



MES Abasaheb Garware College, Karve Road, Pune -411004

(Autonomous)

(Affiliated to SAVITRIBAI PHULE PUNE UNIVERSITY)

Three Year B.Sc. Degree Program in Botany

(Faculty of Science & Technology)

T.Y.B. Sc Botany

Choice Based Credit System Syllabus

To be implemented from Academic Year 2024- 2025

**Titles of the courses of T.Y.B.Sc. Autonomous to be implemented from 2024-25
SEMESTER V**

Structure of Course:

Y e a r	Sem este r	Course Type	Course Code	Course Title	Re mar k	Cr edi t	No. of L / P
3	V	Compulsory	USBO- 351	Lower cryptogams	T	2	30
		Compulsory	USBO- 352	Higher cryptogams	T	2	30
		Compulsory	USBO- 353	Seed plants and Medicinal Botany	T	2	30
		Compulsory	USBO- 354	Plant Ecology	T	2	30
		Compulsory	USBO- 355	Cell and Molecular Biology	T	2	30
		Compulsory	USBO- 356	Genetics and Plant Breeding	T	2	30
		Compulsory	USBOP-357	Practicals based on USBO-351&USBO- 352	P	2	12 P
		Compulsory	USBOP-358	Practicals based on USBO-353&USBO- 354	P	2	12 P
		Compulsory	USBOP-359	Practicals based on USBO-355&USBO- 356	P	2	12 P
		SEC	USBOSEC-3510	Industrial and Economic Botany	T	2	30
		SEC	USBOSEC-3511	Computational and data modeling in Botany	T	2	30

SEMESTER VI

V I	Compu lsory	USBO- 361	Plant Metabolism	T	2	30
	Compu lsory	USBO- 362	Phytochemistry	T	2	30
	Compu lsory	USBO- 363	Plant Pathology & Weed management	T	2	30
	Compu lsory	USBO- 364	Evolution and Population genetics	T	2	30
	Compu lsory	USBO- 365	Advanced Plant Biotechnology	T	2	30
	Compu lsory	USBO- 366	Polyhouse and Seed Technology	T	2	30
	Compu lsory	USBOP- 367	Practicals based on USBO-361 & USBO-362	P	2	12 P
	Compu lsory	USBOP- 368	Practicals based on USBO-363 & USBO-364	P	2	12 P
	Compu lsory	USBOP- 369	Practicals based on USBO-365 & USBO-366	P	2	12 P
	SEC	USBOSE C3610	Nursery and Gardening Management	T	2	30
SEC	USBOSE C3611	Biofertilisers, Biopesticides & organic farming	T	2	30	

Equivalence of Previous Syllabus:

Old Course (2020 Pattern) SPPU	New Course (2024 CBCS Pattern) AGC
Semester V	Semester V
BO 351 Algae and Fungi	USBO- 351 Lower cryptogams
BO 352 Archegoniate	USBO- 352 Higher cryptogams
BO 353 Spermatophyta and Paleobotany	USBO- 353 Seed plants and Medicinal Botany
BO 354 Plant Ecology	USBO- 354 Plant Ecology
BO 355 Cell and Molecular Biology	USBO- 355 Cell and Molecular Biology
BO 356 Genetics	USBO- 356 Genetics and Plant Breeding
BO 3510 Medicinal Botany	USBOSEC-3510 Industrial and Economic Botany
BO 3511 Plant Diversity and Human Health	USBOSEC-3511 Computational and data modeling in Botany
Semester VI	Semester VI
BO 361 Plant Physiology and Metabolism	USBO-361 Plant Metabolism
BO 362 Biochemistry	USBO-362 Phytochemistry
BO 363 Plant Pathology	USBO-363 Plant Pathology & Weed Management
BO 364 Evolution and population genetics	USBO-364 Evolution and Population Genetics
BO 365 Advanced Plant Biotechnology	USBO-365 Advanced Plant Biotechnology
BO 366 Plant Breeding and Seed Technology	USBO-366 Polyhouse and Seed Technology
BO 3610 Nursery and Gardening Management	USBOSEC-3610 Nursery and Gardening Management
BO 3611 Biofertilizers	USBOSEC-3611 Biofertilisers, Biopesticides & organic farming

T.Y.B.Sc. Botany CBCS Pattern (Semester V, Paper I) 2024-2025
USBO 351: Lower Cryptogams - 2 Credits (30 Lectures)

Sr. No.	Topic Details	No. of Lectures
	Credit-I Algae	15
1.	Introduction: Cryptogams- meaning. Types- Lower Cryptogams, brief review with examples.	1
2.	Algae: General characters, distribution, Thallus organization, habit and Habitat reproduction and Classification (G.M.Smith 1955) up to classes.	4
3.	Study of life cycle of algae with reference to taxonomic position, Occurrence, Thallus structure, and reproduction of <i>Nostoc</i> , <i>Caulerpa</i> , <i>Chara</i> , <i>Sargassum</i> and <i>Gelidiella / Gelidium</i> .	8
4	Economic importance of algae- Role in industry, agriculture, fodder and medicine.	2
	Credit-II Fungi	
5	Fungi: General characters, Habit and habitats, thallus organization, cell wall composition, nutrition and Classification. (Alexopoulos and Mims 1979) up to classes.	3
6.	Study of life cycle of fungi with reference to taxonomic position, thallus structure, and reproduction of <i>Mucor</i> (Zygomycotina), <i>Aspergillus</i> (Ascomycotina), <i>Sphacelotheca</i> (Basidiomycotina), <i>Cercospora</i> (Deuteromycotina).	8
7.	Mycorrhiza- Mycorrhiza and types of mycorrhiza and application of mycorrhiza in industry.	4

Suggested Reading:

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. Kumar H.D. 1988. Introductory Phycology. Affiliated East-West Press Ltd New Delhi.
5. Vashishta B.R. et al., Botany for degree students- Fungi
6. Sharma, P.D. - The Fungi
7. Sharma, O.P. - Fungi Economic importance of fungi
8. Alexopoulos C. J, Mims C.W. and Blackwell M.I 1996. Introductory Mycology. John Wiley and Sons Inc.

T.Y.B.Sc. Botany CBCS Pattern (Semester V, Paper II) 2024-2025
USBO- 352 - Higher cryptogams - 2 Credits (30 Lectures)

Sr. No.	Topic Details	No. of Lectures
Credit-I Bryophytes		15
1.	Introduction, general characters, distribution of Bryophytes to land habit, classification of Bryophytes according to G.M. Smith (1955) up to classes with reasons.	3
2.	Range of thallus organization, origin of Bryophytes - Pteridophytes and Algal hypothesis, evolution of sporophyte.	2
3.	Study of Life Cycle of Bryophytes with respect to Taxonomic position, Morphology, Anatomy, Reproduction, Gametophytes, and sporophytes of <i>Marchantia</i> , <i>Anthoceros</i> and <i>Funaria</i> .	9
4	Ecological and economic importance of Bryophytes.	1
Credit-II Pteridophytes		15
6	Introduction, Vascular Cryptogams, General characteristics, Classification according to K.R. Sporne (1975) up to classes with reasons, Diversity and Distribution of Pteridophytes.	2
7.	Resemblances of Pteridophytes with Bryophytes, Differences between Pteridophytes and Bryophytes, Origin of Pteridophytes -Algal and Bryophytes, Evolution of Pteridophytes- Telome Theory and Enation Theory.	3
8.	Study of Life Cycle of Pteridophytes with respect to Taxonomic position, Morphology, Anatomy, Reproduction, Sporophytes, and Gametophytes of <i>Psilotum</i> , <i>Selaginella</i> , and <i>Equisetum</i> .	9
09	Ecological and Economical Importance of Pteridophytes.	1

Note: Development of sex organs and Sporophytes is not expected.

