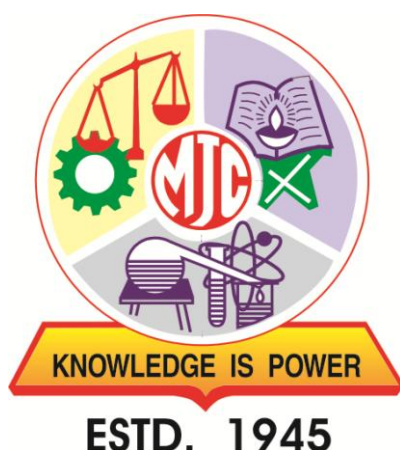


Khandesh College Education Society's  
**Moolji Jaitha College, Jalgaon**  
An "Autonomous College" Affiliated to  
KBC North Maharashtra University, Jalgaon



## **SYLLABUS**

# **Botany** **S.Y.B. Sc.** **(Semester III&IV)**

**Under Choice Based Credit System (CBCS)**

**[w. e. f. Academic Year: 2020-21]**

## Course Structure S. Y. B. Sc. (Botany)

**Duration:** The duration of B.Sc. (Botany) degree program shall be three years.

Term / Semester	Course Module	Subject Code	Title of Paper	Credit	Hours per Week	Hours per Semester
<b>III</b>	DSC	BOT-231	Plant anatomy	2	2	30
	DSC	BOT-232	Plant physiology	2	2	30
	DSC	BOT-233	Practical course based on BOT-231 & 232	2	4	60
	SEC	BOT-230	Mushroom culture technology	2	2	30
<b>IV</b>	DSC	BOT-241	Embryology	2	2	30
	DSC	BOT-242	Plant metabolism	2	2	30
	DSC	BOT-243	Practical course based on BOT-241 & 242	2	4	60
	SEC	BOT-240	Nursery and gardening	2	2	30

DSC : Discipline Specific Elective Core Course

SEC : Skill Enhancement Course

BOT-YSC : Botany (Y-year; S-Semester; C-Course number)

### Examination Pattern for S. Y. B. Sc.

Examination	Marks
External Marks	40
Internal Marks	10
Total Marks	50

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

### **BOT-231: Plant anatomy**

**Total Hours: 30**

**Credits: 2**

#### **Course objectives:**

- To know scope and importance of plant anatomy
- To study various tissue systems
- To know primary structure of dicot and monocot plants
- To study normal secondary growth in plants and their causes
- To study protective tissue system

#### **Course outcomes**

- Students will know scope and Importance of plant Anatomy
- Students will get knowledge of various tissue system
- The course will help the Students to acquire the knowledge of primary structure of stem and root of plant
- The course will help the Students to get acquainted with secondary growth in plant and their causes
- The Students will be provided with knowledge of protective tissue system in plant

#### **Unit-I : Plant Tissues**

**6h**

- 1.1 Definition, scope and importance of plant anatomy
- 1.2 Definition of plant tissues
- 1.3 Meristematic tissues- Classification based on position and origin
- 1.4 Tissues and its types
  - a) Simple Tissues - i) Parenchyma: Aerenchyma, Chlorenchyma and Palisade  
ii) Collenchyma  
iii) Sclerenchyma: Fibre and Sclereids/ Stone cells
  - b) Complex Tissues
    - i) Xylem and its elements
    - ii) Phloem and its elements

#### **Unit-II : Mechanical and Secretory Tissue System**

**6h**

- 2.1 Study of Mechanical Tissue System based on principles
  - a- Inflexibility
  - b- Inextensibility
  - c- Incompressibility
  - d- Shearing Stresses
- 2.2 Secretory Tissue System
  - a- Digestive Glands
  - b- Nectaries
  - c- Resin Ducts

