

**KAVAYITRI BAHINABAI CHAUDHARI NORTH MAHARASHTRA
UNIVERSITY, JALGAON**



Faculty of Science and Technology

SYLLABUS FOR CORE AND SKILL ENHANCEMENT COUESES IN BOTANY

As Per U. G. C. Guidelines

Based on

Choice Based Credit System (CBCS)

S. Y. B. Sc. BOTANY SEMESTER-WISE SYLLABUS

(Theory and Practicals)

Semester-III

Bot. 301: Plant Anatomy

Bot. 302: Plant Physiology

Bot. 303: Practical Based on Bot: 301 and Bot: 302

Bot. 304: Mushroom Culture Technology

Semester-IV

Bot. 401: Plant Embryology

Bot. 402: Plant Metabolism

Bot. 403: Practical Based on Bot: 401 and Bot: 402

Bot. 404: Nursery and Gardening

w. e. f. June, 2019

**KAVAYITRI BAHINABAI CHAUDHARI NORTH MAHARASHTRA
UNIVERSITY, JALGAON**

Structure of S.Y. B.Sc. Botany Syllabus under CBCS Pattern

w.e.f. June, 2019

Year	Sem.	Paper	Code	Title of Course	Marks		Credits
					Int.(CA)	Ext.(UA)	
II	III	I	Bot. 301	Plant Anatomy	40	60	2
		II	Bot. 302	Plant Physiology	40	60	2
		III	Bot. 303	Practical (LAB – I)	40	60	2
		IV	Bot. 304	Mushroom Culture Technology (SEC)	40	60	2
	IV	I	Bot. 401	Plant Embryology	40	60	2
		II	Bot. 402	Plant Metabolism	40	60	2
		III	Bot. 403	Practical (LAB – I)	40	60	2
		IV	Bot. 404	Nursery and Gardening (SEC)	40	60	2

KAVAYITRI BAHINABAI CHAUDHARI NORTH MAHARASHTRA UNIVERSITY,

JALGAON

Syllabus of S.Y.B.Sc. Botany w.e.f. June, 2019

CBCS Pattern

Semester: III

PAPER-I

BOT. - 301: PLANT ANATOMY

Lectures: 30

AIMS AND OBJECTIVES

1. To know scope and importance of plant anatomy
2. To study various tissue systems
3. To know primary structure of dicot and monocot plants
4. To study normal secondary growth in plants and their causes
5. To study protective tissue system

Unit-1: Introduction

02 L

1.1 Definition, Scope and Importance

Unit- 2: Plant Tissues

08 L

2.1 Definition

2.2 Meristematic tissues: Classification based on position and origin

2.3 Tissues and its types:

(a) Simple tissues:

i) Parenchyma: Aerenchyma, Chlorenchyma and Palisade

ii) Collenchyma

iii) Sclerenchyma: Fiber and Sclereids / Stone cells

(b) Complex tissues:

i) Xylem and its elements

ii) Phloem and its elements

Unit-3: Protective Tissue System

07 L

3.1 Epidermal Tissue System: Definition and Function

3.2. Types of Epidermal Appendages

- a) Unicellular, Multicellular (Uniseriate and Multiseriate) Trichomes
- b) Glandular, Non-glandular Trichomes
- c) Stellate, Dendroid Trichomes and Peltate scales

3.3 Types of Stomata

- i. Ranunculaceous (Anomocytic)
- ii. Cruciferous (Anisocytic)
- iii. Rubiaceus (Paracytic)
- iv. Caryophyllaceous (Diacytic)
- v. Gramineous

Unit-4: Primary Structure

08 L

4.1 Dicotyledonous (Sunflower)

- i. Root
- ii. Stem
- iii. Leaf

4.2 Monocotyledonous (Maize)

- i. Root
- ii. Stem
- iii. Leaf

Unit- 5: Secondary Growth

05L

5.1 Vascular cambium- Structure and function, seasonal activity

5.2 Secondary growth in root and stem of Sunflower

5.3 Wood- Heartwood and sapwood

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- 2) Chandurkar, P.J, (1971) Plant Anatomy (3rd Ed.), Oxford and IBH Publishing Co. New Delhi and Bombay, India.
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- 4) Cutter, E. G. (1971) Plant Anatomy: Experiment and Interpretation Part-II, Organ. Edward Arnold, London, UK.