Suggested readings:

1. Chopra G.L. and Yadav D.L. A Text book of Bryophytes.
2. Das, Datta and Gangulee-College Botany Vol I
3. Parihar, N.S. An introduction to Embryophyta: Bryophyte-I
4. Puri Prem. Brayophytes, Atmaram and Sons. Delhi.
5. Parihar N.S. 1991. Bryophyta. Central Book Depot, Allahabad.
6. Sporne K.R. 1991. The Morphology of Pteridophytes. B.I. Publishing Pvt. Ltd. Bombay.
7. Vashishta B.R. Botany for degree students Bryophytes- Vol-III
8. Vashishta B.R. Botany for degree students Pteridophytes.

T.Y.B.Sc. Botany CBCS Pattern (Semester V, Paper III) 2024-2025
USBO- 353 - Seed plants and Medicinal Botany - 2 Credits (30 Lectures)

Sr. No.	Topic Details	No. of Lectures
	Credit-I - Angiosperms.	15
1.	Angiosperms - Origin of angiosperms: with reference to time, place and ancestry - Pseudanthial theory 2) Transitional-Combinational Theory -	2
2.	Classification: Outline, Merit and Demerits of Cronquist's System and APG IV system of classification. Study of following families with reference to systematic position (As per Bentham & Hooker), Diagnostic characters, floral formula, floral diagram and any five examples with their economic importance – Magnoliaceae, Asteraceae, Amaranthaceae, Cannaceae	6
3.	Gymnosperms: Introduction, general characters, economic importance and classification according to Chamberlain (1934).	2
4	Study of life cycle of <i>Pinus</i> with reference to distribution, morphology, anatomy, reproduction, gametophyte, sporophyte, seed structure and alternation of generations	5
	Credit-II - Medicinal Botany	15
6	Medicinal Botany - Introduction to Medicinal botany, Origin, history, definition and scope of Pharmacognosy, Methods of classification and their significance in the study of drugs of natural origin (alphabetical, biological, chemical, taxonomical, and pharmacological).	3
7.	Analytical Medicinal botany - Drug adulteration, Methods of extraction (percolation, maceration, Soxhlet extraction etc.) of different classes of phytochemicals from crude drugs. Methods of drug evaluation- Morphological, Microscopic, Chemical and Physical methods.	5
8.	Study of medicinally important drugs Study of drugs w.r.t. occurrence, distribution cultivation, microscopic characters, constituents and uses of Root Rhizome drugs: - <i>Glycyrrhiza</i> , Stem drugs: - <i>Tinospora cordifolia</i> Leaf drugs: - <i>Adhatoda</i> , Flower drugs: - Clove, Fruit drugs: - Amla, Unorganized drugs: - Shilajit, Contraceptive drugs: - <i>Dioscorea</i> .	5
09	Concept, definition and introduction Biopharmaceutics, Pharmacodynamics and clinical Pharmacokinetics with applications	2

Suggested Readings :

1. Cronquist, A. 1968. The Evolution and Classification of Flowering Plants. Thomas Nel and Sons, Ltd. London.
2. Singh V. and D.K Jain, 1981 Taxonomy of Angiosperms. Rastogi Publication, Meerut.
- 3 Takhtajan A. 1969. Flowering Plants; Origin and Disposal.
4. Pande B.P 1997. Taxonomy of Angiosperms. S. Chand.
5. Gurucharan Singh 2005- Plant systematics
6. Naik V.N. - Taxonomy of Angiosperms.
- 7 Sharma O.P. Plant Taxonomy Tata McGraw-Hill
- 8 A Pharmacognosy and Pharmacobiotechnology. New Age international (P)Limited, Publishers (formerly wiley Eastern Limited)
9. Brunton J.: Pharmacognosy, Phytochemistry, Medicinal Plants: Intercept

Limited.

10 . Harborne, J. B. (1973): Phytochemical Methods: A guide to Modern

11. Techniques of plant Analysis. Chapman A ad Hal, London

12. Kokate C.K. (2014) Practical Pharmacognosy, Vallabhprakashan, New Delhi, 5th edition

13. Kokate C.K. Purohit A.P. and Gokhale S.B. Pharmacognosy, Nirali Prakashan Pune

T.Y.B.Sc. Botany CBCS Pattern (Semester V, Paper IV) 2024-2025
USBO- 354 – Plant Ecology - 2 Credits (30 Lectures)

Sr. No.	Topic Details	No. of Lectures
	Credit-I	15
1.	Introduction, interrelationship between the living world and the environment, levels of organization, components and dynamism of ecosystem, homeostasis, niche concept, concept of limiting factors	03
2.	Biogeography: Floristic realms, speciation and its types, biogeographic regions of India, Plant indicators	03
3.	Population ecology: Definition, characteristics, population growth form, r and k selection	03
4.	Community ecology: Introduction and Definition, community structure, physiognomy, Raunkiaer's life form classification, keystone species, edge and ecotone	04
5.	Biogeochemical cycles: The carbon cycle, Nitrogen cycle, Phosphorus cycle, and Hydrologic cycle	02
	Credit-II	15
6.	Ecological Impact Assessment (EIA) - Introduction, Historical Review of EIA, Objectives of EIA, Stages of EIA process: Screening; Scoping; Baseline study; Impact prediction and assessment; Mitigation; Producing Environmental Impact Statement (EIS); EIS review; Decision making; Monitoring, Compliance and Enforcement; Benefits of EIA.	05
7.	Environmental Audit - Meaning and concept, need, objectives, benefits, types, audit protocol, process, certification, personnel environmental audit	04
8.	Remote Sensing - Definition, basic principles, process of ecological data acquisition and interpretation, global positioning system, application of remote sensing in ecology.	04
9.	Ecological management: Concepts, sustainable development, sustainability indicators	2

References:

