



M. C. E. Society's

Abeda Inamdar Senior College

Of Arts, Science and Commerce (Autonomous), Camp, Pune-1

Affiliated to Savitribai Phule Pune University

NAAC accredited 'A' Grade

S.Y.B.Sc Botany

Academic Year - 2022-23 (CBCS – Autonomy 21 Pattern)

Course/ Paper Title	Taxonomy of Angiosperms and Economic Botany
Course Code	21SBBO 231
Semester	III
No. of Credits	2 (36 Lectures of 50 Minutes)

Aims & Objectives of the Course

Sr. No.	Objectives
1.	The paper deals with general principles of taxonomy of angiosperms.
2.	To understand different types of plant classification.
3.	Create potential among students to become an entrepreneur.
4.	To equip the students with skills of computers in taxonomy.
5.	To create foundation for further studies in Botany

Expected Course Specific Learning Outcome

Sr. No.	Learning Outcome
1.	Knowledge of different types of classification.
2.	Knowledge of binomial nomenclature and its use.
3.	Use of cereals and legumes in daily life.

Syllabus

Unit No	Title with Contents	No. of Lectures
CREDIT I	Taxonomy of Angiosperms	18
I	<p>Introduction to Taxonomy of Angiosperms</p> <p>1.1 Definition, scope, aims, objectives and importance of taxonomy.</p> <p>1.2 Concept of Chemotaxonomy and molecular taxonomy and taxonomy in plant breeding.</p> <p>1.3 Multidisciplinary approaches of taxonomy</p>	02
II	<p>Systems of classification</p> <p>2.1 Comparative account of various systems of classification.</p> <p>2.2 Artificial system- Carl Linnaeus,</p> <p>2.3 Natural system- Bentham and Hooker,</p> <p>2.4 Phylogenetic system- Engler and Prantl,</p> <p>2.5 APG system- A brief review</p>	04
III	<p>Binomial nomenclature</p> <p>3.1 Concept of nomenclature, brief history, Binomial nomenclature.</p> <p>3.2 International Code for Nomenclature of Algae, Fungi and Plants (ICN)- Principles, Rules and Recommendations;</p> <p>3.3 Concept of Typification. ‘Type’ specimen and its types (Holotype, Paratype, Isotype, Lectotype, Neotype).</p> <p>3.4 Ranks and endings of taxa names, Coining of Genus and Species names. Single, double and multiple authority citations.</p>	04
IV	<p>Computer in taxonomy</p> <p>4.1 Concept of herbarium their advantages and limitations.</p> <p>4.2 Digital /e-herbarium and their advantages</p> <p>4.3 Data bases: concept and needs.</p> <p>4.4 Use of computer in plant classification.</p>	02

V	Study of Plant Families 5.1 Study of following families with reference to systematic position (As per Bentham and Hooker's system of classification). Common examples and Economic value of each family. 5.2 Families from Polypetalae: Annonaceae, Brassicaceae 5.3 Families from Gamopetalae: Solanaceae, Asclepidaceae 5.4 Family from Monochlamydae: Euphorbiaceae 5.5 Family from Monocotyledon: Amaryllidaceae	06
CREDIT II	Economic Botany	18
VI	Introduction , Definition, scope, history of Economic Botany and commercial application of Economic botany.	03
VII	Economic Importance of Plants Cereals 7.1 Wheat, Sugar cane, coffee, tea and Rice (Origin, morphology, processing & uses) 7.2 Brief account of millets.	04
VIII	Pulses 8.1 General account, 8.2 Importance to man with suitable example	02
IX	Fibre 9.1 General account 9.2 Importance to man with suitable example	02
X	Medico Botany 10.1 Study of Medicinal plants with reference to botanical name, local name, morphological features, part used, medicinal importance (Adulsa, Avala, Ginger) 10.2 Ayurvedic preparation from plants (Adulsa syrup, Alipak and Avala candy) 10.3 Ayurvedic formulation, Churna, Asav, Arishtha.	07

SUGGESTED BOOKS:

