"Education for Knowledge, Science and Culture."
– Shikshanmaharshi Dr. Bapuji Salunkhe

Shri Swami Vivekanand Shikshan Sanstha's

VIVEKANAND COLLEGE, KOLHAPUR (AUTONOMOUS)

Syllabus
for
Bachelor of Science

B.Sc. Part - II BOTANY

(Semester-III & IV)

Under Choice Based Credit System

CBCS Syllabus to be implemented from 2019 – 2020

(Subject to modifications in the future)

CHOICE BASED CREDIT SYSTEM

B.Sc. II (Sem. – III and IV) Botany

Course Structure

Paper No.	Course Code	Title of Paper	No. of Credits
Semester III			
III	DSC -1007C	Taxonomy, Embryology and Plant Physiology	04
Semester IV			
IV	DSC-1007D	Plant Anatomy and Plant Metabolism	04

CHOICE BASED CREDIT SYSTEM

B.Sc. - II: Botany

Paper - III "Taxonomy, Embryology and Plant Physiology"

(DSC – 1007 C)

Section I: Taxonomy, Embryology

Course Outcomes: On completion of the course, students will be able to:

CO1: Understand organization and different mechanism of flower.

CO 2: Understand development and types of embryo.

CO 3: Understand the morphological, floral, distinguishing characters and economic importance of families.

CO 4: Understand different taxonomic literature.

Paper III	**DSC 1007 C :" Taxonomy, Embryology and Plant Physiology"** **Section : I (DSC 1007C1): Taxonomy, Embryology**	**No. of Hours per Unit / Credit**
Unit : I.	**Organization of flower** : 1a: Concept of flower as a modified shoot, structure of typical flower. 1b. Structure of typical stamen, microsporogensis, pollen germination and development of male gametophyte. 1c. Structure of typical gynoecium, structure of a typical ovule, types of ovules. 1d. Megasporogenesis, structure of embryo sac: Monosporic (*Polygonum*) ,Bisporic (*Allium*) and Tetrasporic (*Pepromia*) development of female gametophyte.	05 hrs
Unit . II.	**Pollination and Fertilization :** 2a.Definition, Types and mechanism in Anemophily (*Zea mays*), Entomophily (*Calotropis*) and Hydrophily (*Vallisneria*), Mimicry (*Orchid*). 2b. Fertilization: Entry of pollen tube,double fertilization and triple fusion.Significance of double fertilization. 2c: Structure and development of embryo in Monocotyledons. 2d: Structure and development of embryo in Dicotyledons. 2e: Development of endosperm, Types of endosperm- Nuclear, Helobial and Cellular. 2f: Apomixes	12hrs

Unit. III.	**Taxonomic Literature** Introduction of Flora, Monograph, Revisions, Mannunals, Journals, Periodicals, Reference Books , research papers ,Websites.	05hrs
Unit . IV	**Plant Families** Morphological, floral, distinguishing character and economic importance of following families. i.Annonaceae ii. Meliaceae iii. Apocynaceae iv. Lamiaceae v. Amaranthaceae vi. Orchidaceae	08hrs

Total hours: 30

References:

1) Bhojwani S. S. and Bhatnagar S. P., An Embryology of Angiosperms,
2) Maheshwari P, An Introduction to Embryology of Angiosperm,
3) Pandey and Chadha, Plant Anatomy and Embryology, Vikas Publishing House, Pvt, Ltd, New Delhi.
4) S. C. Datta, Systematic Botany, New Age International Publishers, New Delhi.
5) V. N. Naik, Taxonomy of Angiosperms, Tata Mc Graw Hill Publication.

CHOICE BASED CREDIT SYSTEM

B.Sc. - II: Botany

Paper - III "Taxonomy, Embryology and Plant Physiology"

(DSC – 1007 C)

Section II: Plant Physiology

Course Outcomes: On completion of the course, students will be able to:

CO1: Know the plant water relationship.
CO 2: Understand the concept of photosynthesis.
CO 3: Understand the concept of respiration.
CO 4: Know the role of minerals in plant growth.