1. Current sciences special issue remote sensing for national development Volume 61 numbers 3 and 4 August 1991
2. Daubenmire R.F. 1974. Plants and Environment- A Text Book of Plant Ecology (3rd edition). John Wiley & Sons. New York.
3. E.P. Odum. 1996. Fundamentals of Ecology. Natraj Publishing, Dehradun.
4. G.J. Rau and C.D. Weeten, "Environmental Impact Analysis Hand book, McGraw Hill, 1980.
5. George Joseph Fundamentals of remote sensing (Second edition, 2005) by Universities press (India) Private Ltd., Hyderabad.
6. John R. Jensen (2000) Remote sensing of the environment, Dorling Kindersley India Pvt. Ltd,
7. Kendeigh S.C. 1980. Ecology with Special Reference to Animals and Man. Prentice Hall of India Pvt. Ltd., New Delhi.
8. Kermondy F.J. 1996. Concepts of Ecology. Prentice Hall of India Pvt. Ltd. New Delhi.
9. Kumar H.D. 1996. Modern Concepts of Ecology (3rd edition). Vikas Publishing House Pvt., Ltd. Delhi.
10. Kumar H.D. 1997. General Ecology. Vikas Publishing Pvt. Ltd., Delhi.
11. Larry W. Canter, " Environment Impact Assessment", McGraw-Hill Book Company, New York
12. M. Anji Reddy Textbook of Remote sensing and GIS (Third edition, 2006) by BS Publication, Hyderabad
13. Singh JS, Singh SP, & Gupta SR, (2006) Ecology, Environment and Resource Conservation. Anamaya publ, New Delhi
14. Smith L.R. 1996. Ecology and Field Biology (5th edition). Harper Collns College Publishers, USA.
15. Smith L.R. and Mith T.M. 1998. Elements of Ecology. (4th edition). An imprint of Addison Wesley, Longman ink., California
16. Weaver. J.E. and Clements. S.E. 1966. Plant Ecology. Tata McGraw Publishing Co. Ltd. Bombay.

**T.Y.B.Sc. Botany CBCS Pattern (Semester V, Paper V) 2024-2025
USBO- 355 - Cell and Molecular Biology - 2 Credits (30 Lectures)**

Sr. No.	Topic Details	No. of Lectures
	Credit-I – Cell Biology	15
1	Introduction to Cell Biology: Definition, Brief history of Cell Biology, Units of measurement for cell	01
2	Cell organelles: Ultrastructure, components and functions of Cell wall, endoplasmic Reticulum, Golgi apparatus, Lysosomes, Vacuoles, Peroxisomes & Glyoxysomes	4
3	Nucleus: Morphology and ultrastructure of nucleus, nucleolus and nucleolar organizer, Nuclear envelope – structure of nuclear pore complex, transport of molecules across nuclear envelope.	3
4	Chromosomes: Euchromatin and heterochromatin Histones, Packing of DNA into chromosomes in eukaryotes, Karyotype and ideogram,	2
5	Cell signaling: Introduction and definition, Signaling molecules and receptors, Calcium signaling pathway in plants	2

6	Protein sorting and transport: Protein translocation and processing in Endoplasmic reticulum, Protein processing in golgi and export from golgi	3
	Credit-II - Molecular Biology	15
7	Genetic material DNA: Griffith's and Avery's transformation experiments, Hershey-Chase bacteriophage experiment.	2
8	DNA replication: Molecular mechanism of DNA replication, Enzymes involved in prokaryotic DNA replication and their inhibitors	2
9	Gene expression: Transcription in prokaryotes, Types of RNA: mRNA, tRNA, rRNA; types of promoters; types of RNA polymerase enzymes in; molecular mechanism of transcription in prokaryotes.	4
10	Translation (Prokaryotes): Definition, concept and properties of genetic code; molecular mechanism of translation.	3
11	Regulation of gene expression: Concept of operon, "lac" operon, "trp" operon, and "arabinose" operons - positive and negative control	4

Suggested readings:

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

T.Y.B.Sc. Botany CBCS Pattern (Semester V, Paper VI) 2024-2025 USBO- 356 - Genetics and Plant Breeding - 2 Credits (30 Lectures)

Sr. No.	Topic Details	No. of Lectures
	Credit-I	15
1	Introduction to Genetics. History, Definition, Concept, branches and applications of Genetics. Mendelism - Genetical terminology, Monohybrid cross, Law of dominance, Incomplete dominance, Law of segregation, Dihybrid cross, Dihybrid ratio, Law of independent assortment, Back cross and Test cross.	3
2	Neo Mendelism (Gene Interaction) Genetic interaction, Epistatic interactions –supplementary gene (recessive epistasis 9:3:4), Inhibitory genes (13:3), Masking genes (12:3:1), Non- Epistatic inter-allelic genetic interactions- Complementary genes (9:7), Duplicate genes (15:1)	2
3	Multiple alleles -Definition, Concept, Characters of multiple alleles, Example of multiple alleles – Blood group in human Cytoplasmic Inheritance -Definition and concept, Chloroplast- Variegation in Four O'clock plants, Mitochondria- Petite mutants in yeast.	2
	Linkage, Recombination and Crossing Over - Linkage- Definition and Types,	3

	Crossing over: Definition and Types, Construction of a linkage map by two point test cross and three point test cross, Recombination: Concept, definition and types Sex Linked Inheritance: Concept of Sex chromosomes and autosomes, Inheritance of X- linked genes –Inheritance of colour blindness in humans, Inheritance of Y-linked (Holandric genes) in humans, Sex influenced genes, Sex-limited genes.	
4	Mutation: Concept, definition and types Structural alterations of chromosomes.: Types, cytology and genetic effects of Deletion, Duplication, Inversion and Translocation with examples. Numerical alterations of chromosomes.: Euploidy, Aneuploidy-Concept and Types, Aneuploidy in Plants and Human, Polyploidy in Plants & Animals, Induced Polyploidy, applications of Polyploidy	5
	Credit-II	15
5	Introduction: Definition, Scope and objectives Techniques and practices of plant breeding A. Plant Introduction –Definition, Types (Primary and Secondary), Procedure, Merits and Demerits, Important Achievements B. Selection methods - Concept, Types of selections –mass selection, pure line selection and clonal selection, Advantage and disadvantages of selection, Achievements of selection breeding	6
6	C. Hybridization - Definition, Concept and Objectives, Precaution to be taken during hybridization, Types: Intervarietal and Distant, General procedure of hybridization, Methods of hybridization: Pdigree and bulk, Hybrid vigour and heterosis	5
7	Advanced techniques in Plant breeding A. Mutation breeding - Definition and concept, Mutagens (Physical and Chemical), Mutants, Types of mutation (Spontaneous and Induced), Application of mutation breeding, Limitations of mutation breeding	03
8	B.Tissue Culture - Definition and concept, Totipotency, Application of tissue, embryo and anther culture in seed production	01

Suggested Readings -

1. Atherly, A.G., Girton, J.R. and McDonald, J.F 1999. The Science of Genetics Saunders College Publishing, Frot Worth, USA.
2. Hartle D.L and Jones, E.W 1998 Genetics: Principles and Analysis (Fourth Edition). Jones and Bartlett Publishers, Massachusetts, USA.
3. Khush, G.S 1973. Cytogenetics of Aneuploids. Academic Press, New York, Lewis, R. 1997. Human Genetics: Concepts and Application (Second Edition). WCB McGraw Hill, USA.
4. Russel, P.J. 1998. Genetics (Fifth Edition). The Benjamin/Cummings Publishing Company IND., USA.
5. Snustad, D.P and Simmons, M.J 2000. Principles of Genetics (Second Edition). John Wiley and Sons Inc., USA.
6. Gardner and Simmons Snustad 2005 (Eighth Edition). Principles of Genetics, John Wiley and Sons, Singapore.
7. Sarin C 2004 (Sixth Edition) Genetics. TATA McGraw-Hill Publishing Company Ltd., New Delhi.
8. Ahluwalia K.B 2005 (First Edition). Genetics. New Age International Private Ltd. Publishers, New Delhi.