- d- Laticiferous Ducts
- e- Hydathodes
- f- Oil Ducts

**Unit III : Protective Tissue System 6h**

- 3.1 Epidermal Tissue System: Definition and Function
- 3.2 Types of Epidermal Appendages
  - i. Unicellular, Multicellular (Uniseriate and Multiseriate) Trichomes
  - ii. Glandular, Non-glandular Trichomes
  - iii. Stellate, Dendroid Trichomes and Peltatescales
- 3.3 Types of Stomata
  - i. Ranunculaceous (Anomocytic)
  - ii. Cruciferous (Anisocytic)
  - iii. Rubiaceus (Paracytic)
  - iv. Caryophyllaceous (Diacytic)
  - v. Gramineous

**Unit IV: Primary Structure 7h**

- 4.1 Dicotyledonous (Sunflower)
  - i. Root
  - ii. Stem
  - iii. Leaf
- 4.2 Monocotyledonous (Maize)
  - i. Root
  - ii. Stem
  - iii. Leaf

**Unit V: Secondary Growth 5h**

- 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

**References:**

1. Carlquist, S. (1961) Comparative Plant anatomy. Hold, Rinehart and Winson, New York, USA.
2. Chandurkar, P.J, (1971) Plant Anatomy (3rd Ed.), Oxford and IBH Publishing Co. New Delhi.
3. Choyal Rajaram (2012) Plant Anatomy and Physiology, Sonali Publications, New Delhi.
4. Cutter, E. G. (1971) Plant Anatomy: Experiment and Interpretation Part-II, Organ. Edward Arnold, London, UK.
5. Das Susheela, M. (2017) A Text Book of Plant Anatomy. Dominant Publishers and Distributors Pvt. Ltd., New Delhi.
6. Fahn, A. (1982) Plant Anatomy (3rd Ed.) Pergman Press, Oxford and New York. USA.
7. Grewal, R.C. (2011) Plant Anatomy. Campus Books International, New Delhi

8. Menan, A.B. (2008) Introduction to Plant Anatomy. Rajat Publications, New Delhi, India.
9. Pandey, S.N. and A. Chadha (2006) Plant Anatomy and Embryology. Vikas Publishing House Pvt., Ltd., New Delhi.
10. Sharma Rajani (2009) An Introduction to Plant Anatomy. Campus Books International, New Delhi.
11. Singh Sanjay Kumar ((2005) Text Book of Plant Anatomy. Campus Books International, New Delhi.
12. Singh, S. K., and Seema Srivastava (2011) Anatomy of Angiosperm. Campus Books International, New Delhi.
13. Singh, V., P.C. Pande and D.K. Jain (1998) Anatomy of Seed Plants. Rastogi Publications, Meerut.
14. Singh, V., P. C. Pande and D.K. Jain (2013) A Text Book of Botany Angiosperm. Rastogi Publications, Meerut,India.
15. Tandan Neeraj (2014) An Introduction to Plant Anatomy. Anmol Publications, Pvt., Ltd., New Delhi.
16. Tayal, M. S. (1994) Plant Anatomy. Rastogi Publications, Meerut, a.

#### **Proposed methods of teaching/ innovative teaching**

- Classroom teaching, lecture cum demonstration methods, question answer method, brain storming method, assignment method
- Innovative teaching: audio video, science museum, ICT enabled teaching, video clips/ movies, field trips.

### **S.Y. B.Sc. (Botany): Semester-III BOT-232: Plant physiology**

**Total Hours: 30**

**Credits: 2**

#### **Course objectives**

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

#### **Course outcomes**

- Students will know the scope and imporatnce of Plant Physiology
- They will aquire knowledge of plant and plant cell in relation to water
- Different process related with strucuture of organism and its evironment will be studied by them
- Mechanism of absorption of water, gaes and solutes will be undestood by them
- This course will help the Students to understand growth at varuous level

**Unit I: Introduction****6h**

- 1.1 Definition, Scope and Importance of Plant Physiology
- 1.2 Plant cell and water relation
- 1.3 Diffusion, Definition, mechanism of diffusion with suitable example, Diffusion Pressure, Graham's law of diffusion and significance of diffusion.
- 1.4 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.
- 1.5 Imbibition: Definition, mechanism, imbibition pressure, Importance of imbibition.

