

## Program Outcomes (Pos) for B. Sc. Program

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

Anekant Education Society  
**Tuljaram Chaturchand College of Arts, Science and Commerce,  
Baramati**  
(Autonomous)  
**SYLLABUS (CBCS) FOR S. Y. B. Sc. BOTANY (w.e.f. June, 2023)**  
**Academic Year 2023-2024**

<b>Semester</b>	<b>Paper Code</b>	<b>Paper Title</b>	<b>Credit</b>
<b>III</b>	USBT 231	Taxonomy of Angiosperms	03
	USBT 232	Plant Physiology	03
	USBT 233	Practical based on USBT 231 and USBT 232	02
<b>IV</b>	USBT 241	Anatomy and Embryology	03
	USBT 242	Plant Ecology	03
	USBT 243	Practical based on USBT 241 and BOT 242	02

Class : S. Y. B. Sc. (Semester - III)

Paper Code: USBT 231

Paper : I

Credit : 3

Title of Paper : **Angiosperms Taxonomy**

No. of lectures: 48

**A) Learning Objectives:**

1. To study the comparative account of plant families.
2. To give knowledge of identification of plants and their nomenclature.
3. To understand Classification systems of angiosperms.

**B) Course Outcome:**

By the end of the course, students will be able to:

CO1. Describe the morphology and reproductive structure of Phanerogams.

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

CO3. Know scope of the Phanerogams diversity with special reference to Gymnosperms and Angiosperms.

CO4. Know different methods of conservation of Phanerogams.

CO5. Study the applications of cryptogams.

CO6. Describe and identify flowering plants.

CO7. Understand the local flora with respect to Phanerogams.

**Credit - I (14 L)**

**1. Introduction to Plant Taxonomy:**

**(4L)**

Definition, scope and importance, objectives, Identification, classification, nomenclature  
Concept of Systematics.

**2. Systems of classification :**

**(7L)**

Types of systems with their merits and limitations- a) Artificial system- Carl Linnaeus , b) Natural system -Bentham and Hooker, c) Phylogenetic system- Engler and Prantl.

**3. Taxonomic literature:**

**(3L)**

Flora, monograph , manuals, journals, periodicals, references books.

**Credit - II**

**(13 L)**

**4. Sources of data for Systematics:**

**(6L)**

Morphology, Anatomy, Cytology, Phytochemistry, Molecular biology.

**5. Botanical Nomenclature :**

**(7L)**

History, Binomial nomenclature, ICN – principles, Rules of nomenclature, Coining of generic names and specific epithets. Ranks and endings of taxa names, Principle of priority, Effective

and valid publications, Single and double authority citation, *Nomina conservanda*.

**Credit - II** (21 L)

**6. Study of Plant Families** (13L)

Study of following families with reference to systematic position, salient features, floral formula, floral diagram and any five examples with their economic importance - Annonaceae, Meliaceae, Myrtaceae, Rubiaceae, Solanaceae, Apocynaceae, Euphorbiaceae and Amaryllidaceae.

**7. Computer in taxonomy:** (8L)

Concept of herbarium, advantages and limitations, Digital /e-herbarium and its advantages QR code generation. Concept and overview of APG system.