Paper III	**DSC 1007 C :" Taxonomy, Embryology and Plant Physiology"** **Section : I (DSC 1007C2): Plant Physiology**	**No. of Hours per Unit / Credit**
Unit : I.	**Plant water relationship** 1a. Introduction, Physiological importance of water. 1b. Water transport process: Mechanism of water absorption: Active (Osmotic and Non osmotic) and passive (Transpiration pull) absorption theories, water transport through xylem and tracheids. 1c. Transpiration: Definition, Types of transpiration, Mechanism of stomatal movement, Starch-sugar hypothesis, Factors affecting transpiration, Significance of transpiration.	08 hrs
Unit . II.	**Mineral Nutrition** 2a. Introduction, Criteria of essentiality 2b. Macro and Micronutrients 2c. Mineral nutrient uptake- Passive uptake (Diffusion), Active uptake (Carrier Concept - Protein Lecithian Theory). 2d. Role and Deficiency Disorders of Macronutrients (P, K, Ca, Mg) and Micronutrients (Fe, Mn, Zn, Br) in plants and its recovery.	07hrs
Unit. III.	**Photosynthesis** 3a. Introduction : Ultrastructure of Photosynthetic apparatus. 3b.Photosynthetic pigments-(Chlorophylls, Carotenoids and Phycobilins) 3c. Mechanism of Photosynthesis: a) Light reaction- Photolysis of water, Photosystem I and Photosystem II, Electron transport and Photophosphorylation- Cyclic and Non-cyclic. b) Dark reaction: Calvi cycle C_3 c) Adaptive Pathway of Photosynthesis- Hatch- Slack Pathway- (C_4) and CAM pathway	08hrs

	3d. Significance of photosynthesis	
Unit . IV	**Respiration** 4a. Introduction 4b.Types of respiration 4c.Glycolysis 4d. Formation of Acetyl Co A 4e. TCA cycle 4f. ETS in mitochondria 4g. Significance of respiration	07hrs

Total hours: 30

References:

1) R.C. Grewal , Plant Physiology., Campus Books International 483/24, Prahiad street Ansari Road, Darya ganj, New Delhi.
2) Salisburry, F.B. and Ross, Plant Physiology. (4th edition), C. W. 1992.,Wadsworth Publishing Co., California, USA.
3) Taiz, L. and Zeiger, E. 1998., Plant Physiology. (2nd edition) , ,Sinauer Associates, Inc., Publishers, Massachusetts, USA.
3) V.K. Jain, Fundamentals of Plant Physiology, S. Chand & Company Ltd. Ramnagar, New Delhi.
4) Salisbury Ross, Plant Physiology, CBS, Publishers & Distributions 485/ Jain Bhawan, Bhole Nath Nagar, Shahdara, New Delhi.

CHOICE BASED CREDIT SYSTEM

B.Sc. - II: Botany

Paper - IV "Plant **Anatomy and Plant Metabolism**"

(DSC – 1007 D)

Section I: Plant Anatomy

Course Outcomes: On completion of the course, students will be able to:

CO1: Understand the scope, importance and techniques of anatomy.

CO 2: Know the various plant adaptations.

CO 3. Know the organization of higher plant body.

CO 4: Know tissue and tissue system.

