Rayat Shikshan Sanstha's

SADGURU GADGE MAHARAJ COLLEGE, KARAD

(An Autonomous College, Affiliated to Shivaji University, Kolhapur)

Accredited By NAAC with A^+ Grade (CGPA 3.63)

National Education Policy (NEP-2.0)

Syllabus for

B.Sc. Part -II

BOTANY

(Major)

Syllabus to be implemented from June 2024 onwards of

Academic Year 2024-25

Rayat Shikshan Sanstha's

Sadguru Gadge Maharaj College, Karad (Autonomous)

Syllabus for Bachelor of Science (B. Sc.) Part – II

1. TITLE: **Botany**

2. YEAR OF IMPLEMENTATION: **2024 – 2025**

3. PREAMBLE:

The B. Sc. Botany course under autonomy has been prepared keeping in view the unique requirements of B. Sc. Botany students. The contents have been drawn up to accommodate the widening horizons of the discipline of biological sciences. The emphasis is to provide students the latest information along with due weightage to the concepts of classical botany so that they are able to understand and appreciate the current interdisciplinary approaches in the study of plant sciences and its role in societal development. The course content also lists new practical exercises so the students gets a hands on experience of the latest techniques that are currently in use. The course will also inspire students to pursue higher studies in botany, for becoming an entrepreneur and enable students to get employed in plant based industries.

4. GENERAL OBJECTIVES OF THE COURSE:

- To impart the knowledge of science is the basic objective of education.
- To develop scientific attitude among the students and to make the students open minded, critical and curious.
- To develop skill in practical work, experiments and laboratory materials.
- To understand scientific terms, concepts, facts, phenomenon and their relationships.
- To make the students aware of natural resource and environment.

- To enable the students to acquire knowledge of plant and related subjects so as to understand nature and environment in the benefit of human beings.
- To develop ability for the application of acquired knowledge to improve agriculture and related fields to make the country self-reliant.

5. DURATION: **01 year**

6. PATTERN:**NEP 2.0**

7. MEDIUM OF INSTRUCTION: **English**

8. STRUCTURE OF COURSE:

1) THIRD SEMESTER (NO.OF PAPERS–02)

Sr. No.	**Subject**	**Theory**					**Practical**	
		Paper No. & Paper Code	**Title of Paper**	**No. of lectures per week**	**Credits**		**No. of lectures Per week**	**Credits**
1.	Botany	Paper V: **MJ-BBT 23-301**	Plant Taxonomy and Embryology	2	2	Practical III: MJ-BBP 23-303	8	2
		Paper VI: **MJ-BBT 23-302**	Plant Physiology and Metabolism	2	2			

2) FOURTH SEMESTER (NO.OF PAPERS–02)

Sr. No.	**Subject**	**Theory**					**Practical**	
		Paper No. & Paper Code	**Title of Paper**	**No. of lectures per week**	**Credits**		**No. of lectures Per week**	**Credits**
1.	Botany	Paper VII: **MJ-BBT23-401**	Plant Anatomy and Ecology	2	2	Practical IV: MJ - BBP 23-403	8	2
		Paper VIII: **MJ-BBT23-402**	Herbal Technology	2	2			

3) Structure and Titles of papers of B.Sc. Course

B.Sc. II Semester III

Paper V: Plant Taxonomy and Embryology

Paper VI: Plant Physiology and Metabolism

Botany Practical III: Practical's based on Theory Paper V and VI

B.Sc. II Semester IV

Paper VII: Plant Anatomy and Ecology

Paper VIII: Herbal Technology

Botany Practical IV: Practical's based on Theory Paper VII and VIII

4) Other Features:

A) LIBRARY:

Reference books, Text books, Journals, Periodicals available in Institute and Departmental Library. (Separate reference lists are attached along with the respective course syllabus)

B) SPECIFIC EQUIPMENTS:

a) Computer, LCD projector, Visualizer, Smart Board

b) Laboratory Equipment's:

1. Microscope with digital camera
2. Digital weighing balance
3. pH meter
4. Spectrophotometer
5. Cooling centrifuge
6. Laminar air flow
7. Microtome
8. Autoclave
9. Hot Air Oven
10. Incubator
11. Refrigerator
12. Stereo zoom microscope
13. Dissecting microscope