**Unit II : Absorption of water****10h**

- 2.1 Importance of water.
- 2.2 Mechanism of water absorption.
  - a) Active absorption- Osmotic theory and non-osmotic theory.
  - b) Passive absorption.
- 2.3 Factors affecting water absorption.
- 2.4 Ascent of Sap
  - 2.4.1 Introduction and definition
  - 2.4.2 Theories of ascent sap.
    - a) Vital theories
    - b) Root pressure theory.
    - c) Physical force theories
    - d) Transpiration pull theory.

**Unit III: Transpiration****5h**

- 3.1 Definition, Magnitude and types of transpiration, Structure of stomata, mechanism of opening and closing of stomata.
- 3.2 Theories of stomatal opening and closing.
  - a) Theory of Starch- Glucose interconversion and stomatal opening in Succulent plants (Steward's Theory)
  - b) K<sup>+</sup> pump theory.
- 3.3 Factors affecting rate of transpiration.
- 3.4 Significance of transpiration.

**Unit IV: Mineral nutrition and absorption of mineral salt****(5h)**

- 4.1 Introduction, essential and non-essential elements, Macro and micro nutrient elements.
- 4.2 Specific functions and deficiency symptoms of- Nitrogen, Sulphur, Phosphorus, Potassium, Magnesium and Boron.
- 4.3 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 a carrier.

**Unit V: Physiology of Flowering (4h)**

- 5.1 Photo periodism: Discovery, Classification of Plants: - Short Day, Long Day and Day Neutral Plants. Photoperiodic Induction, Inductive cycles, role of phytochrome in photoperiodism
- 5.2 Vernalization: Discovery, Perception of temperature, Mechanism of Vernalization, hormonal replacement of Vernalization

**References:**

1. Jain. V.K. (1977) Fundamentals of plant physiology. S. Chand and Company Ltd. New Delhi, India.
2. Kochhar. P. L. (1962) A Text Book of Plant Physiology, Atmaran and Sons, New Delhi, India.
3. Kumar, A. and S.S. Purohit (1998) Plant Physiology, Fundamentals and Application. Agro Botanical, Bikaner.
4. Meyer. B.S and D.B. Anderson (1952) Plant Physiology Affiliated East-West Press Pvt. Ltd., New Delhi.
5. Mukharji and Ghosh A.K. (1996) Plant Physiology. Tata McGraw-Hill Publishing company Ltd. New Delhi.
6. Pandey and Sinha (1999) Plant Physiology. Vikas Publishing House Pvt. Ltd. New Delhi, India.
7. Sarabhai, B.P. (1995) Elements of Plant Physiology. Anmol Publication Pvt. Ltd, New Delhi
8. Srivastava. H.C (1994) Plant Physiology, Rastogi Publication, Meerut, India.
10. Sundara Rajan (2000) College Botany ( Plant Physiology and Molecular Biology Vol.IV, Himalaya Publishing House, New Delhi,
9. Varma, V. (1984) Introduction to Plant Physiology. Emkay Publication, New Delhi.
10. Varma V. (1995) A Text Book of Plant Physiology and Biochemistry. S. Chand and Company. New Delhi, India.
11. Taiz, L. Zeiger E. (2010) Plant Physiology. Sinauer Associates Inc.; U.S.A. 5<sup>th</sup> edition.

**Proposed methods of teaching/ innovative teaching**

- Classroom teaching, lecture cum demonstration methods, question answer method, brain storming method, assignment method
- Innovative teaching: audio video, science museum, ICT enabled teaching, video clips/ movies, field trips.

**S.Y. B.Sc. (Botany): Semester-III**  
**BOT-233: Practical course based on BOT-231 and BOT-232**

**Total Hours: 60**

**Credits: 2**

**Course objectives**

1. To incorporate the practical knowledge among the Students.
2. To make Students aware of tissue system in plants.
3. Students will learn the methodologies and working of experiments of plasmolysis, transpiration and demonstration experiments.