Paper IV	**DSC 1007 D : " Plant Anatomy and Plant Metabolism "** **Section : I (DSC 1007D1): Plant Anatomy**	**No. of Hours per Unit / Credit**
Unit : I.	**Unit : I. Organization of higher plant body** 1a. Plant organs (Introductory) 1b. Development of plant body (Seedling development) 1c. Internal organization	03hrs
Unit . II.	**Tissue and Tissue System** 2a. Meristem: a) Introduction, Characteristics and Classification of meristems based on position b) Theories of structural development- i) Apical cell theory ii) Histogen theory iii) Tunica Corpus theory. 2b. Permanent tissue: i) Simple tissue- Parenchyma, Collenchyma and Sclerenchyma ii) Complex tissue: Xylem and Phloem 2c. Epidermal tissue system 2d. Secretary tissue system 2e. Mechanical tissue system 2f. Types of Vascular bundles	12hrs
Unit. III.	**Primary and secondary structure of plant body** 3a. Primary structure of Monocotyledon and Dicotyledon root, stem and leaf. 3b. Normal secondary growth in Dicotyledon root and stem. 3c. Anomalous secondary growth in *Bignonia* (Dicot.) and *Dracaena* (Monocot.) stem. 3d. Periderm and Lenticel	08hrs

Unit. IV	**Plant Adaptations** 4a. Mangrove Biology 4b. Xeric adaptations 4c. Carnivorous Plant 4d. Epiphytic and Parasitic Plant	07hrs

Total hours: 30

References:

1) A. C. Datta., Botany For Deree students, Press-Delhi, Bombay, Madras.
2) B. P. Pandey, Plant Anatomy, S. Chand & Company, LTD. Ram Nagar, New Delhi.
3) Carlquist, S., Comparative Wood Anatomy, Systematic, Ecological and Evolutionary Aspects of dicotyledonous Wood. Springer – Verlag, Berlin
4) Culter, E.G., Cells and Tissues, Edward Arnold, London
5) P.C. Vasista, Plant Anatomy, Pradip Publications, Opposite Sitla mandir, Jalandhar.

CHOICE BASED CREDIT SYSTEM

B.Sc. - II: Botany

Paper - IV "Plant **Anatomy and Plant Metabolism**"

(DSC – 1007 D)

Section II: Plant Metabolism

Course Outcomes: On completion of the course, students will be able to:

CO1: Know the mechanism of enzymes

CO 2: Understand the mechanism of nitrogen metabolism.

CO 3: Know the mechanism of growth in plants.

CO 4: Know the mechanism of seed dormancy and seed germination.

Paper IV	**DSC 1007 D : " Plant Anatomy and Plant Metabolism "** **Section : II (DSC 1007D2): Plant Metabolism**	**No. of Hours per Unit / Credit**
Unit : I.	**Enzymes** 1a.Introduction 1b. Chemical nature and properties of enzymes 1c. Classification and Nomenclature of enzyme 1d.Mechanism of enzyme action- Lock and Key hypothesis and Induced fit hypothesis. 1e. Factors affecting enzyme activity- temperature , pH . 1f. Allosteric modification and Feedback inhibition.	08hrs
Unit . II.	**Nitrogen Metabolism** 2a. Introduction – Role of N_2 2b. Biological Nitrogen Fixation- Asymbiotic and Symbiotic 2c. General structure and role of Nitrogenase 2d. Mechanism of Reduction of Nitrate into Ammonia 2e. Mechanism of Ammonia assimilation in plants. 2g. nif genes	07hrs
Unit. III.	**Growth and Development** 3a. Definition and Phases of growth 3b. Plant growth regulators: Discovery, site of synthesis, Physiological (Practical applications) roles of growth regulators – Auxins, Cytokinin, Gibberellins and Abscisic acid.	08hrs

	3c. Photoperiodism and Floreign Concept, Photoperiodic classification of plants- LDP, SDP, DNP. 3d. Vernalization: Concept, site of vernalization and its significance.	
Unit . IV	**Seed Dormancy and Germination** 4a. Concept of dormancy, causes of seed dormancy. 4b. Methods of breaking of seed dormancy. 4c. Seed germination- Introduction and types (Epigeal, Hypogeal and Viviparous). 4d. Factors affecting on seed germination	06hrs

Total hours: 30

References:

1) Dennis, D.T., Turpin, D.H., Lefebvre, D.D. and Layzell, D.B. 1997. Plant Metabolism. 2nd Edition. Longman Group, U.K.
2) Fitter, A. and Hay, R.K.M. 2001. Environmental Physiology of Plants. Academic Press, UK.
3) Helgi O Pik, Stephen A. Rolfe, Arthur J. Willis.,The Physiology of Flowering Plants, Cambridge University Press, UK
4) Kirkham, M.B. 2004. Principles of Soil and Plant Water Relations. Elsevier, Amsterdam, Netherlands.