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- 10) Mauseth, J.D. (1988) Plant Anatomy. The Benjamin/Cummings Publisher, USA.
- 11) Menan , A.B. (2008) Introduction to Plant Anatomy. Rajat Publications, New Delhi, India.
- 12) Pandey, B.P. (1954) Plant Anatomy. S. Chand and Co. (P.) Ltd. New Delhi, India.
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- 16) Singh Sanjay Kumar ((2005) Text Book of Plant Anatomy. Campus Books International, New Delhi, India.
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- 20) Tandan Neeraj (2014) An Introduction to Plant Anatomy. Anmol Publications, Pvt., Ltd., New Delhi, India.
- 21) Tayal, M.S. (1994) Plant Anatomy. Rastogi Publications, Meerut, India.
- 22) Vashista, P.C. (1986) Plant Anatomy. Pradeep Publications, Jalandhar, India.

PAPER – II
BOT.302: PLANT PHYSIOLOGY

Lectures: 30

AIMS AND OBJECTIVES

1. To know importance and scope of plant physiology.
2. To study plant and plant cell in relation to water.
3. To study different process in relation with structure of organism and its environment.
4. To understand mechanism of absorption of water, gases and solutes.
5. To understand growth at various level.

Unit: 1.Introduction **01 L**

1.1 Definition, scope and importance of plant physiology.

Unit: 2. Plant cell and water relation **05 L**

2.1 Diffusion, Definition, mechanism of diffusion with suitable example, Diffusion Pressure, Graham's law of diffusion and significance of diffusion.

2.2 Osmosis: Introduction, definition, mechanism of osmosis with suitable Osmometer, osmotic pressure, turgor pressure and wall pressure, DPD and its relation with OP, TP, and WP. Types of solution- Hypotonic, Hypertonic and Isotonic. Type of Osmosis- Exosmosis and Endosmosis, significance of osmosis , Plasmolysis, de-plasmolysis.

2.3 Imbibition: Definition, mechanism, imbibition pressure, Importance of imbibition.

Unit: 3. Absorption of water **05 L**

3.1 Importance of water.

3.2 Mechanism of water absorption.

a. Active absorption- Osmotic theory and non-osmotic theory.

b. Passive absorption.

3.3 Factors affecting water absorption.

Unit: 4. Ascent of Sap **05 L**

4.1 Introduction and definition

4.2 Theories of ascent sap.

a. Vital theories

- b. Root pressure theory.
- c. Physical force theories
- d. Transpiration pull theory.

Unit: 5. Transpiration

05 L

- 5.1** Definition, Magnitude and types of transpiration, Structure of stomata, mechanism of opening and closing of stomata.
- 5.2** Theories of stomatal opening and closing.
 - a. Theory of Starch- Glucose interconversion and stomatal opening in Succulent plants(Steward's Theory)
 - b. K⁺ pump theory.
- 5.3** Factors affecting rate of transpiration.
- 5.4** Significance of transpiration.

Unit: - 6. Mineral nutrition and absorption of mineral salt

05 L

- 6.1** Introduction, essential and non essential elements, Macro and micro nutrient elements.
- 6.2** Specific functions and deficiency symptoms of- Nitrogen, Sulphur, Phosphorus, Potassium, Magnesium and Boron.
- 6.3** Mechanism of mineral salt absorption.
 - a) Passive absorption- Mass flow theory, Ion exchange and Donnan's equilibrium.
 - b) Active absorption- Carrier concept theory- Protein lecithin as carrier.