**Course outcomes**

1. Students will be incorporated with the practical knowledge.
2. Students will be aware of tissue systems in plants like Parenchyma, Collenchyma and Sclerenchyma etc.
3. Students will learn the methodologies and working of experiments of plasmolysis, transpiration, assessment of minerals from plant ash and demonstration experiments.

**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 :** Study of secondary growth structure in dicot stem and root (Sunflower) with the help of Permanent slides

**Practical No. 7a:** Study of mechanical tissue system with the help of permanent slide

**Practical No. 7b:** Study of secretory tissue system with the help of suitable plant material

**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.12:** 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 funnelexperiment.
3. Bolting (Specimen orphotograph)

**Practical No.15.** Demonstration experiments.

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

**References:**

1. Cutter, E. G. (1971) Plant Anatomy: Experiment and Interpretation Part-II, Organ. Edward Arnold, London,UK.
2. Fahh, A. (1982) Plant Anatomy (3rd Ed.) Pergman Press, Oxford and New York.USA.
3. Grewal,R.C.(2011)PlantAnatomy.CampusBooksInternational,NewDelhi,India.
4. Pandey,B.P.(1954)PlantAnatomy. S.ChandandCo.(P.)Ltd.NewDelhi,India.
5. Pandey, S.N. and A. Chadha (2006) Plant Anatomy and Embryology. Vikas Publishing House Pvt., Ltd., New Delhi,India.
6. Varma V. (1995) A Text Book of Plant Physiology and Biochemistry. S. Chand and Company. New Delhi,India.
7. Taiz, L. Zeiger E. (2010) Plant Physiology. Sinauer Associates Inc.; U.S.A.5<sup>th</sup>edition.
8. SundaraRajan(2000) College Botany ( Plant Physiology and Molecular Biology Vol.IV, Himalaya Publishing House, New Delhi, India.
9. Amar Singh (1977) Practical Plant Physiology. Kalyani Publication, New Delhi, Ludhiana,India.

**Proposed methods of teaching/ innovative teaching**

- Lecture cum demonstration methods, laboratory method, project method, question answer method, assignment method
- Innovative teaching: audio video hands on learning, science museum, project based learning, ICT enabled teaching, video clips/ movies, science fairs, field trips.

**S.Y. B.Sc. (Botany): Semester-III**  
**BOT-230: Mushroom culture technology**

**Total Hours: 30**

**Credits: 2**

**Course 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.

## Course outcomes

1. Students provide with history scope and importance of Mushroom Culture Technology
2. They will get the knowledge of nutritional and medicinal values of edible mushrooms
3. This course helps to make them aware the storage, marketing and various food preparations of mushrooms.
4. Economics of mushrooms cultivation will be studied by them

### Unit I : Introduction to Mushroom Cultivation

5h

- 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 II: Cultivation Technology

12h

- 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*.
- 2.6 Some important tips for growing mushrooms successfully

### Unit III: Common Problems in mushroom growing

05h

- 3.1 Media preparation or culture
- 3.2 Preparation of mother spawn (Grain Culture)
- 3.3 Preparation of mother spawn (Sawdust Culture)
- 3.4 Preparation of planting spawn
- 3.5 Outdoor bed tech for *Volvariella* sp.
- 3.6 Sawdust tech (*Pleurotus*, *Lentinula*, *Auricularia*)

### Unit IV: Storage

04h

- 4.1 Short-term storage (Refrigeration - upto 24hours)
- 4.2 Long term storage (canning, pickling). Drying, storage in salt solutions.
- 4.3 Marketing

### Unit IV: Food Preparation

04h

- 5.1 Types of foods prepared from mushroom: Soup, Cutlet, Omlette, Samosa, Pickles and Curry.