**References :**

- 1) Almeida, M.R. 1996, 1998, 2001a, 2001b, 2003a, 2003b 2009. *Flora of Maharashtra*. Vol. 1(Ranunculaceae to Connaraceae), 294 pp.; Vol. 2(Fabaceae to Apiaceae), 372 pp.; Vol. 3a(Rubiaceae to Ehretiaceae)300 pp.; Vol. 3b(Cuscutaceae to Martyniaceae) 301–464 pp.; Vol. 4a(Acanthaceae to Balanophoraceae)278 pp.; Vol. 4b(Bischofiaceae to Ceratophyllaceae) 279–399 pp. and Vol. 5a(Hydrocharitaceae to Typhaceae) 1–245 pp.St. Xavier's College, Mumbai.
- 2) Angiosperm Phylogeny Group (2016) An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants: APG IV. *Botanical Journal of the Linnean Society* 181: 1–20.
- 3) Douglas E. Soltis, Pamela E. Soltis, Peter K. Endress and Mark W. Chase, 2005. *Phylogeny and Evolution of Angiosperms*. Sinauer Associates, Inc., Publishers, Sunderland, USA.
- 4) Ian J. Kitching, Peter L. Forey, Christopher J. Humphries and David M. Williams, 1998. *Cladistics: The Theory and Practice of Parsimony analysis* (2nd Ed.). The Oxford University Press.
- 5) Radford, A.E., W.C. Dickinson, J.R. Massey and C.R. Bell. 1974. *Vascular Plant Systematics*, Harper & Row, New York.
- 6) Salemi, M. and A.-M. Vandamme (Eds.) 2003. *The Phylogenetic Handbook. A Practical Approach to DNA and Protein Phylogeny*. Cambridge University Press.
- 7) Simpson, Michael George. 2006. *Plant systematics*. Elsevier Academic Press.
- 8) Singh, Gurcharan. 2019. *Plant Systematics: An Integrated Approach*, Fourth Edition. CRC Press.
7. Singh, N.P., Karthikeyan, S., Lakshminarasimhan, P. & Prasanna, P.V. (2000) *Flora of Maharashtra State: Dicotyledons Vol. I*. Botanical Survey of India, Calcutta, 898.
- 9) Singh, N.P., Lakshminarasimhan, P., Karthikeyan, S. & Prasanna, P.V. (2001) *Flora of Maharashtra State (Dicotyledones)*. Vol. 2. Botanical Survey of India, Calcutta, India, 1080.
- 10) Stevens, P. F. (2001 onwards). *Angiosperm Phylogeny Website*. Version 9, June 2008

[and more or less continuously updated since].  
<http://www.mobot.org/MOBOT/research/APweb/>

- 11) Stuessy Tod F. 2002. Plant taxonomy. The systematic Evaluation of comparative data. Bishen Singh Mahendra Pal Singh, Dehra Dun.
- 12) Stuessy, Tod F., 2009. Plant taxonomy: the systematic evaluation of comparative data (2nd ed.). New York: Columbia University Press.
- 13) Taylor, D. V. and L. J. Hickey 1997. Flowering plants: Origin, evolution and phylogeny CBS Publishers a Distributors New Delhi.
- 14) Walter S. Judd, Christopher S. Campbell, Elizabeth A. Kellogg, Peter F. Stevens and Michael J. Donoghue, 2007. Plant Systematics: A Phylogenetic Approach, Third Edition. Sinauer Associates, Inc., Publishers, Sunderland, USA.
- 15) Yadav S.R. and Sardesai M.M. - Flora of Kolhapur District. Shivaji University, Kolhapur.

### **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](https://bsi.gov.in/content/1416_1_FloraofIndia.aspx)

FLOWERS OF INDIA

<http://www.flowersofindia.net/>

eFLORAS OF WORLD

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

Choice Based Credit System Syllabus (2022 Pattern)

**Mapping of Program Outcomes with Course Outcomes**

**Class:** S.Y. B. Sc. (Sem. III)

**Subject:** Botany

**Course:** Angiosperm Taxonomy

**Course Code:** USBT 231

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

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

**Justification for the mapping**

**PO1: Disciplinary Knowledge**

CO1. Describe the morphology and reproductive structure of Phanerogams.

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

CO3. Know scope of the Phanerogams diversity with special reference to Gymnosperms and Angiosperms.

CO4. Know different methods of conservation of Phanerogams.

CO5. Study the applications of cryptogams.

CO6. Describe and identify flowering plants.

CO7. Understand the local flora with respect to Phanerogams.

**PO2: Critical Thinking and Problem Solving**

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

CO4. Know different methods of conservation of Phanerogams.

CO5. Study the applications of cryptogams.

**PO 3: Social competence**

CO7. Understand the local flora with respect to Phanerogams.

**PO 4: Research-related skills and Scientific temper**

CO6. Describe and identify flowering plants.

**PO5: Trans-disciplinary Knowledge**

CO6. Describe and identify flowering plants.

**PO6: Personal and Professional Competence**

CO4. Know different methods of conservation of Phanerogams.

CO5. Study the applications of cryptogams.

CO6. Describe and identify flowering plants.

CO7. Understand the local flora with respect to Phanerogams.

**PO 8: Environment and Sustainability**

CO4. Know different methods of conservation of Phanerogams.

**PO 9: Self-directed and Life-long Learning**

CO1. Describe the morphology and reproductive structure of Phanerogams.

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

CO6. Describe and identify flowering plants.

CO7. Understand the local flora with respect to Phanerogams.