9. Burus and Bottino 1989. (Sixth Edition). The Science of Genetics. Macmillan Publishing Company, New York (USA).
10. Pawar C.B 2003 (First Edition). Genetics Vol. I and II. Himalaya Publishing House, Mumbai.
11. Strickberger 2005. (Third Edition). Genetics. Prentice Hall of India Pvt. Ltd., New Delhi.
12. Allard R.W 1995. Principles of Plant Breeding. John Wiley and Sons, Inc., Singapore.
13. Sharma J.R 1994 Principles and practices of Plant Breeding. Tata McGraw-Hill Publishers Company Ltd., New Delhi.
14. Verma and Agarwal, Genetics, S. Chand Co, New Delhi.
15. Singh B.D 2004. Genetics. Kalyani Publication, Ludhiana.
16. Gupta P.K Genetics and Cytogenetics, Rastogi Publications.
17. Gupta P. K. Genetics Rastogi Publications.
17. Phundan Singh Genetics, Kalyani Publications.
18. Verma P.S and Agarwal V.K. (2006) Cell Biology, Genetics, Molecular Biology, Evolution, Ecology. S.Chand and Company, New Delhi.
19. Shukla R.S. & Chandel P.S. Cytogenetics, Evolution & Biostatistics. S.Chand Publications.
20. Tomar & Singh Evolutionary Biology, Rastogi Publications.
21. Sharma J.R 1994 Principles and practices of Plant Breeding. Tata McGraw Hill Publishers Company Ltd., New Delhi.
22. Singh B.D 1996 Plant Breeding – Principles and methods. Kalyani Publications, Ludhiana.
23. Allard R.W 1995. Principles of Plant Breeding. John Wiley and Sons, Inc., Singapore.

T.Y.B.Sc. Botany CBCS Pattern Practical (Semester V, Paper VII) 2024-2025
USBOP- 357 - Practicals based on USBO- 351 &USBO- 352- 2 Credits

Sr. No.	Title	No. of Practical
1.	Study of Algae with respect to systematic position, thallus structure and reproduction of <i>Nostoc</i> , <i>Caulerpa</i> , <i>Chara</i> , <i>Sargassum</i> , <i>Gelidiella/Gelidium</i> .	04
2.	Study of Fungi respect to systematic position, thallus structure and reproduction of <i>Mucor</i> , <i>Saccharomyces</i> , <i>Penicillium</i> , <i>Puccinia</i> and <i>Cercospora</i> .	04
3.	Isolation and identification of Mycorrhizal fungi	01
4.	Study of <i>Marchantia</i> with respect to systematic position, morphology of thallus –rhizoids, and scales, Gemma Cup, structure of sporophyte, reproduction.	01
5.	Study of <i>Anthoceros</i> with respect to systematic position, structure of gametophyte, anatomy of thallus, structure of Sporophytes, reproduction.	01
6.	Study of <i>Funaria</i> with respect to systematic position, morphology of thallus- leaf, rhizoids, operculum, anatomy of axis, leaf, reproduction	01
7.	Study of Sporophyte evolution in Bryophytes with the help of permanent slides.	01
8.	Study of <i>Psilotum</i> with respect to Taxonomic position, Morphology of sporophyte, anatomy, and reproductive structure	01
9.	Study of <i>Selaginella</i> with respect to Taxonomic position, Morphology of sporophyte, anatomy and reproductive structures.	01
10.	Study of <i>Equisetum</i> with respect to taxonomic position, Morphology of Sporophyte, anatomy, and reproductive structure	01
11.	Study of Stellar evolution in Pteridophytes with the help of permanent slides	01

Note: Botanical Excursion and submission of Tour Report with Photographs is compulsory.

T.Y.B.Sc. Botany CBCS Pattern Practical (Semester V, Paper VIII) 2024-2025
USBOP- 358- Practicals based on USBO-353 &USBO- 354- 2 Credits

Sr. No.	Title	No. of Practical
1.	Study of the following families w.r.t. systematic position (As per Bentham & Hooker), Diagnostic characters, floral formula, floral diagram and any five examples, Magnoliaceae, Asteraceae, Amaranthaceae, Cannaceae.	2
2.	Preparation of indented and bracketed keys using Vegetative/ reproductive characters.	1
3.	Study of life cycle of <i>Pinus</i> with reference to morphology, anatomy and reproduction.	1
4.	Study of drugs w.r.t. morphology and anatomical characters of <i>Tinospora</i> stem and floral bud of clove.	1
5.	Phytochemical (Alkaloids) analysis of leaves of <i>Adhatoda</i> with respect to confirmatory tests.	1
6.	Study of polluted water body with ref. to BOD (D zero day and D fifth day).	02
7.	Study of physicochemical properties of water body by using Sacchi disc, pH meter and electric conductivity meter	02
8.	Acquisition of ecological data of particular locality by using GPS/ altimeter/geographic maps etc	02
9.	Study of suitable ecosystem by line/belt transect method/ nested quadrat method – Analysis of data by Shanon and Simpson indices	02

T.Y.B.Sc. Botany CBCS Pattern Practical (Semester V, Paper IX) 2024-2025
USBOP- 359 - Practicals based on USBO- 355 &USBO- 356- 2 Credits

Sr. No.	Title	No. of Practical
1.	Cytological techniques- preparation of stains (Aceto-carmin and Aceto-orcin).	1
2	Study of various stages of mitosis and meiosis	1
3	Isolation of plant genomic DNA and visualization of DNA by agarose gel electrophoresis	1
4	Estimation of Plant DNA by DPA method	1
5	Estimation of RNA by Orcinol Method	1
6	Micrometry- Measurement of cell size taking different types of cells.	
7	1. Isolation and characterization of the following subcellular components, using appropriate samples, by differential centrifugation: i. Nuclei: staining and counting ii. Mitochondria: Succinate Dehydrogenase assay iii. Lysosomes: Acid Phosphatase assay	2
8	Preparation of salivary gland chromosomes in <i>Chironomous</i> larvae.	1
9	Genetic problems on gene mapping using three point test cross data.	1
10	Study of structural heterozygotes (multiple translocations) in <i>Rhoeo</i> .	1
11	Problems on Multiple Alleles. (Blood group in Human)	1
12	To study the monohybrid and dihybrid crosses with suitable data and its analysis by Chi-Square test.	1
13	Demonstration of Hybridization Techniques (Emasculation, Hand Pollination, Bagging and Tagging) in cotton and tomato.	1
14	Effect of chemical mutagens on seed germination and seedling growth.	1
15	Study of pollen viability and floral morphology of crops	1
16	Visit to a Plant Breeding Research Centre	1

T.Y.B.Sc. Botany CBCS Pattern (Semester V, Paper X) 2024-2025
USBOSEC-3510 - Industrial and Economic Botany - 2 Credits (30 Lectures)