## 5.2 Training Centres: National and Regional level.

### Reference:

1. Marimuthu, T. Krishnamoorthi, A.S. Sivaprakasam, K. and Jayarajan. R (1991) Oyster Mushrooms. Department of Plant Pathology. Tamil Nadu 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. Tewari S.C. Pankaj Kapoor,(1988).Mushroom Cultivation,Mittal Publications.Delhi.
4. Bahl Nita (1984-1988) Hand book of Mushrooms, II Edition. Vol.I and Vol.II.
5. Vijaya Khader (1993) Mushrooms for Livelihood. Kalyani Publishers.Pp170.
6. Tripathi D. P. (2005) Mushroom cultivation. Oxford IBH Publishing Co. Pvt.Ltd.Pp354.
7. Tiwari S.C. and Pankaj Kapoor. (1988) Mushroom Cultivation. Mittal Publications,
8. Khanna P.K. and Kapoor S. (2007) Manual of mushroom production. Dept. of Microbiology. College of Basic Sciences and Humanities, Punjab Agriculture University, Ludhiana.pp.86-90
9. Kumarsan V., Mushroom Cultivation, Saras Publication, PP-324
10. Pathak V. N., Nagendra Yadav and Manesh Gaur (2018) Mushroom Production and Processing Technology Agrobios, PP-176

### Proposed methods of teaching/ innovative teaching

- Classroom teaching, lecture cum demonstration methods, question answer method, brain storming method, assignment method
- Innovative teaching: audio video, science museum, ICT enabled teaching, video clips/ movies, field trips.

## **S.Y. B.Sc. (Botany): Semester-IV BOT-241: Plant Embryology**

**Total Hours: 30**

**Credits: 2**

### Course 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 inembryology

### Course outcomes

1. Students will be acquainted with scope and importance of Plant Embryology
2. They will get the information of structure of micro and megasporangium
3. They will be provided with knowledge of pollination, fertilization, Endosperm and Embryogeny
4. Exposure will be given to the Students regarding techniques in embryology

- Unit I: Microsporangium (Anther) 05h**
- 1.1 Definition, Scope and importance of Embryology
  - 1.2 Structure of anther- Epidermis, endothecium, middle layer sporogenous tissue and Tapetum.
  - 1.3 Tapetum types- a) Amoeboid or plasmodia b) Secretary orglandular
  - 1.4 Functions of Tapetum
  - 1.5 Microsporogenesis- karyokinesis and cytokinesis (simultaneous and successive)
  - 1.6 Structure of pollen and Malegametophyte
  - 1.7 Types of pollen tetrad –linear, isobilateral, tetrahedral, decussate, T-shaped.
- Unit II: Megasporangium (Ovule) 05h**
- 2.1 Structure of Ovule.
  - 2.2 Types of ovule: i) Orthotropous ii) Anatropous iii) Amphitropous iv) Hemianatropous v) Compylotropous vi) Circinotropous
  - 2.3 Types of Embryosac. i) Monosporic (Polygonum) ii) Bisporic (Allium) iii) Tetrasporic (Peperomia)
- Unit III: Pollination and Fertilization 05h**
- 3.1 Definition and Types of Pollination: Anemophily, Entomophily, Hydrophily
  - 3.2 Fertilization i) Definition ii) Entry of pollen tube into ovule -Porogamy, chalizogamy and mesogamy iii) Process of double fertilization and tripfusion iv) Significance of double fertilization mechanism.
- Unit IV: Endosperm and embryo 09h**
- 4.1 Definition.
  - 4.2 Structure and function of endosperm.
  - 4.3 Types of Endosperm. i) Nuclear ii) Cellular iii) Helobial.
  - 4.4 Definition
  - 4.5 Structure of Dicot Embryo e.g. Capsella brassica pastories (Development not expected)
  - 4.6 Structure of monocot embryo e.g. Sagittaria (Development not expected)
  - 4.7 Polyembryony: Definition
  - 4.8 Types of polyembryony: i. Simple ii. Cleavage iii Rosette
  - 4.9 Causes of Polyembryony
- Unit V: Seed structure and dispersal 06h**
- 5.1 Definition, structure of seed.
  - 5.2 Appendages and dispersal mechanism of seed- Aril, Coma, Caruncle
  - 5.3 Dispersal Mechanism:
    - By Wind -(Anemochory) : a. Winged seed and fruits b. Parachute mechanism c. Hairs
    - By Water (Hydrochory): a. Floating devices b. Protective covering