CHOICE BASED CREDIT SYSTEM

B.Sc. Part II CBCS syllabus with effect from 2019 -2020

Botany

"Taxonomy, Embryology and Plant Physiology"

PRACTICAL – I (Based on Paper III)

Practical- I

1) Study structure of stomata and determination of stomatal density.
2) Study stomatal and cuticular transpiration by cobalt chloride paper method.
3) Study of role and deficiency symptoms of P, K, Ca, Mg.
4) Separation of photosynthetic pigments by ascending paper chromatography.
5) Study of Kranz leaf anatomy in C_4 plants.
6) Estimation of TAN value in CAM plants.
7) Analysis of vegetative growth (any suitable method).
8) Effect of different concentrations of Auxins (IAA) on seed germination (any suitable dicot seeds).
9) Effect of different concentrations of Gibberlic acid (GA) on seed germination (any suitable monocot seeds).
10) Effect of Cytokinin on Leaf Senescence.
11) Study of effect of light intensity on photosynthesis.
12) Detection of Calcium, Phosphate, Potassium and Iron in the plant tissue by biochemical tests.
13) Demonstration of Endo-osmosis and Exo-osmosis.
14) Study of permeability of plasma membrane by using different concentrations of organic solvent.
15) Study of typical flower and its parts (floral whorls with their functions).
16) Study of young / mature anther by permanent slide .

17) Study of germination of pollen grains.

18) Detection of pollen fertility by staining technique.

19) Study of types of ovules (by permanent slide or photograph).

20) Study of dicotyledon and monocotyledon embryo (by permanent slide or photograph).

21) Preparation of weed herbarium.

22) – 25) Study angiospermic families as per syllabus.

Distribution of Marks	
PRACTICAL – I	**Marks**
1) Taxonomy	11
2) Embryology	10
2) Plant Physiology	19
3) Journal	05
4) Field visit / Tour report	05
Total	**50**

CHOICE BASED CREDIT SYSTEM

B.Sc. Part II CBCS syllabus with effect from 2019 -2020

Botany

"Plant Anatomy and Plant Metabolism"

PRACTICAL – II (Based on Paper IV)

Practical- II

1) Study of shoot and root apex by permanent slides.
2) Study of simple tissues.
3) Study of complex tissues.
4) Study of primary structure of dicot and monocot root.
5) Study of primary structure of dicot and monocot stem.
6) Study of normal secondary growth in dicot stem (*Parthenium* / *Moringa* / Sunflower) by temporary double stained techniques.
7) Double stained permanent micro preparation of any suitable material.
8) Study of anomalous/abnormal secondary growth in *Bignonia* (Dicot stem).
9) Study of anomalous/abnormal secondary growth in *Dracaena* (Monocot stem).
10) Study of periderm and lenticels (by permanent slides)
11) Study of anatomy of porous (ring porous & diffused porous) and non porous wood.
12) Study of Epidermal tissue system.
13) Study of Mechanical tissue system (I-girdles).
14) Study of Secretary tissue system (glandular hairs).
15) Study of excretory products viz., Cystolith, sphaeraphides, raphides in plants.
16) Determination of rate of respiration during seed germination by Ganong's respirometer.
17) Breaking of seed dormancy by mechanical and chemical scarification.

18) Study of effect of pH on enzyme activity of Catalase.

19) Study of effect of temperature on enzyme activity of Malate dehydrogenase.

20) Study of fermentation by inverted tube method.

21) Morphological and Anatomical adaptations in Mangroves.

22) Study of Mimicry in *Orchid* flowers.