Sr. No.	Topic Details	No. of Lectures
	Credit-I - Industrial Botany	15
1.	Industrial Botany - Concept and types of nurseries; Ornamental plant nursery fruit plant nursery with reference to infrastructure required and commercial applications	5 L
2.	Introduction to floriculture, important floricultural crops, open cultivation practice, harvesting and marketing.	3L
3.	Propagation methods: seed propagation natural vegetative propagation and artificial propagation. (Layering, Grafting and Cutting).	5L
4	Importance of seed industries, seed production, seed processing and marketing, major seed industries.	2L
	Credit-II - Economic Botany	15
6	Economic Botany - Introduction to economic botany and its scope Concept of Centres of Origin, their importance with reference to Vavilov's work. examples of major plant introductions.	3
7.	Cereals - Origin, evolution, source & uses of Wheat, Rice, Millets, Safflower, Sugarcane.	6
8.	Oil and Fats - General description, classification, extraction, their uses and health implications groundnut, coconut, linseed and Brassica and Coconut (Botanical name, family & uses).	6

Suggested Readings:

1. Kochhar, S.L. (2012). Economic Botany in Tropics, MacMillan & Co. New Delhi, India.
2. Wickens, G.E. (2001). Economic Botany: Principles & Practices. Kluwer Academic Publishers, The Netherlands.
3. Chrispeels, M.J. and Sadava, D.E. (2003). Plants, Genes and Agriculture. Jones & Bartlett Publishers.

T.Y.B.Sc. Botany CBCS Pattern (Semester V, Paper XI) 2024-2025**USBOSEC-3511- Computational and data modeling in Botany - 2 Credits (30 Lectures)**

Sr. No.	Topic Details	No. of Lectures
	Credit-I – Computational Botany	23
1.	Introduction - Importance and scope of statistical methods in biology, Important terms in biometry, Sampling of data: random and non-random sampling, Graphic representation of data- Histograms and line graphs.	4
2.	Measures of central tendency and dispersion - Measurement of central tendency, mean (arithmetic), mode median, Measure of dispersion- Range, Mean deviation, Variance, Standard errors, Standard Deviation & Coefficient of Variation.	5
3.	Probability and probability distribution - Concept of probability definition and rules for combining probability estimation of probability and its applications, Probability distribution- Introduction, Discrete distribution, Binomial distribution and Poison distribution, Continuous distribution, Normal distribution.	6
4	Statistical method for testing goodness of fit. - Testing of hypothesis- Null hypothesis, Chi-square test, level of significance, Degree of freedom, application of chi-square, limitation of chi-square.	5
5	Correlation and regression - Correlation- Introduction, types, measures of correlation coefficient of correlation and application, Regression- Introduction, linear regression.	3
	Credit-II - Data modeling in Botany	07
6	Introduction Biological Sequences and their Classes Locations on Biological Sequences Associating Annotation With Locations On Biological Sequences Collections of Related Biological Sequences Consequences of the Data Model	

T.Y.B.Sc. Botany CBCS Pattern (Semester VI, Paper I) 2024-2025
USBO-361 - Plant Metabolism - 2 Credits (30 Lectures)

Sr. No.	Topic Details	No. of Lectures
	Credit-I	15
1.	Mineral nutrition: Classification of mineral elements, macro and micronutrients; Role of essential elements; Transport of ions across cell membrane, Ionophores , Carriers and Channels	03
3.	Photosynthesis: Mechanism of photosynthesis- Electromagnetic spectrum Ultra-Structure of Chloroplast, Organization of Light-Absorbing Antenna Systems, Light Reaction: (Cyclic and Non-cyclic photophosphorylation), Dark Reaction: Calvin–Benson Cycle, Photorespiration, C4 cycle and CAM pathway of carbon fixation).	07
4.	Metabolic pool and synthesis of various compounds, Study of different pathways involved and production of various secondary metabolites, Classification of Secondary metabolites and their Physiological roles.	05
	Credit-II	15
5	Stomatal Biology: Light-dependent Stomatal Opening, Mediation of Blue-light Photoreception in Guard Cells by Zeaxanthin, Reversal of Blue Light–Stimulated Opening by Green Light, The Resolving Power of Photophysiology (Overview).	04
6.	Translocation in phloem: Composition of phloem sap, girdling experiment; Pressure flow model.	03
7.	Plant growth regulators: Discovery and physiological roles of auxins, gibberellins, cytokinins, ABA, ethylene.	05
8	Photomorphogenesis: Red and far red light responses on photomorphogenesis; Phytochrome (discovery and mode of action).	03

Suggested Books:

1. Lincoln Taiz, Eduardo Zeiger, Ian Max Moller and Angus Murphy 2015. Plant Physiology and Development (Sixth Edition) Sinauer Associates, Inc Publishers Sunderland, Massachusetts U.S.A.
2. Epstein, E., and Bloom, A. J. (2005) Mineral Nutrition of Plants: Principles and Perspectives, 2nd ed. Sinauer Associates, Sunderland, MA.
3. Salisbury F.B and Ross C.W (1992). Plant physiology (Fourth Edition) Wadsworth Publishing Company, California, USA.
4. V. K. Jain (2017) Fundamentals of Plant Physiology S. Chand Publications.

T.Y.B.Sc. Botany CBCS Pattern (Semester VI, Paper II) 2024-2025
USBO-362 –Phytochemistry - 2 Credits (30 Lectures)

Sr. No.	Topic Details	No. of Lectures
	Credit-I	15
1.	Foundation of Biochemistry: From molecules to the first cell (origin of a cell), Miller and Urey experiment. Biomolecules of a cell, functional groups in biomolecules, conformations and configurations of biomolecules.	03
2	Water: The solvent of life: Physical properties of water, structure of water molecule, polarity of water molecule, weak interactions in aqueous solutions.	02
3.	Amino acids and proteins: Structure, classification, properties and functions of amino acids. Structure (primary, secondary, tertiary and quaternary), properties and functions of proteins. Biological disorders of amino acid metabolism. Commercial applications.	05
4.	Enzymes: Definition, nature of enzymes and co-factors, classification and properties of enzymes, active site. Mechanism of enzyme action: free energy, activation energy, binding energy, transition state, lock and key hypothesis, induced fit theory. Factors affecting enzyme activity: pH, temperature, substrate concentration, enzyme concentration. Enzyme inhibition: Competitive, uncompetitive, non-competitive. Reversible and irreversible inhibition, feedback inhibition.	05
	Credit-II	15
5	Carbohydrates: Definition, classification of carbohydrates- Monosaccharides: aldoses and ketoses, configurations, linear to ring structure; Oligosaccharides: glycosidic bond, reducing and non-reducing sugars; Polysaccharides: homopolysaccharides, heteropolysaccharides, examples, their structures, locations and role. Properties and functions of carbohydrates, Carbohydrate pathway, Commercial applications.	08
6.	Lipids: Definition, classification of lipids: simple, conjugate and derived lipids, properties and functions of lipids. Biological disorders of lipid metabolism, Lipid metabolism, Commercial applications.	05
7.	Vitamins: Definition, classification of vitamins, source and functions of vitamins.	02

Suggested Books:

Nelson, D. L., & Cox, M. M. (2017). *Lehninger principles of biochemistry* (7th ed.). W.H. Freeman.

Buchanan, B. B., Gruissem, W., & Jones, R. L. (2000). *Biochemistry & molecular biology of plants*. Rockville, Md.: American Society of Plant Physiologists.