1. Balfour Austin (2016). Plant Taxonomy. Syrawood Publishing House
2. Cooke, Theodore (1903-8). The Flora of the Presidency of the Bombay Vol. I, II, III (Repr. ed), Botanical Survey of India.
3. Datta S.C. (1988). Systematic Botany. New Age Publ.
4. Davis P.H and V.H Heywood (1963). Principles of Angiosperm Taxonomy. Oliver and Boyd, London.
5. Heywood V.H. (1967). Plant Taxonomy, Hodder & Stoughton Educational, London.
6. Judd Walter S., Campbell, C. S., Kellogg, E. A., Stevens, P.F. and M. J. Donoghue. (2008). Plant Systematics- A Phylogenetic Approach. Sinauer Associates, INC, Publishers. Sunderland, Massachusetts, USA.
7. Lawrence G.H.M. (1955). An Introduction to Plant Taxonomy. McMillan, New York.
8. Mondol A.K. (2016) Advanced Plant Taxonomy, New Central Book Agency (NCBA)
9. Naik V.N. (1988) Taxonomy of Angiosperms. Oxford and IBH
10. Pande B.P. (1997). Taxonomy of Angiosperms. S. Chand.
11. Pande B.P. (2001) Taxonomy of Angiosperms. S. Chand.
12. Radford A.E. 1986. Fundamentals of Plant Systematics, Harper and Row N Y.
13. Santapau H. (1953). The Flora of Khandala on the Western Ghats of India. BSI
14. Sharma O.P. (2011), Plant Taxonomy, Tata Mc grow Hill
15. Kochhar, S.L. (2012). Economic Botany in Tropics, MacMillan & Co. New Delhi, India.
16. Wickens, G.E. (2001). Economic Botany: Principles & Practices. Kluwer Academic Publishers, The Netherlands.
17. Chrispeels, M.J. and Sadava, D.E. (2003). Plants, Genes and Agriculture. Jones & Bartlett Publishers.

IMPORTANT WEBSITES

The families of flowering plants- l. Watson and m.j. dallwitz

<https://www.delta-intkey.com/angio/index.htm>

Angiosperm phylogeny website, version 14.

<http://www.mobot.org/mobot/research/apweb/>

The plants of the world online portal

<http://www.plantsoftheworldonline.org/>

International plant name index (ipni)

<https://www.ipni.org/>

Tropicos

<https://www.tropicos.org/home>

Biodiversity heritage library

<https://www.biodiversitylibrary.org/>

Botanicus digital library

<https://www.botanicus.org/>

Internet archive- digital library

<https://archive.org/>

Database of plants of indian subcontinent

<https://sites.google.com/site/efloraofindia/>

Botanical survey of india

https://bsi.gov.in/content/1416_1_floraofindia.aspx

S.Y.B.Sc Botany

Academic Year - 2022-23 (CBCS – Autonomy 21 Pattern)

Course/ Paper Title	Fundamentals of Plant Biotechnology
Course Code	21SBBO232
Semester	III
No. of Credits	2 (36 Lectures of 50 Minutes)

Aims & Objectives of the Course

Sr. No.	Objectives
1.	The paper deals with Fundamentals of plant biotechnology
2.	To understand about enzyme, enzyme immobilization and its functions.
3.	To equip the students with role of environmental biotechnology.
4.	To create foundation for further studies in Fundamentals of Plant Biotechnology.

Expected Course Specific Learning Outcomes

Sr. No.	Learning Outcome
1.	To provide Knowledge of Fundamentals of Plant Biotechnology
2.	Knowledge of principles of microbial growth and different types of bioreactors.
3.	Create potential among students to become an entrepreneur.

Syllabus

Unit No	Title with Contents	No. of Lectures
Credit I	Fundamentals of Biotechnology	18
I	<p>Introduction to Fundamentals of Plant Biotechnology</p> <p>1.1 History Definition of Biotechnology, Interdisciplinary subject.</p> <p>1.2 Scope and importance of Biotechnology.</p> <p>1.3 Commercial application of biotechnology in Medicine, Agriculture, Environment, Industry.</p> <p>1.4 Current status of Biotechnology in India.</p>	05
II	<p>Plant Genetic Engineering</p> <p>2.1 Introduction, Concept and Definition, rDNA technology, genetic engineering - safety, social, moral and ethical aspects.</p> <p>2.2 Genetically manipulated organisms .</p> <p>2.3 Applications of genetic engineering : Insect Pest Resistance, Herbicide Resistance, Abiotic Stress Tolerance.</p>	05
III	<p>Bioprocess Technology</p> <p>3.1 Introduction, Principles of microbial growth</p> <p>3.2 Concept of Bioreactor, Media design for fermentation process, Solid substrate fermentation.</p> <p>3.3 Downstream processing, Production of citric acid</p> <p>3.4 Commercial applications of bioprocess technology.</p>	08
CREDIT II	Fundamentals of Plant Biotechnology	18
IV	<p>Enzyme Technology</p> <p>4.1 Introduction, concept, definition, properties and classification of enzymes</p> <p>4.2 Immobilization of enzymes.</p> <p>4.3 Lock and key mechanism.</p> <p>4.4 Commercial applications of enzymes.</p>	04