Class : **S. Y. B. Sc. (Semester - III)**

Paper Code: **USBT 232**

Paper : **II**

Credit : **3**

Title of Paper: **Plant Physiology**

No. of lectures: **48**

**A) Learning Objectives:**

1. To understand physiology of plants.
2. To study the physiological processes occurring in plants.
3. To get idea about functioning of instruments.

**B) Course Outcome:**

- CO1. Use knowledge for improvement of agricultural yield
- CO2. Students aware about the plant to response environmental conditions.
- CO3. Students get knowledge of internal activities in plant.
- CO4. Development of expertise in plant physiology.
- CO5. Get knowledge of plant metabolism.
- CO6. Students get knowledge of plant cycle.
- CO7. Students get knowledge of biomolecules.

**Credit - I (15 L)**

**1. Introduction to Plant Physiology**

**(3L)**

Brief history, Scope and applications of plant physiology, Contribution of some Indian physiologist.

**2. Plant – Water relations**

**(8L)**

Structure of cell and types of tissue – cellular and organism level.

Membrane structure (Fluid Mosaic Model), permeability and aquaporins.

Diffusion – Definition, factors affecting diffusion, importance of diffusion in plants

Osmosis – Definition, types of solutions – hypotonic, hypertonic and isotonic, endosmosis and exosmosis, concept of osmotic pressure (OP), turgor pressure (TP), wall pressure (WP), Diffusion pressure deficit (DPD), relation between OP, TP and DPD, role of osmosis in plants.

Plasmolysis – Definition, mechanism, deplasmolysis, significance of plasmolysis

Imbibition – Concept, mechanism and significance.

**3. Absorption of water**

**(4L)**

Role of water in plants, Concept of water potential and capillary water

Mechanisms of water absorption (Accepted mechanism only)



Factors affecting on rate of water absorption

**Credit - II** (17 L)

**4. Ascent of sap:** (5L)

Introduction and definition. Theories of ascent of sap, Vital theories: Jamin – Chame theory and Bose theory, Physical force theories: a) Capillary theory, b) Imbibitional theory, c) Atmospheric pressure theory.

Transpiration pull or cohesion-tension theory, evidences and objections,  
Factors affecting on ascent of sap.

**5. Transpiration:** (7L)

Definition, Types of transpiration – cuticular, lenticular and stomatal

Structure of stomata, Mechanism of opening and closing of stomata –Steward's hypothesis, active K<sup>+</sup> transport mechanism, Factors affecting the rate of transpiration, Significance of transpiration Antitranspirants, Guttation, Exudation.

**6. Seed dormancy and germination:** (5L)

Definition and types of seed dormancy, Factors causing seed dormancy, Methods to break seed dormancy, metabolic changes occurs during seed germination.

**Credit - III** (16 L)

**7. Plant growth and plant growth regulators:** (8L)

Introduction, Phases of growth and plant growth curve. Measurement of growth- Arc auxanometer, Bose Crescograph, fresh and dry weight method, Factors affecting on growth, Plant Growth Regulators- Introduction and definition, Specific practical applications of auxins, cytokines, gibberellins, ethylene and abscisic acid.

**8. Physiology of flowering:** (8L)

Photoperiodism – Concept, definition, short day plants, long day plants and day neutral plants, Phytochrome- properties, Pr to Pfr interconversion, role of phytochrome in flowering of SDP and LDP Phytohormones and initiation of flowering

Applications of photoperiodism

Vernalisation – concept and definition, mechanism of vernalisation, applications of vernalisation, devernialization.

**References:**

- 1) Jain, V.K. (2000): Fundamentals Of Plant Physiology, S.Chand&Co, New Delhi.
- 2) Verma, V. (2007): Text Book Of Plant Physiology, Ane Books India, New Delhi.
- 3) Nobel, P.S. 2009. Physicochemical and Environmental Plant Physiology.4th edition AcademicPress, UK
- 4) Taiz, L. and Zeiger, E. 2006. Plant Physiology. 4th Edition. Sinauer Associates, Sunderland, Massachusetts, USA
- 5) Salisbury F.B. and Ross C.B. 2005. Plant Physiology. 5th Edition. Wadsworth Publishing Co.Belmont CA.
- 6) Helgi O'Pik, Stephen A. Rolfe, Arthur J. Willis. 2005. The Physiology of Flowering Plants, Cambridge University Press, UK
- 7) Kirkham, M.B. 2004. Principles of Soil and Plant Water Relations. Elsevier, Amsterdam, Netherlands.
- 8) Dennis, D.T., Turpin, D.H., Lefebvre, D.D. and Layzell, D.B. 1997. Plant Metabolism. 2nd Edition. Longman Group, U.K.
- 9) Fitter, A. and Hay, R.K.M. 2001. Environmental Physiology of Plants. Academic Press, UK.
- 10) Press, M.C., Barker, M.G., and Scholes, J.D. 2000. Physiological Plant Ecology, British Ecological Society Symposium, Volume 39, Blackwell Science, UK.