Taiz, L. Zeiger, E., Moller, I.M. and Murphy, A. (2015) *Plant Physiology and Development*. 6th Edition, Sinauer Associates, Sunderland, CT.

Jain, J. L., Jain, S. & Jain, N. (2020) *Fundamentals of Biochemistry*, Revised edition, S. Chand Publishing

Verma S.K. and Verma M. (2007) *A text book of Plant Physiology, Biochemistry and Biotechnology*, S. Chand Publishing.

T.Y.B.Sc. Botany CBCS Pattern (Semester VI, Paper III) 2024-2025
USBO-363 - Plant Pathology & Weed management - 2 Credits (30 Lectures)

Sr. No.	Topic Details	No. of Lectures
	Credit-I	15
1	Fundamentals of Plant Pathology: Introduction, Important terminology- Incitants, Host, Symptoms, Parasite, Pathogen, Inoculum, Penetration, Infection, Incubation, Disease. Economic importance of plant diseases, Introduction to Indian Agriculture Research Institute (IARI), International Crop Research Institute for Semi-Arid Tropics (ICRISAT), Contribution of Anton De Bary and Prof. B.B. Mundkur.	01
2	Disease Development: Concept of disease cycle, Inoculation, Prepenetration, Penetration, Infection, Dissemination. Epidemics- Forms, Decline, Exponential model.	01
3.	Defense Mechanisms: Concept and Definition, Types-Preexisting- Structural and chemical, Induced- Structural and Biochemical.	01
4.	Methods of Studying Plant Diseases. Macroscopic study, Microscopic study, Koch's postulates. Types of culture Media, Pure culture methods- Streak plate, Pour plate, Spread plate.	02
5	Fungal Plant Diseases Introduction to fungi as plant pathogens. Study of Diseases- Head smut of Jowar, Tikka diseases of Groundnut with reference to causal organism, symptoms and disease management.	03
6	Bacterial Plant Diseases. Introduction to bacteria as plant pathogens, Study of Diseases- Citrus Canker with reference to causal organism, symptoms and disease management.	02
7	Weed Management - Weeds: Introduction, harmful and beneficial effects, classification, propagation and dissemination; Weed biology and ecology, crop weed association and competition and concept of Invasion, allelopathy/ allelobiogenesis, Concepts of weed prevention, control and eradication, Methods of weed control: physical, cultural, chemical and biological methods. Integrated weed management	05
	Credit-II	15
5	Mycoplasma Plant Diseases: Introduction to Mycoplasma as plant pathogens, Study of Diseases- Grassy shoot disease of sugarcane, with reference to causal organism, symptoms and disease management.	03
6.	Nematodal Plant Diseases: Introduction to Nematodes as plant pathogens. Study of Diseases- Root knot diseases of vegetables, Nematodes with reference to causal organism, symptoms, Integrated management of Nematodal diseases.	02
7.	Viral Plant Diseases: Introduction of Virus as plant pathogens. Study of Diseases- Papaya Mosaic Disease with reference to causal organism, symptoms and causal organism	02

8	Non-Parasitic Diseases. The impact and abiotic causes- Temperature, Soil moisture and relative humidity, Poor oxygen, Poor light, Air pollutants, mineral deficiencies. Herbicidal injury, Study of Mango necrosis, Black Heart of Potato.	04
9	Principles of plant diseases control: General account, Quarantine, Eradication, cultural control practices, Biological control. Curative measures, chemical control, Use of Effective Microorganism solution (EMS), Microbial Pesticides.	04

Suggested Books:

1. Singh R. S. (2019) Introduction to Principles of Plant Pathology, 4 Ed (PB2019) Paperback.
2. Plant Pathology 2/e PBSharma PD Paperback – 1 January 2016
3. A.V.S.S. Sambamurthy (2010) Principles of plant pathology, Wiley distributor
4. George Agrios (2004) Plant Pathology 5th Edition, Academic Press

T.Y.B.Sc. Botany CBCS Pattern (Semester VI, Paper IV) 2024-2025 USBO-364 - Evolution and Population genetics - 2 Credits (30 Lectures)

Sr. No.	Topic Details	No. of Lectures
	Credit-I	15
1.	Organic Evolution: Distinction between Origin of life and Organic Evolution, Historical account of Origin of life, Origin of Earth Vs Origin of life: Gaia Hypothesis, Earliest Fossils, Prebiotic Evolution, Abiotic synthesis of organic matter, Primordial soup, origin of membranes, Oparin's Coacervate model, Theory of Panspermia, Early life and RNA and Origin of genetic code.	6
2	Organic Evolution: The concept of organic evolution, Theories of Evolution, Pre-Darwinian period, Theory of Inheritance of acquired characters (Lamarck's), Darwinism-Theory of Natural Selection, Post-Darwinian period- Modern synthetic theory.	5
3.	Evidences of Evolution: Direct evidences and conclusions from fossil records, Indirect evidences, Evidences from Genetics, Evidences from bio-geographical relations.	4
	Credit-II	15
5	Evolution Through Ages: Fossils and Geological Time scale: Fossils and Fossilization, Conditions of fossilization, Dating of fossils: Uranium Lead method, Radio-carbon method, U-series and ESR method, Geological Time scale: Eras, Periods, epochs, and duration in millions of years and plant life.	5
6	Population Genetics and Evolution: Concept of Mendelian population, Gene Pool and its models, Hardy-Weinberg law of gene frequencies, Factors affecting allelic frequency, Genetic	4

	polymorphism.	
7	Speciation and Isolating Mechanisms: Introduction, Morphological Criteria for Species and Races, Allopatric and Sympatric Populations, Isolating Mechanisms: Pre zygotic Isolation mechanisms: Concept, Spatial & Ecological, Seasonal Isolation, Ethological Isolation, Mechanical Isolation, Post zygotic Isolation mechanisms: Concept, Hybrid in viability, Hybrid sterility & Hybrid breakdown.	6

Suggested Books:

1. P. K Gupta, Cytology, Genetics and Evolution, Rastogi Publications.
2. Verma P.S and Agarwal V.K. (2006) Cell Biology, Genetics, Molecular Biology, Evolution, Ecology. S. Chand and Company, New Delhi.
3. Shukla R.S. & Chandel P.S. Cytogenetics, Evolution & Biostatistics. S. Chand Publications.
4. Tomar & Singh, Evolutionary Biology, Rastogi Publications.
5. Suryaprakash Mishra. A textbook of Cell Biology, Genetics and Evolution, Kalyani Publication.
6. N Shukla, Population Genetics, Discovery Publishing, Pvt. Ltd.
7. Veer Bala Rastogi, Organic Evolution (Evolutionary Biology), Scientific International Pvt. Ltd.
8. N. Anurgam, Evolution, Saras Publications.
9. N. Anurgam, Organic Evolution, Saras Publications.