Unit: 7 .Plant growth and Phytohormones

04 L

- 7.1** Introduction, Definition of growth, Development and Differentiation
- 7.2** Definition of Phytohormones and role of Auxins, Gibberellins, Cytokinins, Ethylene and Abscisic acid.

REFERENCES:-

- 1. Amar Singh (1977) Practical Plant Physiology. Kalyani Publication, New Delhi, Ludhiana, India.

2. Jain. V.K. (1977) Fundamentals of plant physiology. S. Chand and Company Ltd. New Delhi, India.
3. Kochhar. P. L. (1962) A Text Book of Plant Physiology, Atmaran and Sons, New Delhi, India.
4. Kumar, A. and S.S. Purohit (1998) Plant Physiology, Fundamentals and Application. Agro Botanical, Bikaner, India.
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11. Varma, V. (1984) Introduction to Plant Physiology. Emkay Publication, New Delhi, India.
12. Varma V. (1995) A Text Book of Plant Physiology and Biochemistry. S. Chand and Company. New Delhi, India.
13. Taiz, L. Zeiger E. (2010) Plant Physiology. Sinauer Associates Inc.; U.S.A. 5th edition.

PAPER- III

BOT. 303:Practical (Based on BOT. - 301 and BOT. - 302)

Practical No.1&2

- i) Study of meristem (Permanent slides/ Photographs).
- ii) Study of Simple Tissues:
Parenchyma, Collenchyma and Sclerenchyma (Permanent Slides/
Photographs)
- iii) Macerated xylem and phloem elements (Permanent slides/ Photographs).
- iv) Study of dicot leaf(Sunflower) and monocot leaf (Maize) (permanent slides.)

Practical No: 3 and 4: Study of primary structure of dicot stem (Sunflower) and monocot stem (Maize).

Practical No.5: Study of primary structure of dicot root (Sunflower) and monocot root(Maize) (Permanent slides).

Practical No.6 and 7:Study of secondary growth structure in dicot stem and root (Sunflower)

Practical No. 8:

Study of trichomes (any three types) and stomata (any three types) with the help of locally available plant materials.

Practical No. 9: To determine DPD by using potato tuber.

Practical No.10: Determination of osmotic potential of plant cell sap by plasmolytic method.

Practical No. 11: To study the effect of two environmental factors (light and wind) on transpiration by excised twig.

Practical No.12and 13: Qualitative assessment of minerals in plant ash (any two from Macro and Micro elements)

Practical No.14. Demonstration experiments.

1. Osmosis by Curling experiment.
2. Osmosis-Thistle funnel experiment.
3. Bolting (Specimen or photograph)

Practical No.15. Demonstration experiments.

1. Suction due to transpiration.
2. Relative Transpiration.
3. Imbibition Pressure.
4. Ringing experiment.

PAPER – IV
SKILL ENHANCEMENT COURSE (SEC)
BOT. 304: MUSHROOM CULTURE TECHNOLOGY

Lectures: 30

AIMS AND OBJECTIVES

1. To learn the history, scope and importance of mushroom technology
2. To understand nutritional and medicinal values of edible mushrooms
3. To know about the storage, marketing and various food preparations of mushrooms.
4. To understand the economics of mushroom cultivation.

Unit 1: Introduction

05 L

- 1.1: Scope and importance.
- 1.2: Nutritional and medicinal value of edible mushrooms.
- 1.3: Edible and non-edible mushrooms.
- 1.4: Morphology and distinguishing characteristics of following mushrooms:
 - a. Button (*Agaricus bisporus*)
 - b. Oyster (*Lentinus sajor-caju*, Syn. *Pleurotus sajor-caju*)
 - c. Paddy straw (*Volvariella volvacea*)

Unit 2: Cultivation Technology

15 L

- 2.1: Mushroom farm layout and requirements
- 2.2. Materials for compost preparation, Different formulations, Selection of composting materials, Commonly used formulations, Synthetic compost and its advantages,
- 2.3: Spore culture and preparation of spawn.
- 2.4: Casing and its Importance, Quality parameters of casing mixture and commonly used materials for casing.
- 2.5: Cultivation procedure of: a. *Agaricus bisporus* b. *Pleurotus sajor-caju*.