5) Evaluation Structure for B.Sc. II

Sem.	Paper Code	Credits	Title of Paper	Evaluation Scheme (Marks)			Grand Total
				CCE	SEE	**Total**	
III	MJ-BBT23-301	02	Plant Taxonomy and Embryology	10	40	**50**	**150**
	MJ-BBT23-302	02	Plant Physiology and Metabolism	10	40	**50**	
	MJ-BBP23-303	02	Botany Practical III	-	-	**50**	
IV	MJ-BBT23-401	02	Plant Anatomy and Ecology	10	40	**50**	**150**
	MJ-BBT23-402	02	Herbal Technology	10	40	**50**	
	MJ-BBP23-403	02	Botany Practical IV	-	-	**50**	
Total		**12**				**300**	**300**

Evaluation Pattern for Practical (Semester wise)

Sem.	Practical Code	Credits	Title of Practical	Evaluation Scheme (Marks)			Total
				Practical Exam	Journal	Student performance /Project/Tour Report	
III	MJ-BBP23-303	02	Botany Practical III	40	05	**05**	**50**
IV	MJ-BBP23-403	02	Botany Practical IV	40	05	**05**	**50**
Total		**04**					**100**

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Sadguru Gadge Maharaj College, Karad (Autonomous)

Syllabus introduced from June 2024

Bachelor of Science (B.Sc.)Part II: Botany

Semester III

Theory Paper V: MJ - BBT 23-301 Plant Taxonomy and Embryology (Credit-02)

Learning objectives:

i. To impart knowledge about code of nomenclature, Botanical gardens in India and World.
ii. To give basic knowledge about processes of pollination and fertilization.
iii. To impart the basic knowledge of Embryo development.
iv. To give the basic knowledge of polyembryony, apomixis.

Total Lectures: 30

Unit I : Systems of classification **07**

Code of Nomenclature: Principles and rules (ICN). Outline of Artificial, Natural and Phylogenetic classification. Bentham and Hooker's classification with its merits and demerits. Taxonomic literatures: Floras and Monograph.

Unit II: Angiosperm families and Botanical gardens **08**

Angiosperm families: Classification, morphology of vegetative and reproductive parts, floral formula, floral diagram and economic importance of following families -

a) Rutaceae b) Combretaceae c) Solanaceae d) Liliaceae

Botanical gardens: Introduction, role and significance of Botanical Gardens.

Botanical gardens in India: Indian Botanical Garden, Calcutta; National Botanical Garden, Lucknow and Lead Botanical Garden, Shivaji University, Kolhapur. Botanical gardens in the world: Royal Botanical garden, Kew and New York Botanical garden.

Unit III: Pollination and Fertilization **08**

Pollination: Definition and types (self and cross Pollination). Mechanism in Anemophily (*Zea mays*), Entomophily (*Salvia*) and Hydrophily (*Vallisneria*).

Microsporogensis, and development of male gametophyte; Megasporogenesis and development of female gametophyte: Monosporic (*Polygonum*) and Bisporic (*Allium*).

Fertilization: Entry of pollen tube, double fertilization and triple fusion; Significance of double fertilization.

Unit IV: **Embryo and Endosperm Development** **07**

Structure and development of embryo in Monocotyledons, Dicotyledons.

Development of endosperm, Types of endosperm: Nuclear, Helobial and Cellular.

Polyembryony: Introduction and significance.

Apomixis: Introduction and significance.

Learning Outcomes:

The students will able to-

i. Understand code of nomenclature; get knowledge about Botanical gardens in India and World.

ii. Define concepts regarding pollination and fertilization.

iii. Understand the process of embryo development.

iv. Understand polyembryony and apomixis.

References:

1. Cooke T., Bishen Singh, Mahendra Pal Singh, 1958. *The flora of the Presidency of Bombay*. Volume- I, II & III. - Dehradun.
2. Jeffrey, C. 1982. *An Introduction to Plant Taxonomy*. 2 nd edition. Cambridge University Press, Cambridge, London.
3. Radford, A.E. and Caddell, G.M. 1986. *Fundamentals of Plant Systematics*. Harper & Row, New York.
4. Singh, G. 2012. *Plant Systematics: Theory and Practice*. 3 rdedition. Oxford & IBH Pvt. Ltd., New Delhi.
5. Naik, V.N. 1984. *Taxonomy of Angiosperms*. Tata McGraw Hill, New Delhi.
6. Bhojwani, S.S., Bhatnagar, S.P. and Dantu, P.K. 2015. *The Embryology of Angiosperms.* 6th edition. Vikas Publishing House Pvt. Ltd., Noida.
7. Maheshwari P. *An introduction to Embryology of Angiosperms*. Alpha Publication.
8. Nair P. K. K. 1966. *Essentials of Palynology*. Asia Pub. House, New York.
9. Pandey S. N. and A. Chadha. Plant Anatomy and Embryology. Vikas Publishing House,Pvt, Ltd, New Delhi.