T.Y.B.Sc. Botany CBCS Pattern (Semester VI, Paper V) 2024-2025
USBO-365 - Advanced Plant Biotechnology - 2 Credits (30 Lectures)

Sr. No.	Topic Details	No. of Lectures
	Credit-I	15
1.	Biotechnology: Introduction, Traditional and modern Biotechnology. Impact of Biotechnology on Health care, Agriculture, and Environment	01
2	Plant Tissue Culture: Method of development and applications of callus culture, suspension culture, organogenesis (direct and indirect), somatic embryogenesis (direct and indirect) and artificial seed production. Bioreactors in plant production	05
3.	Techniques of Genetic Engineering: Introduction to Molecular tools: Definition and role of Nucleases, Polymerases, Ligases, Polynucleotide kinases, Alkaline Phosphatases. Gene amplification technique -Polymerase chain reaction DNA finger printing Applications of plant genetic engineering - Transgenic plants resistant to fungi and viruses, plants with increased rate of photosynthesis, plants tolerant to temperature stress and osmotic stress, Horizontal gene transfer, Molecular markers and marker assisted selection	09
	Credit-II	15

5	Cryopreservation and Germplasm Conservation: Definition and concept, Techniques of cryopreservation, cold storage, long term and short term storage, applications	03
6	Patenting of biotechnological inventions and Intellectual property rights.	01
7	Microbial Biotechnology: Biochemistry of fermentation, Microorganism used in fermentation, fermentable substrate, Ethanol fermentation methods, Distilleries producing alcohols. Commercial production: Alcoholic beverages, organic acids, citric acids. Advantages and disadvantages of fermentation.	05
8	Transgenic Plants as Bioreactors: Metabolic engineering of starch, cyclodextrins, fructans, Bioplastics, Genetically engineered plants as protein factories, Production of therapeutic proteins from plants (edible vaccines and plantibodies).	05
9	Nano-biotechnology: Definition and concept, Applications of nanotechnology in agriculture (fertilizers and pesticides)	01

Suggested Books:

1. R. C. Dube (2008) - A Text Book of Biotechnology, S. Chand
2. P.K. Gupta-Elements of Biotechnology
3. Satyanarayana - Biotechnology
4. Kalyan Kumar De-Plant tissue culture
5. Pal J.K. and Ghaskadabi S.S. (2008) Fundamentals of Molecular Biology.
6. Verma and Agrawal- Molecular Biology
7. Devi P.2008-Principle and Methods of plant Molecular Biology, Biochemistry and Genetics Agrobios, Jodhpur, India.
8. Glick B.R. and Tompson J.E. 1993 Methods in Plant Molecular Biology and Biotechnology CRC Press Boca Raton, Florida.
9. Hall R.D. (Ed.) 1999 Plant cell culture Protocol human press Inc., New Jersey, USA
10. Kumar H.D. 2002 A Text Book of Biotechnology 2nd Edn. Affiliated Easyt West Press Private Ltd New Delhi.
11. Ramawat K.G. 2003 Plant Biotechnology, S. Chand & Co. Ltd. Ramnagar New Delhi. 110055
12. Trivedi P.C.2000 Plant Biotechnology, Panima Publishing Carpaton, New Delhi.
13. Rajdan- Plant tissue culture.
14. Kalyan Kumar De - Plant tissue culture
15. Pal J.K. and Ghaskadabi S.S. (2008) Fundamentals of Molecular Biology.
16. Razdan M.K. - Introduction to Plant Tissue culture (Oxford & IBH Publ, New Delhi)

T.Y.B.Sc. Botany CBCS Pattern (Semester VI, Paper VI) 2024-2025 USBO-366 -Polyhouse and Seed Technology - 2 Credits (30 Lectures)

Sr. No.	Topic Details	No. of Lectures
	Credit-I - Polyhouse technology	15
1.	Definition, scopes importance, Types of protected structure based on site and climate; cladding material involved in greenhouse/ poly house	5
2	Greenhouse design, environment control, artificial lights, automation.	2

3.	Soil preparation and management, substrate management, types of benches and containers Irrigation and fertigation management	4
4	Propagation and production of quality planting material of horticultural crops Insect pest and disease management.	4
	Credit-II - Seed Technology	15
5	Introduction, Definition of seed, Stages of Seed Production, Classes of Seed (nucleus seed, breeders seed, foundation seed, certified seed and truthful seed), Role of seed technology.	2
6	Seed sampling, storage and packaging - Seed sampling, Types of seed samples. Factors affecting seed storage and need of seed storage, Methods of protection and control, Air conditioning and dehumidification, Sanitation and fumigation of seed stores. Seed sorting and bagging, bag weighing, bag closing, type of bag closer, Labelling and maintaining lot identify, lot numbers, seed pellets, Handling and stacking, Maintenance of seed processing record	6
7	Physical purity analysis - Definition of purity components Procedure ODV test Reporting and results.	2
8	Seed Testing - Moisture Testing By air oven method Moisture meters, Germination testing Definition and objectives, General principles and requirements, Procedure and methods (Paper, Sand and Soil) Seedling evaluation Seed production agencies, seed industry and custom seed production in India.	5

Suggested Books:

- 1) S.D. Warade. 2003. Protected cultivation of Horticulture crops, CAFT(fruits), MPKV, Rahuri
- 2) Balraj Singh. 2005. Protected cultivation of vegetable crops, Kalyani publishers, New Delhi
- 3) Commercial Floriculture – Prasad & Kumar.
- 4) Agarwal RL. 1997. Seed Technology. 2nd Ed. Oxford & IBH. Chhabra AK. 2006.
- 5) Seeds Handbook. Marcel Dekker. Kelly AF. 1988.
- 6) Seed Production of Agricultural Crops. Longman. McDonald MB Jr & Copeland LO. 1997.
- Seed Production: Principles and Practices. Chapman & Hall. Musil AF. 1967.
- 7) Plant Breeding: Principles and Methods. Kalyani. Singhal NC. 2003. Hybrid Seed Production in Field Crops. Kalyani. Thompson JR. 1979.

T.Y.B.Sc. Botany CBCS Pattern (Semester VI, Paper VII) 2024-2025
USBOP-367 - Practicals based on USBO-361&USBO-362 - 2 Credits

Sr. No.	Title	No. of Practical
1.	Determination of osmotic potential of plant cell sap by plasmolysis method	01
2	Calculation of stomatal index and stomatal frequency of a mesophyte and a xerophyte.	01
3	Demonstrate the activity of catalase and study the effect of pH and enzyme concentration.	01
4	To study the effect of light intensity and bicarbonate concentration on O ₂ evolution in photosynthesis.	01
5	Comparison of the rate of respiration in any two parts of a plant.	01
6	Separation of amino acids by paper chromatography.	02
7	Demonstration experiments (any four) i) Bolting. ii) Effect of auxins on rooting. iii) Suction due to transpiration. iv) R.Q. v) Respiration in roots.	01
8	Estimation of total free amino acids by spectrophotometry	01
9	Separation of amino acids by paper chromatography.	01
10	Estimation of soluble proteins by Lowery <i>et. al.</i> method.	01
11	Demonstration of Enzyme activity: Amylase /invertase /catalase	01
12	Estimation of reducing sugars by DNSA method.	01
13	Estimation of Vitamin C (Ascorbic acid) from plants.	01
14	Qualitative tests for starch, lipids and proteins.	01
15	Determination of the iodine number of lipids using Hanus method.	01

T.Y.B.Sc. Botany CBCS Pattern (Semester VI, Paper VIII) 2024-2025
USBOP-368 - Practicals based on USBO-363 &USBO-364 - 2 Credits