Unit 3: Storage

04 L

- 3.1: Short-term storage (Refrigeration - upto 24 hours)
- 3.2: Long term storage (canning, pickling). Drying, storage in salt solutions.
- 3.3: Marketing

Unit 4: Food Preparation

06 L

4.1: Types of foods prepared from mushroom: Soup, Cutlet, Omlette, Samosa, Pickles, Curry.

4.2 Training Centres: National and Regional level.

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1. Marimuthu, T. Krishnamoofthl, A.S. Sivaprakasam, K. and Jayarajan. R (1991) Oyster Mushrooms. Department of Plant Pathology. TamilNadu Agricultural University, Coimbatore.
2. Swarninathan, M. (1990) Food and Nutrition. Bappco, The Bangalore Printing and Publishing Co. Ltd., No. 88, Mysore Road, Bangalore - 560018.
3. S.C.Tewari. Pankaj Kapoor, (1988). Mushroom Cultivation, Mittal Publications. Delhi.
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5. Vijaya Khader (1993) Mushrooms for Livelihood. Kalyani Publishers. Pp170.
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9. Google.co.in

Semester: IV
PAPER- I
BOT. - 401: PLANT EMBRYOLOGY

Lectures: 30

AIMS AND OBJECTIVES

1. To know the scope and Importance of Embryology
2. To study structure of micro and megasporangium.
3. To study pollination, fertilization, Endosperm and Embryogeny.
4. To give exposure of techniques in embryology

Unit 1: Introduction **01L**

1.1: Definition, Scope and importance of Embryology

Unit 2: Microsporangium (Anther) **04 L**

2.1: Structure of anther- Epidermis, endothecium, middle layer sporogenous tissue and Tapetum.

2.2: Tapetum types- a) Amoeboid or plasmodia b) Secretary or glandular

2.3: Functions of Tapetum

2.4: Microsporogenesis- karyokinesis and cytokinesis (simultaneous and successive)

2.5: Structure of pollen and Male gametophyte

2.6: Types of pollen tetrad – linear, isobilateral, tetrahedral, decussate, T- shaped.

Unit 3: Megasporangium (Ovule) **05 L**

3.1: Structure of Ovule.

3.2: Types of ovule: i) Orthotropous ii) Anatropous iii) Amphitropous
iv) Hemianatropous v) Compylotropous vi) Circinotropous

3.3: Types of Embryo sac. i) Monosporic (*Polygonum*) ii) Bisporic (*Allium*)
iii) Tetrasporic (*Peperomia*)

Unit 4: Pollination and Fertilization **05 L**

4.1: Definition and Types of Pollination: Anemophily, Entomophily, Hydrophily

4.2: Fertilization i) Definition ii) Entry of pollen tube into ovule - Porogamy,

chalizogamy and mesogamy

iii) Process of double fertilization and tripl fusion

iv) Significance of double fertilization mechanism.

Unit 5: Endosperm **03L**

5.1: Definition.

5.2: Structure and function of endosperm.

5.3: Types of Endosperm. i) Nuclear ii) Cellular iii) Helobial.

Unit 6: Embryo **03L**

6.1: Definition

6.2: Structure of Dicot Embryo e.g. *Capsella brussa pastories* (Development not expected)

6.3: Structure of monocot embryo e.g. *Sagittaria* (Development not expected)

Unit 7: Seed structure and dispersal **06L**

7.1: Definition, structure of seed.