Choice Based Credit System Syllabus (2022 Pattern)

**Mapping of Program Outcomes with Course Outcomes**

**Class:** S.Y. B. Sc. (Sem. III)

**Subject:** Botany

**Course:** Plant Physiology

**Course Code:** USBT 232

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

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

Justification for the mapping

**PO1: Disciplinary Knowledge**

CO1. Use knowledge for improvement of agricultural yield.

CO3. Students get knowledge of internal activities in plant.

CO5. Get knowledge of plant metabolism.

CO6. Students get knowledge of plant cycle.

CO7. Students get knowledge of biomolecules.

**PO2: Critical Thinking and Problem Solving**

CO2. Students aware about the plant to response environmental conditions.

**PO 3: Social competence**

CO1. Use knowledge for improvement of agricultural yield.

**PO 4: Research-related skills and Scientific temper**

CO3. Students get knowledge of internal activities in plant.

CO5. Get knowledge of plant metabolism.

CO6. Students get knowledge of plant cycle.

CO7. Students get knowledge of biomolecules.

Class : S. Y. B. Sc. (Semester - III)

Paper Code : USBT 233

Paper : III Title of Paper : Practical based on USBT 231 and USBT 232

Credit : 2 No. of Practicals : 12

**A) Learning Objectives:**

1. To understand physiology of plants.
2. To study the physiological processes occurring in plants.
3. To get idea about functioning of instruments.

**B) Learning Outcome:**

By the end of course students will be able to

- CO1. Develop identification skill in cryptogams.
- CO2. Train in cell biology techniques.
- CO3. Understand basic knowledge about life cycle of cryptogams.
- CO4. Internal and external structure of cryptogams.
- CO5. Explain basic knowledge about evolution of lower cryptogams.
- CO6. Discuss spore dispersal mechanism.
- CO7. Understand variations in cryptogamic diversity.

**Practicals :**

- 1) Tools of taxonomy (01 P)
- 2) Description of flowering plant in botanical terms (02 P)
- 3) Plant identification – key to groups upto family (01 P)
- 4) Study of plant families (any six) (03 P)
- 5) Study of plasmolysis in suitable plant material (01 P)
- 6) Determination of Diffusion Pressure Deficit (DPD). (01 P)
- 7) Determine rate of transpiration under different conditions of Sunlight, Shade and wind (01 P)
- 8) Demonstration Experiments. (Compulsory Practical ): Curling Experiment, Imbibition in seeds, Arc Auxanometer, Effect of auxins on rooting, Transpiration pull, Spectrophotometer, Portable leaf area meter, Conductivity meter, Centrifuge (01 P)
- 9) Assessing seed viability by TTC method (01 P)

Note :

1. Study Tour is compulsory.
2. Submission of botanical excursion report and herbarium of at least five correctly identified local dominant plants is compulsory.

Choice Based Credit System Syllabus (2022 Pattern)

**Mapping of Program Outcomes with Course Outcomes**

**Class:** S.Y.B. Sc. (Sem. III)

**Subject:** Botany

**Course:** Practical I

**Course Code:** USBT 233

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

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

**Justification for the mapping**

**PO1: Disciplinary Knowledge**

CO3. Understand basic knowledge about life cycle of cryptogams.

CO4. Internal and external structure of cryptogams.

CO5. Explain basic knowledge about evolution of lower cryptogams.

CO6. Discuss spore dispersal mechanism.

CO7. Understand variations in cryptogamic diversity.

**PO2: Critical Thinking and Problem Solving**

CO7. Understand variations in cryptogamic diversity.

**PO 4: Research-related skills and Scientific temper**

CO1. Develop identification skill in cryptogams.

CO2. Train in cell biology techniques.

**PO6: Personal and Professional Competence**

CO3. Understand basic knowledge about life cycle of cryptogams.

CO7. Understand variations in cryptogamic diversity.

**PO 9: Self-directed and Life-long Learning**

CO7. Understand variations in cryptogamic diversity.