Distribution of Marks	
PRACTICAL – II	**Marks**
1) Plant Anatomy	23
2) Plant Metabolism	17
4) Journal	05
5) Submission	05
Total	**50**

CHOICE BASED CREDIT SYSTEM

PRACTICALS IN BOTANY
B.Sc. Part – II
(To be implemented from 2019-2020)

Botanical excursions –

One teacher along with a batch not more than sixteen students is taken for Botanical excursions to places of botanical interest, one in each term. If there are female students in a batch of sixteen, one additional lady teacher is permissible for excursion. Each excursion will not be more than 3 days during college working days. T.A. and D.A. for teachers and non teaching staff participating in the excursions should be paid as per the rules. The tour report duly certified by the concerned teacher and the head of the department should be submitted at the time of practical examination.

Practical – I and II are to be covered in 25 practicals each. These practicals are to be performed by the students. Each practical is to be supplemented by permanent slides, preserved / fresh specimens / materials, charts, herbarium sheets, wherever necessary.

Every candidate must produce a certificate from Head of the Department in his / her college stating that he / she has completed practical course in a satisfactory manner as per the lines laid down by academic council on the recommendations of Board of Studies in Botany. The student should record his / her observations and report of each experiment should be written in the Journal.

The Journal is to be signed periodically by teacher in charge and certified by Head of the Department at the end of the year. Candidates have to produce their certified journal and tour reports at the time of practical examination. A candidate will not be allowed to appear for the practical examination without a certified journal, otherwise a candidate must produce a separate certificate of his / her regular attendance for practical course and completion of the same signed by the concerned teacher and Head of the Department.

CHOICE BASED CREDIT SYSTEM

PRACTICALS IN BOTANY
B.Sc. Part – II
(To be implemented from 2019-2020)

Total Marks for practical 100 Marks - a) Practical – I - 50 Marks b) Practical – II - 50 Marks

The practical course is to be covered in 50 practicals .The practical course should be divided into practical no. I which will comprise 25 practicals based on Paper No. V & Paper No.VI where as the practical No. II will comprise 25 practicals based on Paper No.VII & VIII. The practical No I will carry 50 marks & practical II will also carry 50 marks. The practical examination will be conducted at the end of semester IV on two successive days.

Each practical examination (Practical I and II) should be of maximum 5 hours duration and shall test a candidate in respect of following –

i. Identification and preparation of temporary and permanent slides.
ii. Practical study of external and internal structures of different plants as per the syllabus.
iii. Understanding of principles of the experiments.
iv. Identification and setting of ecological experiments.
v. Identification and setting of Physiological experiments.
vi. Recording of observations and conclusions.
vii. Identification and understanding of the practicals conducted with respect to development of plants.
viii. Spotting of the specimens as per the syllabus.
ix. Submission of the tour report.

CHOICE BASED CREDIT SYSTEM

B.Sc. II (Sem. III & IV) Botany

Evaluation Pattern

With effect from 2019-20

Paper No.	Title of the paper	Course Code	Semester End Examination	Continuous Internal Evaluation Marks	Total Marks
III - Sec. I	Taxonomy, Embryology	DSC 1007C1	40	10	50
III - Sec. II	Plant Physiology	DSC1007C2	40	10	50
IV - Sec. I	Plant Anatomy	DSC1007D1	40	10	50
IV - Sec. II	Plant Metabolism	DSC1007D2	40	10	50

CHOICE BASED CREDIT SYSTEM

B.Sc. II (Sem. III & IV) Botany

Semester End Examination

Structure of Question Paper

Total Marks : 40 **Time : 2 hours**

Question No.	Question Pattern	Marks
Q.1	Select correct alternative. (MCQ).	08
Q.2	Attempt any two. (Long answer questions).	16
Q.3	Attempt any four. (Short notes).	16
	Total	40

B.Sc. II (Sem. III & IV) Botany

Continuous Internal Evaluation (CIE)

Evaluation Type	Marks
Home Assignment/Book Review/ Student Project/Test/PPT Presentation	10