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Bachelor of Science (B.Sc.)Part–II: Botany

Semester III

Theory Paper VI :MJ –BBT 23- 302 Plant Physiology and Metabolism (Credit-02)

Learning Objectives:

1. To impart the basic knowledge of photosynthesis
2. To impart the knowledge of concepts in respiration in plants
3. To impart the basic knowledge of processes involved in growth and development in plants.
4. To impart the basic knowledge of seed dormancy and germination in plants

Total Lectures: 30

Unit I Photosynthesis **07**

Introduction ; Structure of Chloroplast; photosynthetic pigments (Chlorophylls, Carotenoids and Phycobilins)

Mechanism of photosynthesis : a) Light reaction – Photolysis of water, Photosystem I and II, Photophosphorylation - Cyclic and Non-cyclic;

b) Dark reaction: C_3, C_4 and CAM pathway. Significance of photosynthesis, Photorespiration.

Unit II Respiration **08**

Introduction, Glycolysis, Aerobic and Anaerobic respiration, Formation of Acetyl CoA, TCA cycle, Structure of mitochondrion, ETC in mitochondria, ATP synthesis.

Unit III Growth and development **08**

Growth: Introduction, Definition, Region of growth, Phases of growth, growth curve, Grand period of growth Plant growth regulators: Introduction and definition; Discovery, site of synthesis,

Physiological and Practical applications of growth regulators – Auxins, Cytokinins, Gibberellins.

Reproductive growth: Concept of photoperiodism; SDP, LDP, Day neutral plants;

Vernalization–concept and definition, mechanism of vernalization, applications of vernalization and devernalization.

Unit IV Seed Dormancy and Germination **07**

Concept of dormancy, Causes of dormancy, Methods of breaking of seed Dormancy,

Seed germination Introduction and types (Epigeal, Hypogeal and Viviparous);

Factors affecting seed germination, Biochemical changes during seed germination.

Learning Outcomes:

The Students should be able to…

i. The students learn the basics of the processes involved in photosynthesis.
ii. The students learn the concepts of respiration in plants.
iii. The students learn the mechanisms of growth and development in plants.
iv. The students learn to explain the concepts of seed dormancy and germination in plants.

References:

1. Hopkins, W.G.1995.Introduction to Plant Physiology.JohnWiley &Sons,Inc.,New York, USA. (Unit I)
2. Salisburry,F.B.and Ross,C. W.1992.Plant Physiology.(4th edition).Wadsworth Publishing Co., California, USA. 19 (Unit I, II, III, IV)
3. Taiz,L.and Zeiger,E.1998.Plant Physiology.(2nd edition)Sinauer Associates,Inc., Publishers, Massachusetts, USA. (Unit I, II, III, IV)
4. Grewal R.C. –Plant Physiology.Campus Books International 483/24,Prahiadstreet Ansari Road, Daryaganj, New Delhi – 110002. (Unit I,III)
5. JainV.K.Fundamentals of Plant Physiology.S.Chand &Company Ltd.Ramnagar, New Delhi – 110055. (Unit I, III, IV)
6. VermaV.Text Book of Plant Physiology.Emkay Publications.,B-19,EastKrishna Nagar, Delhi-1100051. (Unit II)
7. Bidwell,R.G.S.1974.Plant Physiology.MacmillanPub.Co.,N.Y.(UnitIII)
8. Hopkins, W.G.1995.Introduction to Plant Physiology.JohnWiley &Sons,Inc.,New York, USA. (Unit III)
9. Pandey,S.N.(1991):Plant Physiology,Vikas Publishing House(P)Ltd.,New Delhi, India. (Unit IV)
10. Pandey,S.N.(1991):Plant Physiology,Vikas Publishing House (P)Ltd.,New Delhi, India. (Unit IV)

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Bachelor of Science (B.Sc.)Part–II: Botany

Semester III

Practical Paper III: MJ-BBP23- 303 (Based on Theory Paper V and VI) 02 credits

1. Study of flora and monograph.
2. Study of morphological and reproductive characters in families-
   - i. Rutaceae
   - ii. Combretaceae
   - iii. Solanaceae
   - iv. Liliaceae
3. Study of young / mature anther by permanent slide.
4. Study of germination of pollen grains.
5. Detection of pollen fertility by staining technique.
6. Study of mechanism of insect pollination.
7. Study of types of ovules (by permanent slide or photograph).
8. Study of dicotyledon and monocotyledon embryo (by permanent slide or Photograph).
9. Dissection of embryo / endosperm from developing seeds (*Grevellia* /*Cucumis*).
10. Estimation of Chlorophylls by Colorimetric/Spectrophotometric method.
11. Separation of photosynthetic pigments by paper chromatography.
12. Study of Kranz leaf anatomy in C_4 plants.
13. Estimation of TAN value in CAM plants
14. Analysis of vegetative growth (any suitable method).
15. Effect of different concentrations of Auxins (IAA) on seed germination (any suitable dicot seeds).
16. Effect of different concentrations of Gibberellic acid (GA) on seed germination (any suitable monocot seeds).
17. Study of evolution of oxygen during photosynthesis.
18. Study of effect of CO_2 concentration on the rate of photosynthesis.