7.2: Appendages and dispersal mechanism of seed- Aril, Coma, Caruncle

7.3 Dispersal Mechanism:

i. By Wind - (Anemochory):

a. Winged seed and fruits b. Parachute mechanism c. Hairs

ii. By Water (Hydrochory): a. Floating devices b. Protective covering

iii. By Animal (Zoochory): a. Hooked fruits and seeds b. Sticky Fruit c. Edible fruit

Unit 8: Apomixis and polyembryony. **03L**

8.1: Apomixis: Definition and types – Non- recurrent, recurrent , adventive embryo and veg. reproduction

8.2: Polyembryony: Definition

8.3 Types of polyembryony: i. Simple ii. Cleavage iii Rosette

REFERENCES:

1. Bhojwani, S.S. and S.P. Bhatnagar, (2013 Reprint) The Embryology of Angiosperms,

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PAPER- II
BOT.-: 402 PLANT METABOLISM

Lectures 30

AIMS AND OBJECTIVES

1. To know the scope and importance of plant metabolism.
2. To study the properties, mechanism and classification of enzymes.
3. To study the process of photosynthesis in higher plants, C₃, C₄ and CAM pathways.
4. To study respiration in higher plants.

Unit 1: Introduction	02 L
1.1: Definition	
1.2: Plant cell as organic Laboratory	
1.3: Anabolism and catabolism	
Unit 2: Enzymes	04 L
2.1: Definition, Structure and properties.	
2.2: Classification of enzymes	
2.3: Mode of enzyme action: Lock and key Model, Induced fit model	
Unit 3: Photosynthesis	11 L
3.1: Definition, photosynthetic apparatus (Structure of Chloroplast)	
3.2: Role of photosynthetic pigments: Chlorophyll (Chl- a, Chl- b), Carotenoids and Phycobillins	
3.3: Photosystem I and II	
3.4: Mechanism	
a : Light Reaction: Cyclic and Non Cyclic Photophosphorylation.	
b : Dark Reaction: C ₃ , C ₄ and CAM pathways.	
3.6: Photorespiration: Definition, Sites and Mechanism of photorespiration.	
3.7: Factor affecting the process of photosynthesis.	
Unit 4: Respiration	07 L
4.1: Introduction, Definition and Types of respiration.	

4.2: Mechanism of Aerobic respiration.

- a) Glycolysis.
- b) Kreb's cycle.
- c) Electron Transfer System (ETS)

4.3 Mechanism of Anaerobic respiration: Alcoholic Fermentation

4.4 Factor affecting the process of respiration.

Unit 5: Nitrogen metabolism

06 L

5.1: Introduction.

5.2: Types of Nitrogen fixation.

5.3: Biological nitrogen fixation.

5.4: Nitrate and ammonia assimilation.

5.5: Importance

REFERENCES:-

1. Kochhar P. L. (1962) Plant Physiology, Atmaram and Sons, Delhi, India
2. Salisbury, F.B and C.W. Ross (1999): Plant Physiology CBS Publishers and Printers, New Delhi
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5. Srivastava H. S., 2004. Plant Physiology and Biochemistry, Rastogi Publications.
6. Verma S. K. and Mohit Verma, 2006. A Text book of Plant Physiology, Biochemistry and Biotechnology, S. Chand and Co.
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PAPER- III

BOT.403: Practical (Based on BOT. - 401 and BOT. - 402)

Practical No.1: Study of the following with the help of P.S. / photographs.

- i) T.S. of microsporangium (Anther)
- ii) Tapetum – a) Amoeboid b) Secretory

Practical No 2: Study of types of ovules with the help of P.S. / Photographs as per theory.

Practical No 3: Study of different kinds of embryo sac with the help of P.S / Photographs

- i) Monosporic - *Polygonum*
- ii) Bisporic - *Allium*
- iii) Tetrasporic - *Peperomia*

Practical No 4: Mounting of embryos from suitable seeds (*Cucumis / Cymopsis / Citrus*).

Practical No 5: Study of structure of dicot and monocot seed

Practical No 6 and 7: Study of seed dispersal mechanism.