V	Biomass Technology for Energy	05
	5.1 Introduction, Photosynthesis-the ultimate energy source, Sources of Biomass. 5.2 Importance of biogas production and Methane production. 5.3 Ethanol from biomass. 5.4 Biodiesel from plants, process and its ecofriendly applications.	
VI	Single Cell Protein	05
	6.1 Concept and Definition, History of SCP. 6.2 The importance of proteins in diet, Acceptability. 6.3 Production of SCP from <i>Spirulina</i> and Yeast. 6.4 Commercial application of SCP.	
VII	Environmental Biotechnology	04
	7.1 Introduction, Waste water treatment 7.2 Landfill technology. 7.3 Environmental sustainability, phytoremediation.	

SUGGESTED BOOKS:

1. Fundamentals of Environmental science 2004 Sayyed Iliyas, Ashok Chavan and Mazhar Farooque, Renuka prakashan Aurangabad. B.D. Singh (4th Edn 2012) Biotechnology-expanding horizons, Kalyani Publishers.
2. K.S. Bilgrami & A.K. Pandey (2007) Introduction to Biotechnology CBS Publishers and Distributors PVT LTD
3. M.K. Razdan (2002) Introduction to Plant Tissue Culture. Oxford and IBH Publishing Co., New Delhi.
4. H.S. Chawla (2005) Introduction to Plant Biotechnology. Oxford and IBH Publishing Co. New Delhi.
5. Plant Biotechnology (2006), John Wiley publ.
6. Basic Biotechnology (2006). Ed. Colin Ratiedge & B. Kristqusen Cambridge publ.
7. Basic Concepts of Plant Biotechnology by Vijay Prakash and Niraj Tripathi,

S.Y.B.Sc Botany

Academic Year - 2022-23 (CBCS – Autonomy 21 Pattern)

Course/ Paper Title	PRACTICALS BASED ON 21SBBO 231 & 21SBBO 232
Course Code	21SBBO233
Semester	III
No. of Credits	2 (46.8 Lectures of 50 Minutes)

Syllabus

Expt. No.	Title with Contents	No. of Practical
1.	Study of tools of taxonomy :-Vasculum, field press, secateurs, margining less, dissecting microscope, herbarium sheet	1 P
2.	Description of flowering plant in botanical terms	1 P
3.	Study of plant families (any four) studied in theory paper.	4 P
4.	Preparation of Ayurvedic formulations – Churna, Asav, candy and Alepak	2 P
5.	Study of finished products from cereals, pulses and fibre (Rava, soji, maida, besan ladu, fersan, cotton fibre and coir etc.)	1 P
6.	Demonstration of the following : 1. Laminar flow, 2. Autoclave, 3. Centrifuge machine 4. Spectrophotometer	1 P
7.	Production of Citric acid by <i>Aspergillus</i> .	1 P
8.	Estimation of Citric acid by titration method.	1 P
9.	Extraction of DNA by agarose gel electrophoresis	1 P
10.	Cultivation of <i>Spirulina</i> and study of its commercial products.	1 P
11.	Cultivation of <i>Spirulina</i> and study of its commercial products	1 P
12.	Visit to biodiversity park/ botanical garden/ pharmaceutical industry/ Medicinal plant garden.	1 P



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Academic Year - 2022-23 (CBCS – Autonomy 21 Pattern)

Course/ Paper Title	Plant Anatomy and Embryology
Course Code	21SBBO241
Semester	IV
No. of Credits	2 (36 Lectures of 50 Minutes)

Aims & Objectives of the Course

Sr. No.	Objectives
1.	The paper deals with Anatomy and embryology of plants.
2.	To understand about cell, tissue and its structure and functions.
3.	To equip the students with role of xylem in conduction of water and minerals.
4.	To create foundation for further studies in Botany

Expected Course Specific Learning Outcome

Sr. No.	Learning Outcome
1.	Knowledge of epidermal tissue system.
2.	General embryo, types of embryo in plants.
3.	Knowledge of secondary growth and abnormal secondary growth in plants.