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Bachelor of Science (B.Sc.)Part II: Botany

Semester IV

Theory Paper VII:MJ-BBT23-401 Plant Anatomy and Ecology (Credit- 02)

Learning Objectives:

The Students should be able to…

i To make student aware about the basic concepts of anatomy.
ii To make the student aware about the different types of tissue systems in plants
iii To make students aware about the concepts of ecology & advanced environmental science.
iv To understand the inter-relationships between the animate and inanimate world.

Total Lectures :30

UNIT-I Meristematic and Permanent tissue 07

Meristem- Introduction characteristics, classification of meristem based on their position, Functions. Theories of structural development- Apical cell theory, Histogen theory, and Tunica carpus theory.

Permanent tissue- Simple and complex tissue, Tissue system and their functions- Epidermal, Secretory and Mechanical tissue system.

UNIT-II Primary and secondary structure of plant body 08

Primary structure of root, stem and leaf of Monocotyledon and Dicotyledon

Normal secondary growth in Dicotyledon roots and stem

Anomalous secondary growth – Introduction, definition and Causes; Anomalous secondary growth in *Bignonia and Dracaena* stem

Structure and function of Periderm and Lenticel.

UNIT-III Ecological factors and Adaptation 07

Introduction, Definition and Scope of ecology.

Ecological factors- Edaphic factors (Soil) - Definition, Composition and soil profile

Climatic factors- Light and Temperature

Plant Adaptation- Ecological adaptation in Hydrophytes and Xerophytes.

UNIT-IV Plant Community and Ecosystem 08

Plant community- Introduction, General characters, Forms and structure. Raunkier's life forms

Plant Succession- Characters, Process and Types (Hydrosere and Xerosere).

Ecosystem-Introduction, components (abiotic and biotic), Types of Ecosystem, Food chain and web, Ecological pyramids.

Learning Outcomes:

The Students should be able to…

i. The students learn to explain morphological and anatomical features of angiosperm.
ii. Students will be able to identify the different types of tissue systems in plants.
iii. Student explains the basic terms and issues in the field of ecology and environment protection.
iv. Describe the relations and interactions between biotic and abiotic components of the environment.

References:

1. P.C.Vashista.- Plant Anatomy. Pradip Publications, Opposite Sitla Mandir, Jalandhar- 144008.
2. B .P. Pandey- Plant Anatomy. S.Chand & Company, LTD. Ram Nagar, New.
3. A. C.Datta.- Botany for Degree Students. Press – Delhi, Bombay, Madras.
4. Carlquist, S.1998.- Comparative Wood Anatomy: Systematic, Ecological and Evalutionary Aspects of dicotyledonous Wood. Springer- Verlag, Berlin.
5. Agarwal, S.K.1992.- Fundamentals of Ecology.(Unit-I, III)
6. Krebs, C.J.1978.- Ecology. (Unit-II)
7. Misira, K.C.1989.-Manual of Plant Ecology. (Unit-I & III)
8. Odum, E.P.1996. - Fundamentals of Ecology. 3rd Ed. (Unit-I & III)
9. Kormondy, E.J.1966. - Concept of Ecology. (Unit-III)
10. Pandeya, S.C. et.al. 1963. - Principles of Environment Sciences. (Unit-IV)
11. Odum, E.P., Barrett, G.W.2010.- Fundamentals of Ecology.6th Ed. (Unit-I & IV)

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Bachelor of Science (B.Sc.)Part II: Botany

Semester IV

Theory Paper VIII: MJ-BBT23-402 Herbal Technology (Credit- 02)

Learning Objectives:

i. To impart the knowledge of raw material as source of herbal drugs from cultivation to herbal drug product.
ii. To impart the knowledge of evaluation of herbal drugs.
iii. To impart the knowledge of herbal cosmetics and nutraceuticals.
iv. To impart the knowledge of phytochemical studies.