- i: Winged – *Moringa, Hiptage*
- ii: Parachute – Pappus (*Tridax*)
- iii: Hair – *Calatropis*
- iv: Floating – Coconut
- v: Animal – *Xanthium, Achyranthes*
- vi: Sticky – *Plumbago / Cleome / Boerrhaavia*

Practical No 8 and 9: Study the activity of catalase and study the effect of pH and enzyme concentration.

Practical No 10 and 11: To study the effect of light intensity and bicarbonate concentration on O₂ evolution in photosynthesis.

Practical No 12: Comparison of the rate of respiration in any two parts of a plant by using Ganong's potometer.

Practical No 13: Separation of amino acids by paper chromatography.

Practical No 14 and 15: Demonstration experiments

- i. To demonstrate the presence of starch in chloroplast
- ii. CO₂ essential for Photosynthesis
- iii. R.Q. (Respiratory Quotient)
- iv. Kuhne's Tube experiment
- v. Isolation and Inoculation of *Rhizobium*

PAPER - IV
SKILL ENHANCEMENT COURSE (SEC)
BOT.404: NURSERY AND GARDENING

Lectures: 30

AIMS AND OBJECTIVES

1. To know the concept of nursery and Gardening.
2. To improve the skills for growing fresh and safe vegetables.
3. To create awareness about home gardening.
4. To develop different skills regarding the gardening operations among the students

Unit 1. Nursery

04 L

Definition, objectives and scope, building up of infrastructure for nursery, planning and seasonal activities. Planting :direct seedling and transplant.

Unit 2. Seed structures and types

04 L

Seed dormancy, causes and methods of breaking dormancy, Seed storage: Seed banks, factors affecting seed viability and genetic erosions.

Unit 3. Vegetative propagation

05 L

Cutting and Air-layering: selection, techniques of cutting, rooting medium, planting and hardening of plants in green house or glass house.

Harvesting, Packing, Storage and Marketing of Nursery stock.

Unit 4. Gardening

07 L

Definition, objectives and scope,. Different types of gardening: Landscape, home gardening and park, and its Components, suitable plants, soil, manuring and watering.

Unit 5. Indoor Gardening

04 L

Definition, characters of indoor plants, containers, selection of indoor plants, Potting media, watering tips.

Botanical name, cultivation practices, Ornamental value, maintenance and care of Cycads and Pothas (Two examples each)

Unit 6: Cultivation practices**06 L**

Introduction, study of cultivation of some vegetables: Brinjal and Tomato w.r.t.

- i) Sowing
- ii) Transplanting of seedling
- iii) Varieties
- iv) Manuaring and irrigation
- v) Pest, Diseases and control measures
- vi) Harvesting
- vii) Storage and Marketing

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1. Bose T.K. and Mukherjee. D. (1972). Gardening in India, Oxford and IBH Publishing Vo., New Delhi.
2. Sandhu, M. K., (1989), Plant Propagation. Wile Eastern Ltd., Bangalore, Madras.
3. Kumar, N., (1997), Introduction to Horticulture, Rajalakshmi Publications, Nagercoil.
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Equivalence: Theory and Practicals			
Class: S. Y. B. Sc.			
Subject : Botany			
PAPER	Old Courses (W.E.F. June, 2016)	PAPER	New Courses (W.E. F. June, 2019)
SEM-III			
BOT. 231	Bryophytes and Pteridophytes	Bot. 402	Plant Metabolism
BOT. 232	Morphology of Angiosperms	Bot. 401	Plant Embryology
BOT. 233	Based on BOT.231, BOT.- 232,	Bot. 403	Practical (LAB – I) Based on Bot. 401 and Bot. 402
SEM-IV			
BOT. 241	Plant Physiology	Bot. 302	Plant Physiology
BOT. 242	Taxonomy of Angiosperms	Bot. 301	Plant Anatomy
BOT. 243	Based On BOT.-241 and BOT.-242	Bot. 303	Practical (LAB – I) Based on Bot. 301 and Bot. 302

