods: A guide to Modern Techniques of Plant Analysis. Chapman and Hall, London. 4. Khandelwal, K. R. (2008). Practical Pharmacognosy, Techniques and Experiments, Nirali Prakashan, Pune. 5. Kokate, C. K. (2014). Practical Pharmacognosy, Vallabh Prakashan, New Delhi, 5 th edition. 6. Kokate, C. K., Purohit, A. P. and Gokhale, S. B., Pharmacognosy, Nirali Prakashan, Pune. 7. Trease, G. E. and Evans, W. C., Pharmacognosy ELBS, 12 th edition. 8. Tyler, V. E., Brady, L. R. and Robbers, J. E. (1976). Pharmacognosy Lea and Febiger, Philadelphia, 8 th edition, K. M. Varghese and Co., Mumbai. 9. Vaidya, S. S. and Dole, V. A., Bhaishyajakalpana, Anmol Prakashan, Pune. 10. Wallis, T. E. (2003). Text books of Pharmacognosy, CBS Publishers and Distributors, New Delhi (Latest Edition). 11. Wallis, T. E., J. & A. Churchill Ltd., London, (1960). Textbook of Pharmacognosy 12. Anonymus: The Ayurvedic Pharmacopoeia of India, Volume - I and IV, Govt. of India, Ministry of Health and Family Welfare, Department of Ayush, Page 41. 13. Kochhar, P. L., (1987). Tropical Crops: A Textbook of Economic Botany, (Macmillan International College Edition) 14. Albert F. Hill, (1952). Economic Botany: A Textbook of Useful Plants and Plant Products, McGraw-Hill. 15. Verma, V. (2009). Textbook of Economic Botany. 16. Prajapati, N. D., (2010). A Handbook of Medicinal Plants.		

T. Y. B. Sc. (BOTANY) SEMESTER - VI
BOTANY PAPER - VI
TITLE: NURSERY AND GARDENING
PAPER CODE: BOT3608

[CREDITS - 3]

Learning Objectives:

1. To understand the aspects of gardening.
2. To study different gardening practices.
3. To aid in self-employment.

Unit - I	Nursery 1.1 Definition, objectives and scope of nursery 1.2 Building up of infrastructure for nursery 1.3 Planning and seasonal activities 1.4 Planting - Direct Seeding and Transplants	4
Unit - II	Seed 2.1 Structure and types of seeds 2.2 Seed dormancy, causes and methods of breaking dormancy 2.3 Seed storage: Seed banks, factors affecting seed viability, genetic erosion 2.4 Seed Production Technology - seed testing and certification	6
Unit - III	Vegetative Propagation 3.1 Methods: Air-layering, cutting, selection of cutting, collecting season, treatment of cutting, rooting medium and planting of cuttings 3.2 Hardening of plants - green house - mist chamber, shed root, shade house and glass house.	6
Unit - IV	Gardening 4.1 Definition, objectives and scope - different types of Gardening 4.2 Landscape and Home Gardening, Parks and its components, plant materials and design 4.3 Computer applications in landscaping 4.4 Gardening operations: soil laying, manuring, watering 4.5 Management of pests and diseases and harvesting.	8
Unit - V	5.1 Sowing / raising of seeds and seedlings - Transplanting of seedlings 5.2 Study of cultivation of different vegetables - cabbage, brinjal, lady's finger, onion, garlic, tomatoes and carrots 5.3 Storage and marketing procedures.	6

Unit - VI	6.1	Field Visit	15
	6.2	Project Report	
References:			
<ol style="list-style-type: none"> 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, Rajalakshmi 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, (3rd 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, Akta Prakashan, Nadiad. 			

T. Y. B.Sc. (BOTANY) SEMESTER - VI
BOTANY PRACTICAL - I
PAPER CODE: BOT3611

[CREDITS - 2]

Title of Practical	
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.	Demonstration of: a. Ringing experiment for path of solute translocation b. Qualitative tests for alkaloids, tannins, starch and proteins
6.	Separation of DNA by Agarose gel Electrophoresis
7.	Problem solving based on DNA transcription and translation
8.	Retrieval of data from NCBI
9.	(a) Preparation of MS medium (b) <i>In vitro</i> sterilization and inoculation methods using zygotic embryo (Maize) and leaf explants (<i>Datura</i> and <i>Brassica</i>)
10.	(a) Demonstration of somatic embryogenesis and artificial seeds (Photographs). (b) Study of types of Biofertilizers - Algal, Fungal, Phosphate solubilizing and organic fertilizers

Note:

Visit to Biofertilizer Unit / any transgenic plant lab.

**T. Y. B.Sc. (BOTANY) SEMESTER - VI
BOTANY PRACTICAL - II
PAPER CODE: BOT3612**

[CREDITS - 2]

Title of Practical	
1.	Study of instruments used to measure microclimatic variables: Soil thermometer, maximum and minimum thermometer, anemometer and hygrometer.
2.	Determination of dissolved oxygen of water samples from polluted and unpolluted sources.
3.	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.
4.	Determination of latitude and longitude using GPS.
5.	Marking of Hot Spots of the World on the World Map.
6.	Hybridization Techniques (General Procedure)
7.	Effect of chemical (EMS) mutagen on germination percentage.
8.	Induction of tetraploidy by using Colchicine on Onion root tips.
9.	(a) Estimation of seed germination by testing - Paper, Sand and Soil methods. (b) Demonstration of seed sampling equipments (Photographs).
10.	(a) Study of physical purity analysis of seed samples (Morphological characters: colour, shape, size and texture) (b) Seed moisture testing by hot air oven method.

Note:

- i. Submission of photographs of ten Endemic plants of Western Ghats.
- ii. Visit to any Seed Technology / Plant Breeding Laboratory.

T. Y. B. Sc. (BOTANY) SEMESTER - VI
BOTANY PRACTICAL - III
PAPER CODE: BOT3613

[CREDITS - 2]

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.	Life cycle of <i>Penicillium</i> and <i>Ustilago</i>
6.	Study of Drug plants: i. Stem Drug - <i>Tinosporia cordifolia</i> ii. Leaf Drug - <i>Adathoda vasica</i> iii. Root / Rhizome Drug - Shatawari
7.	Study of Drug plants: i. Flower Drug - Clove ii. Fruit Drug - Amla iii. Seed Drug - Coriander
8.	Study and preparation of Ayurvedic formulations - Asav, Arishtha and Churna
9.	Qualitative Analysis of Alkaloid, Glycoside and Tannin
10.	Study of Stomatal Index and vein islet number using suitable plant material.

Note:

- i. Visit to Agricultural Research Institute / Plant Pathology Laboratory / Rasshala.
- ii. Submission of Five Herbarium specimens of medicinally important plants.