Total Lectures: 30

Unit I **Herbal medicines** **07**

Importance of medicinal plants; use of medicinal plants in indigenous / traditional systems of medicine - Siddha, Unani, Ayurveda and Homeopathy. Herbal remedies for holistic health. Collection and processing (harvesting, drying, garbling, packing, storage) of crude drugs and their marketing.

Unit II **Pharmacognosy** **08**

Plant morphology, biological source, chemical constituents and medicinal uses of the following herbs: Periwinkle (*Catharanthus roseus)*, Gulvel (*Tinospora cordifolia*), Brahmi (*Bacopa monnieri)*,Turmeric (*Curcuma longa*), Sarpagandha (*Rauvolfia serpentina*).

Unit III **Conservation of medicinal plants** **07**

Conservation and sustainable use of medicinal plants; *in-situ* and *ex-situ* conservation methods. Entries for conservation of medicinal plants – CIMAP and FRLHT, TKDL.

Unit IV **Herbal cosmetics** **08**

Herbal plants used in cosmetic formulations for skin care (cream, lotion and sunscreen), hair care (oil, shampoo, conditioner and dye) and oral care (toothpaste and mouthwash).

Learning outcomes:

The Students should be able to…

i. Students would understand the need of phytochemical studies.
ii. Students would know about the vital phytochemicals present in plants.
iii. Students would able to understand the basic principles, preparations of various Indian systems of medicine like Ayurveda, Unani, Homeopathy, Siddha.
iv. Students would aware about the scope of herbal technology.

References:

1. Textbook of Pharmacognosy by Trease & Evans.
2. Textbook of Pharmacognosy by Tyler, Brady & Robber.
3. Pharmacognosy by Kokate, Purohit and Gokhale
4. Essential of Pharmacognosy by Dr.S.H.Ansari
5. Pharmacognosy & Phytochemistry by V.D.Rangari
6. Pharmacopoeal standards for Ayurvedic Formulation (Council of Research in Indian Medicine & Homeopathy)
7. Mukherjee, P.W. Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals. Business Horizons Publishers, New Delhi, India, 2002.

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Bachelor of Science(B.Sc.)Part–II: Botany

Semester IV

Practical Paper IV:MJ BBP23- 403-(Based on Theory Paper VII and VIII) 02 Credits

Sr.No.	Name of Experiment
1.	Study of simple tissue and complex tissue.
2.	Study of epidermal and mechanical tissue system
3.	Double stained permanent micro preparation of any suitable material.
4.	Study of primary structure of Dicot and Monocot stem.
5.	Study of primary structure of Dicot and Monocot root.
6.	Study of anomalous/ abnormal secondary growth in *Bignonia* and *Dracaena.*
7.	Study of Meteorological Instruments (Any Four).
8.	Study of pH and Water Holding Capacity of soil.
9.	Study of morphological and anatomical adaptations in Hydrophytes – *Hydrilla, Eichhornia.*
10.	Study of morphological and anatomical adaptations in Xerophytes – *Aloe, Nerium.*
11.	Study of Ecological pyramids based on the field data / given data.
12.	Herbal preparations of: Hair oil (Maka), Shampoo (Ritha, Shikakai).
13-14.	Biochemical tests for drug adulteration of: Haladi (*Curcuma longa*), Hing (*Ferula asafoetida),* Camphor (*Cinnamommum camphora*).
15-16.	Phytochemical analysis – Qualitative tests for Alkaloids, Saponin, Steroids, Terpenoids, Flavonoids.
17-18.	Study of medicinal plants - Periwinkle (*Catharanthus roseus),* Brahmi (*Bacopa monnieri),* Turmeric (*Curcuma longa*), Sarpagandha (*Rauvolfia serpentina*).
19.	Separation of alkaloids by using paper chromatography.
20.	Macroscopic study of plants.

Nature of Theory Question Paper

B. Sc. Part II Paper V&VI

Total Marks – 40 Marks

Q.1 Choose the correct alternative from the following. **8 marks**

1) to 8)

Q.2 Attempt any TWO of the following. **16 marks**

A)

B)

C)

Q.3 Write short notes on any FOUR of the following. **16 marks**

a)

b)

c)

d)

e)

f)

Nature of Practical Question Paper

B. Sc. Part II Practical III & IV

Total Marks – 50 Marks

Q.1 Demonstrate the specimens 'A' and 'B'	**16 marks**
Q.2 Comment on the specimens 'C'	**08 marks**
Q.3 Identify and Describe	**16 marks**
D)	
E)	
F)	
G)	
Q. 4 Journal	**05 marks**
Q. 5 Student performance/ Project/ tour report	**05 marks**