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

#### **Reference:**

1. Bhojwani, S.S. and Bhatnagar S.P.,(2013Reprint)TheEmbryologyofAngiosperms, Vikas Publishing House Pvt. Ltd. New Delhi, India.
2. Maheshwari, P. (1950) An introduction to the embryology of Angiosperms, McGraw Hill Book Co. New York, USA.
3. Singh,V., P.C. Pandey and D.K. Jain (1998) Embryology of Angiosperm , Rastogi Publications, Meerut, India
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5. Singh, Sanjay Kumar (2005) A Text Book of Plant Anatomy, Campus Books International, New Delhi, India
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#### **Proposed methods of teaching/ innovative teaching**

- Classroom teaching, lecture cum demonstration methods, question answer method, brain storming method, assignment method
- Innovative teaching: audio video, science museum, ICT enabled teaching, video clips/ movies, field trips.

## **S.Y. B.Sc. (Botany): Semester-IV BOT-242: Plant metabolism**

**Total Hours: 30**

**Credits: 2**

#### **Course 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, C<sub>3</sub>, C<sub>4</sub>and CAM pathways.
4. To study respiration in higher plants.

#### **Course outcomes :**

1. Students will be get to know the scope and imporatnce of Plant metabolism
2. They will be incorporated withknowledge ofproperties, mechanism and classification of enzymes.
3. Students will get the platform to study the process of photosynthesis in higher plants, C<sub>3</sub>, C<sub>4</sub> and CAM pathways.
4. Students will be familier with the respiration in higher plants

<b>Unit I: Introduction</b>	<b>06h</b>
1.1 Definition	
1.2 Plant cell as organicLaboratory	
1.3 Anabolism and catabolism	
1.4 Enzymes	
1.4.1 Definition, Structure and properties.	
1.4.2 Classification of enzymes	
1.4.3 Mode of enzyme action: Lock and key Model, Induced fit model	
<b>Unit II : Photosynthesis -I</b>	<b>05h</b>
2.1 Definition, photosynthetic apparatus (Structure of Chloroplast)	
2.2 Role of photosynthetic pigments: Chlorophyll (Chl- a, Chl-b), Carotenoids and Phycobillins	
2.3 Photosystem I and II	
<b>Unit III: Photosynthesis -II</b>	<b>06h</b>
3.1 Mechanism	
a) Light Reaction: Cyclic and Non-Cyclic Photophosphorylation	
b) Dark Reaction: C3, C4 and CAM pathway	
3.2 Photorespiration: Definition, Sites and Mechanism ofphotorespiration.	
3.3 Factor affecting the process ofphotosynthesis.	
<b>Unit IV: Respiration</b>	<b>07h</b>
4.1 Introduction, Definition and Types of respiration.	
4.2 Mechanism of Aerobic respiration.	
a) Glycolysis.	
b) Kreb'scycle.	
c) Electron Transfer System(ETS)	
4.3 Mechanism of Anaerobic respiration: Alcoholic Fermentation	
4.4 Factor affecting the process of respiration.	
<b>Unit V: Nitrogen metabolism</b>	<b>(06h)</b>
5.1 Introduction.	
5.2 Types of Nitrogen fixation.	
5.3 Biological nitrogen fixation.	
5.4 Nitrate and ammonia assimilation.	
5.5 mportance	

**Reference:**

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
3. Harborne, J.B. (1973). Phytochemical Methods. John Wiley and Sons. New York
4. Mukherjee, S. Ghosh A.K. (1998) Plant Physiology, Tata McGraw Hill Publishers(P) Ltd., New Delhi

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.
7. Jain. V.K. (1977) Fundamentals of plant physiology. S. Chand and Company Ltd. New Delhi, India

#### **Proposed methods of teaching/ innovative teaching**

- Classroom teaching, lecture cum demonstration methods, question answer method, brain storming method, assignment method
- Innovative teaching: audio video, science museum, ICT enabled teaching, video clips/ movies, field trips.