Syllabus

Unit No.	Title with Contents	No. of Lectures
CREDIT-I	Plant Anatomy	18
I	Introduction to plant anatomy 1.1 Definition 1.2 Scope and importance of plant anatomy	03
II	Epidermal tissue system 2.1 Structure, functions and types of epidermis 2.2 Structure, types and functions of Stomata 2.3 Epidermal outgrowths- non-glandular and glandular 2.4 Motor cells	03
III	Mechanical tissue system 3.1 Principles involved in distribution of mechanical tissues with one example each a) Inflexibility, b) Incompressibility, c) Inextensibility and d) Shearing stress 3.2 Vascular tissue system: Structure and function of xylem, phloem and cambium	03
IV	Normal secondary growth 4.1 Introduction 4.2 Normal secondary growth in dicotyledonous stem 4.3 Development of annual rings, periderm, bark, tyloses and lenticel	04
V	Anomalous secondary growth 5.1 Introduction 5.2 Causes of anomalous secondary growth 5.3 Anomalous secondary growth in: a) Dicotyledonous stem (<i>Bignonia</i>), b) Dicotyledonous root (<i>Raphanus</i>), c) Monocotyledonous stem (<i>Dracaena</i>)	05
CREDIT -II	Plant Embryology	18
VI	Introduction to Plant Embryology 6.1 Definition and scope of plant embryology	02

VII	Microsporangium and male gametophyte 7.1 Structure and functions of microsporangium. 7.2 Structure of T.S.of tetrasporangiate anther 7.3 Microsporogenesis : formation, structure of microspore tetrad and pollen grain, 7.4 Male gametophyte: structure and development of male gametophyte	06
VIII	Megasporangium and female gametophyte 8.1 Structure and functions of megasporangium. 8.2 Types of ovules 8.3 Megasporeogenesis: formation and types of megaspore tetrads, megaspore. 8.4 Female gametophyte: structure of typical embryo sac 8.5 Types of embryo sacs – monosporic, bisporic and tetrasporic	05
IX	Pollination and Fertilization: 9.1 Introduction and definition of pollination and fertilization 9.2 Types of pollination 9.3 Germination of pollen grain 9.4 Entry of pollen tube- porogamy, mesogamy and chalazogamy. 9.5 Double fertilization and its significance.	04
X	Endosperm and Embryo 10.1 Endosperm: Types – nuclear, helobial and cellular. 10.2 Structure of Dicotyledonous and Monocotyledonous embryo.	02

SUGGESTED BOOKS:

1. Plant Anatomy, Chandurkar P J, Plant Anatomy Oxford and IBH publication Co. New Delhi 1971
2. B P Pandey, Plant Anatomy. S Chand and Co. Ltd, New Delhi 1978
3. Greulach V A and Adams J E Plant- An introduction to Modern Biology, Toppen Co. Ltd, Tokyo, 4. Eams and Mc Daniel, An Introduction to Plant Anatomy, McGraw –Hill Book Co. Ltd and Kogakusha Co, Tokyo, Japan
5. Adriance S Foster Practical Plant Anatomy, D Van Nostrand Co. INC, New York
6. Esau, Plant Anatomy, Wiley Toppan Co. California, USA
7. Pijush Roy, Plant Anatomy. New Central Book Agency Ltd, Kolkata
8. Pandey S N and Ajanta Chadha, Plant Anatomy and Embryology, Vikas Publishing House, Pvt, Ltd, New Delhi
9. Bhojwani S S and Bhatnagar S P, An Embryology of Angiosperms
10. Maheshwari P, An introduction to Embryology of Angiosperm
11. Nair P K K Essentials of Palynology.

S.Y.B.Sc Botany

Academic Year - 2022-23 (CBCS – Autonomy 21 Pattern)

Course/ Paper Title	Principles of Plant Science
Course Code	21SBBO242
Semester	IV
No. of Credits	2 (36 Lecture of 50 Minutes)

Aims & Objectives of the Course

Sr. No.	Objectives
1.	The paper deals with molecular biology and genetics
2.	To understand about Mendelian genetics and its laws.
3.	To equip the students about nucleic acid and its replication.
4.	To create foundation for further studies in Botany

Expected Course Specific Learning Outcome

Sr. No.	Learning Outcome
1.	It gives in depth knowledge of Molecular Biology
2.	It provides insight into understanding of genetic methodology.
3.	Knowledge of chromosomes, gene and its role in plants.