Sr. No.	Title	No. of Practical
1.	Preparation of any one culture media for isolation of plant pathogens.	01
2	Culture technique- Streak plate methods, pour plate methods, Spread plate methods.	01
3	Study of any two of fungal (Downy mildew of Grapes, Head smut of Jowar, Tikka diseases of Groundnut) diseases	01
4	Study of any two of each bacterial, viral, mycoplasma and non-parasitic diseases	01
5	Preparation of 1% Bordeaux mixture, Bordeaux paste 10% and Jivamruta	01
6	Study of Koch's Postulates.	01
7	Study of Fungicides and Microbial pesticides.	01
8	Survey of weeds in crop fields and other habitats and their Identification Preparation of herbarium of weeds (Minimum 5)	01

9	Study of Geological time scale	01
9	Study of types of Fossils : i) Coal ball ii) Rhynia vii) Lyginopteris iii) Pentoxylon iv) Nipaniophyllum v) Lepidodendron	01
10	Demonstration of any three evidences of Organic Evolution	01
11	Numerical Problems based on Allele frequency and Genotype frequency	01
12	Numerical Problem based on Hardy-Weinberg Equilibrium	01
13	Study of Sympatric and Allopatric speciation with suitable example	01
14	Study of Isolation mechanism : Prezygotic & Postzygotic (Any one example from each)	01
15	Submission of Report on Visit to Paleobotany Laboratory/ Museum/ Fossil Garden	01

**T.Y.B.Sc. Botany CBCS Pattern (Semester VI, Paper IX) 2024-2025
USBOP-369 -Practicals based on USBO-365 &USBO-366 - 2 Credits**

Sr. No.	Topic Details	No. of Practical
	Credit-I	15
1.	Effect of various growth regulators on response <i>in vitro</i>	2P
2	Somatic embryogenesis and Artificial seed production by Sodium Alginate method encapsulation (somatic embryogenesis)	01
3.	Demonstration to equipments used in genetic engineering like gene gun, PCR, gel doc, microcentrifuge, electrophoresis, micropipettes, incubator, shaker etc.	01
4	Study of Transgenic plants- Arabidopsis thaliana as a model plant, Bt Brinjal, Flr-svr Tomato, and other GM crops like soybean, maize, tobacco as a pharmaceuticals, banana as a edible vaccine etc.	01
5	Preparation of plant based nano-particles	01
6	Fermentation of fruit juice and wine production	01
7	Problems on genetic engineering (set of problems will be given on restriction enzymes, vectors etc.)	01
8	Soil and water EC and pH measurement as per crop need	01
9	Bed preparation and planting of crop for production.	01
10	Raising of seedlings and saplings under protected conditions	01
11	To test seed moisture by hot air oven method	01
12	To study germination methods (Paper, Sand and Soil)	01
13	Physical purity analysis of seed sample	01
14	Visit to commercial unit of polyhouse	01

T.Y.B.Sc. Botany CBCS Pattern (Semester VI, Paper X) 2024-2025
USBOSEC 3610 - Nursery and Gardening Management - 2 Credits (30 Lectures)

Sr. No.	Topic Details	No. of Lectures
	Credit-I - Nursery Management	15
1.	Nursery: definition, objectives and scope and building up of infrastructure for nursery, planning and seasonal activities - Planting - direct seeding and transplants.	03
2	Seed: Structure and types - 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.	03
3.	Vegetative propagation: air-layering, cutting, selection of cutting, collecting season, treatment of cutting, rooting medium and planting of cuttings - Hardening of plants	09
	Credit-II - Gardening Management	15
5	Gardening: definition, objectives and scope - different types of gardening - 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.	08
6	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.	07

Suggested Readings

1. Bose T.K. & Mukherjee, D., Gardening in India, Oxford & IBH Publishing Co., New Delhi. 1972.
2. Sandhu, M.K., Plant Propagation, Wile Eastern Ltd., Bangalore, Madras. 1989.
3. Kumar, N., Introduction to Horticulture, Rajalakshmi Publications, Nagercoil. 1997.
4. Edmond Musser & Andres, Fundamentals of Horticulture, McGraw Hill Book Co., New Delhi.
5. Agrawal, P.K. Hand Book of Seed Technology, Dept. of Agriculture and Cooperation, National Seed Corporation Ltd., New Delhi. 1993.
6. Janick Jules. Horticultural Science. (3rd Ed.), W.H. Freeman and Co., San Francisco, USA. 1979.

T.Y.B.Sc. Botany CBCS Pattern (Semester VI, Paper XI) 2024-2025
USBOSEC 3611 -Biofertilisers, Biopesticides & organic farming
2 Credits (30 Lectures)

Sr. No.	Topic Details	No. of Lectures
	Credit-I	15
1.	Introduction: Introduction, Scope and importance of Biofertilizers	1
2	Bacterial Biofertilizers - Isolation of Rhizobium, Identification, Mass multiplication, Carrier based inoculants. Azospirillum isolation and mass multiplication, carrier based inoculants and associative effect of different organisms, Azotobacter, classification and characteristics, Crop response to Azotobacter inoculums, Mass multiplication of Azotobacter, Applications of Azospirillum, Phosphate solubilizing Bacteria	6
3.	Algal Biofertilizers - Cyanobacteria (Blue Green Algae): Isolation of Anabaena from Azolla, Mass Multiplication of Anabaena, Azolla - Anabaena relationship, Applications of BGA	4
4.	Fungal Biofertilizers - Introduction, Occurrence and Distribution of Mycorrhizal association, Types of Mycorrhizal association, growth and yield - colonization of VAM - Vesicular Arbuscular Mycorrhiza Mycorrhizal applications in agriculture	4
	Credit-II	15
5	Biopesticides - Introduction and importance, Types of Biopesticides, Use and Product Development of Biopesticides.	5
6	Organic Farming - Definition, Principles and its Scope in India and world. Organic ecosystem and their concepts, Organic nutrient, resources and its fortification, Choice of Crops and Varieties in Organic Farming	5
7	Certification process and Standards of Organic Farming - Processing, Labelling and Economic consideration and its viability in Organic production	5

Suggested Books:

1. Dubey, R. C. (2005). A text book of Biotechnology. S. Chand & Co. New Delhi, India.
2. Kumarasen, V. (2005). Biotechnology. Saras Publication, New Delhi, India.
3. Sathe, T. V. (2004). Vermiculture and Organic Farming. Daya Publishers, Delhi, India.
4. John, Jothi Prakash, E. (2004). Outline of Plant Biotechnology. Emkay Publication, New Delhi, India.
5. Subha Rao, N. S. (2000). Soil Microbiology. Oxford and IBH Publishers, New Delhi, India.
6. Vayas, S. C., Vayas S. and Modi, H. (1990). Biofertilizers and Organic Farming. Ekta Publication, Nanded, India.
7. Organic Farming for Sustainable Agriculture by Dahama A. K. Agrobios Publication.
8. Organic Farming: Theory and Practices by Palaniappan, S.P. and Annadurai, K.
9. Organic Farming in India, Problems and Prospects by Thapa, U. and Tripathi, P.
10. Trends in Organic Farming in India by Agrobios Publication
11. Handbook of Organic Farming.
12. Recent Developments in Organic farming by Gulati and Barik