### **S.Y. B.Sc. (Botany): Semester-IV BOT-243: Practical course based on BOT-241 and BOT-242**

**Total Hours: 60**

**Credits: 2**

#### **Course objectives :-**

1. To incorporate practical knowledge among the Students.
2. To include the laboratories skill among the Students about the course
3. To teach the methodologies and working of experiments of chromatography, enzyme activity and photosynthesis

#### **Course outcomes :-**

1. Students will be incorporated with the practical knowledge.
2. Students will be inculcated with laboratories skill of the course
3. Students will learn the methodologies and working of experiments of chromatography, enzyme activity, photosynthesis and demonstration experiments.

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

- a. T.S. of microsporangium (Anther)
- b. 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 O<sub>2</sub> evolution in photosynthesis.

**Practical No 12:** Separation of amino acids by paper chromatography.

**Practical No 13 and 14: Demonstration experiments**

- i. To demonstrate the presence of starch in chloroplast
- ii. CO<sub>2</sub> essential for Photosynthesis
- iii. R.Q. (Respiratory Quotient)
- iv. Kuhne's Tube experiment
- v. Isolation and Inoculation of *Rhizobium*

**References:**

1. Bhojwani, S.S. and S.P. Bhatnagar, (2013 Reprint) The Embryology of Angiosperms, Vikas Publishing House Pvt. Ltd. New Delhi, India.
2. Maheshwari, P. (1950) An introduction to the embryology of Angiosperms, McGraw Hill Book Co. New York, USA.
3. Singh, V., P.C. Pandey and D.K. Jain (1998) Embryology of Angiosperm, Rastogi Publications, Meerut, India
4. Harborne, J.B. (1973). Phytochemical Methods. John Wiley and Sons. New York
5. Srivastava H.S., 2004. Plant Physiology and Biochemistry, Rastogi Publications.
6. Amar Singh (1977) Practical Plant Physiology. Kalyani Publication, New Delhi, Ludhiana, India.

**Proposed methods of teaching/ innovative teaching**

- Lecture cum demonstration methods, laboratory method, project method, question answer method, assignment method
- Innovative teaching: audio video hands on learning, science museum, project based learning, ICT enabled teaching, video clips/ movies, science fairs, field trips.

**S.Y. B.Sc. (Botany): Semester-IV**  
**BOT-240: Nursery and gardening**

**Total Hours: 60**

**Credits: 2**

**Course 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



## Course outcomes

1. Students will be given the concept of nursery and Gardening.
2. The skill of Students will be improved for growing fresh and safe vegetables.
3. They will be made aware with the concept of home gardening
4. This course will help to develop different skills regarding the gardening operations among the Students

### Unit I: Nursery

04h

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

### Unit II: Seed structure and types

04h

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

### Unit III: Vegetative propagation

05h

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 IV: Gardening

11h

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

**4.2** 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 *Palms* (Two examples each)

### Unit V : Cultivation practices

06h

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

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

## References:

1. Bose T.K. and Mukherjee. D. (1972). Gardening in India, Oxford and IBH Publishing Vol 1., New Delhi.
2. Sandhu, M. K., (1989), Plant Propagation. Wile Eastern Ltd., Bangalore, Madras.
3. Kumar, N., (1997), Introduction to Horticulture, Rajalakshmi Publications, Nagercoil.
4. Edmond Musser and Andres, Fundamentals of Horticulture, McGraw Hill Book Co., New Delhi.

5. Agrawal. P.K. (1993), Hand Book of Seed Technology, Dept. of Agriculture and Cooperations, National Seed Corporation Ltd., New Delhi.
6. Janick Jules. (1979). Horticultural Science. (3rd Ed.) W. H. Freeman and Co., San Francisco. USA.

**Possible methods of teaching/ innovative teaching**

- classroom teaching, lecture cum demonstration methods, laboratory method, project method, question answer method, assignment method
- Innovative teaching: audio video hands on learning, science museum, project based learning, ICT enabled teaching, video clips/ movies, science fairs, field trips.