Syllabus

Unit No.	Title with Contents	No. of Lectures
CREDIT - I	Molecular Biology	18
I	Introduction to Molecular Biology 1.1 Definition, History, Scope and Importance, 1.2 Central Dogma of Molecular Biology.	2
II	Nature of Genetic Material 2.1 Characteristics of genetic material 2.2 Physical and Biological evidences to prove DNA as genetic material, Chargoff's Law, 2.3 Watson and Cricks Model of DNA, RNA as genetic material TMV.	3
III	DNA Replication 3.1 Introduction and types, 3.2 Messelson and Stahl's Experiment, 3.3 Molecular mechanism of DNA replication.	03
IV	DNA Damage and Repair 4.1 Introduction, Causes and types, 4.2 DNA repair system- Photoreactivation, Dark excision repair.	03
V	Gene Organization 5.1 Promoter-structure and function in prokaryotes and eukaryotes. 5.2 Terminators, Units of Gene, 5.3 Enhancers, Split genes, jumping genes.	03
VI	Gene Action and Regulation 6.1 Relation of Gene and Enzymes- One gene one enzyme hypothesis, regulation of metabolism, 6.2 Inducible and Repressible enzymes, 6.3 Gene regulation- in prokaryotes (Lac Operon Model) and eukaryotes (Britten and Davidson's Model)	04
CREDIT -II	Genetics	18
VII	Introduction 7.1 Definition, Concept of heredity and variations, 7.2 Branches and Applications of Genetics	02

VIII	Mendelism Genetics 8.1 Genetical terminology, Selection of experimental material, 8.2 Monohybrid cross, Law of dominance, Incomplete dominance, Law of segregation / law of purity of gametes, 8.3 Dihybrid cross, Law of independent assortment, 8.4 Back cross and Test cross.	05
IX	Interactions of genes 9.1 Non-epistatic genetic interactions- complementary genes (9:7), Duplicate Genes (15:1), 9.2 Epistatic genetic interactions- Masking genes (12:3:1), 9.3 Supplementary genes (Recessive epistasis) (9:3:4), Inhibitory genes (13:3), 9.4 Lethal genes (2:1)	05
X	Multiple alleles 10.1 Definition, Concept, Characters of multiple alleles, Examples of multiple alleles. 10.2 Inheritance of blood group in human, 10.3 Self-incompatibility in <i>Nicotiana</i> and eye colour in <i>Drosophila</i>	02
XI	Euploidy and Aneuploidy 11.1. Numerical changes in chromosomes- Euploidy and Aneuploidy, 11.2 Monoploidy, Origin and production, morphology and uses. 11.3 Polyploidy - Concept and Characteristics of polyploids, Autopolyploidy- Origin and production, effects of autopolyploidy, uses. 11.4 Allopolyploidy- Concept, synthesized allopolyploidy (wheat and cotton) 11.5 Evolutionary significance of polyploidy –Aneuploidy, Monosomy and nullisomy.	04

SUGGESTED BOOKS:

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

14. Cell Biology, Molecular Biology, Genetic, Evolution and Ecology, Verma and Agarwal
15. Cell and Molecular Biology, Robertis and DeRobertis
16. Molecular Cell Biology, 4th Edition, Lodish S. Baltimore
17. Molecular Biology of Gene, Watson J. D.
18. Molecular and Cell Biology, Wolfe S.L.
19. Gardner, E.J., Simmons, M.J., Snustad, D.P. (1991). Principles of Genetics, John Wiley & sons, India. 8th edition.

S.Y.B.Sc Botany

Academic Year - 2022-23 (CBCS – Autonomy 21 Pattern)

Course/ Paper Title	PRACTICALS BASED ON 21SBBO 241 & 21SBBO 242
Course Code	21SBBO243
Semester	IV
No. of Credits	2 (46.8 Lectures of 50 Minutes)

Syllabus

Expt. No.	Title with Contents	No. of Practical
1.	Study of epidermal tissue system – Unicellular multicellular; branched unbranched; non-glandular and glandular trichomes /hairs typical stomata (Dicotyledonous and Monocotyledonous)	1 P
2.	Study of structure dicot and monocot stomata	1 P
3.	Study of mechanical tissues and their distribution in root, stem and leaves	1 P
4.	Study of normal secondary growth in dicot stem – <i>Annona</i> / <i>Moringa</i> (Double stained temporary preparation).	1 P
5.	Study of anomalous secondary growth in <i>Bignonia</i> and <i>Dracaena</i> stem (Double stained temporary preparation).	1 P
6.	Study of T.S. Tetrasporangiate anther and Types of ovules with the help of suitable example	1 P
7.	Plant Genomic DNA extraction from Cauliflower	1 P
8.	Estimation of Plant DNA by DPA Method	1 P
9.	Extraction and estimation of RNA by Orcinol Method	1 P
10.	Induction of Tetraploidy in onion root cells and preparation of squash for observation of tetraploid cells	2 P

11.	Estimation of frequency of PTC taste sensitivity, earlobe and rolling tongue in known population.	1 P
12.	Genetic problems on gene mapping using three point test cross data	2 P
13.	Study of karyotype e.g. <i>Allium cepa</i>	1 P
14.	Visit to the following places 1. Seed industry 2. Research institute 3. Agriculture institute.	2 P