

Punyashlok Ahilyadevi Holkar Solapur University, Solapur



Name of the Faculty: Science & Technology

CHOICE BASED CREDIT SYSTEM (CBCS)

Syllabus: Botany

Name of the Course: B.Sc. II (Semester III & IV)

(Syllabus to be implemented 2023-24)

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Faculty of Science & Technology

Choice Based Credit System (CBCS) (w.e.f.2023-24)

Revised Structure for B. Sc-II

Subject/ Core Course	Name and Type of the Paper		Paper/ Practical Number	Hrs/week			Total Marks Per Paper	UA	CA	Credi ts
	Type	Name		L	T	P				
Class :	B.Sc.- II Semester – III									
Core Courses (*Students can opt any Three subjects among the Four Subjects offered at B. Sc. I. OR Students can opt any Two subjects among the Four Subjects offered at B. Sc. I and any one from the Interdisciplinary subjects.	DSC 1C	IC-1A	Paper-V	3	--	--	50	40	10	4.0
			Paper-VI	3	--	--	50	40	10	
	DSC 2C		Paper-V	3	--	--	50	40	10	4.0
			Paper-VI	3	--	--	50	40	10	
	DSC 3C		Paper-V	3	--	--	50	40	10	4.0
			Paper-VI	3	--	--	50	40	10	
Total Sem.-III				18	--	--	300	240	60	12
	\$ SEC-1			4	--	--	100	80	20	4
Class :	B.Sc.- II Semester –IV									
As per Sem.-III	DSC 1D	IC-1B	Paper-VII	3	--	--	50	40	10	4.0
			Paper-VIII	3	--	--	50	40	10	
	DSC 2D		Paper-VII	3	--	--	50	40	10	4.0
			Paper-VIII	3	--	--	50	40	10	
	DSC 3D		Paper-VII	3	--	--	50	40	10	4.0
			Paper-VIII	3	--	--	50	40	10	
	Environmental Studies			3	--	--	50	40	10	NC
Total Sem-IV				18			300	240	60	12
Total (Theory)				36	--	--	600	480	120	24
Core Practical	DSC 1C & 1D	AIC	Pr. II &III	--	--	8	200	160	40	4.0
	DSC 2C & 2D	1A &	Pr. II & III	--	--	8	200	160	40	4.0
	DSC 3C & 3D	1B	Pr. II & III	--	--	8	200	160	40	4.0
Total (Practicals)						24	600	480	120	24
Grand Total				36		24	1200	960	240	48
	\$ SEC-1			4			100	80	20	4

*Core Courses: Chemistry/Physics/ /Mathematics/Statistics/Botany/Zoology/ Microbiology/ Electronics/Computer Science

Geology/ Geography/Psychology

Interdisciplinary Courses - Geochemistry/Biochemistry/Meteorology/Plant Protection/NCC etc.

\$ Skill Enhancement Course (SEC) the students can choose MOOCs/ NPTEL/SWAYAM/Path Shala/Add-on / Skill based courses of university/college initiated courses of same credits. (Student can register one course of minimum four credits)

\$ These courses are not compulsory, but after completion of these courses students get additional credits on their mark lists. Selected Course should not be from the syllabus.

\$ SEC courses run by colleges should be communicated to university for information & necessary action.

Punyashlok Ahilyadevi Holkar Solapur University, Solapur BOS Section

The following points required in the syllabus:

1) Introduction: This course includes four papers Paper V: Plant Anatomy Paper VI : Plant metabolism Paper VII : Plant Physiology IV: Embryology of Angiosperms. Each paper consists of two units. All these papers help students to improve their basic knowledge about microbes, algae, fungi, ecology, and Taxonomy.

2) Advantages of Course: All these papers will be helpful to improve their skills in anatomical sectioning, identification of tissues, Practical based on these papers will be helpful to develop skills & understanding all the basic loopholes in every technique. These papers act as baseline to their next year studies.

Abbreviations:

L: Lectures

T: Tutorials

P: Practicals

UA: University Assessment

CA: College Assessment

DSC / CC: Core Course

AEC: Ability Enhancement Course

DSE: Discipline Specific Elective Paper

SEC: Skill Enhancement Course

GE: Generic Elective

CA: Continuous Assessment

ESE: End Semester Examination

3) Objectives of the Course:

PAH Solapur University, Solapur
Faculty of Science
Choice Based Credit System (CBCS) (w.e.f. June 2023)
Structure for B.Sc.II

**Objectives & outcomes of course syllabus of B.Sc. II, CBCS pattern Botany,
Semester III**

Paper V
Plant Anatomy

30 Lectures

(15 L)

Unit 1: Tissue & Tissue Systems

(2 L)

Objective: To get knowledge about meristematic cells, their role & classification

Outcome: The students can understand about cell structure of Meristem, their role & classification

Objective: To get knowledge about theories of structural organization in plant

Outcome: The students can understand about structural organization in plants

Objective: To get knowledge about simple & complex tissue

Outcome: The students can understand structure, types & functions of simple & complex tissue

Objective: To get knowledge about Types of Vascular bundles & types of tissue system

Outcome: The students can understand organization of vascular bundle, types of tissue system & their role

Unit 2. Primary & Secondary structure of plant body.

(15 L)

Objective: To get knowledge about primary structure of root & stem

Outcome: Students will understand the anatomical features of root & stem

Objective: To get knowledge about secondary structure of root & stem

Outcome: Students will understand the difference in primary & secondary anatomical features of root & stem

Objective: To get knowledge about anomalous secondary structure of root & stem

Outcome: Students will understand the anomalous secondary structure of stem & their functions

Objective: To get knowledge about types of wood & its organization

Outcome: Students will understand types of wood & its structural organization

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Paper VI

Plant metabolism

30 Lectures

Unit 1: Mineral nutrition, Enzymes & Plant growth regulators

(15 Lectures)

Objective: To get knowledge about different macro & micro nutrients & its role for plant growth & development

Outcome: Students will get knowledge about different macro & micro nutrients & its role or plant growth & development

Objective: To get knowledge about types, classification & mechanism of enzyme action

Outcome: Students will understand different enzymes & their mechanism

Objective: To get knowledge about plant growth regulators their discovery, physiological roles

Outcome: Students will get knowledge about types of growth regulators their biosynthesis & physiological roles for plant development

Unit 2: Plant metabolism

(15 Lectures)

Objective: To get knowledge about importance of nitrogen in plant growth, nitrogen cycle & its types

Outcome: Students get knowledge about importance of nitrogen, types of nitrogen fixation

Objective: To get knowledge about carbohydrate metabolism

Outcome: Students get knowledge about types of carbohydrates, its classification & examples

SEMESTER IV

Paper VII

Plant Physiology

30 Lectures

Unit 1: Plant response & Translocation

Objective: To get knowledge about plant responses to the light Photoperiodism

Outcome: Students will get knowledge about Enzymes involved in Photoperiodism & its role in plant development

Objective: To get knowledge about vernalization

Outcome: Students will get knowledge about enzymes involved, process & importance of vernalization

Objective: To get knowledge about plant transportation

Outcome: Students will get knowledge about translocation, types of transport , source & sink relationship

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2.1 Plant physiology

Objective: To get knowledge about photosynthesis

Outcome: Students will get knowledge about light, dark reaction, enzymes involved & its role in plant development

Objective: To get knowledge about Respiration

Outcome: Students will get knowledge about process of respiration in plants, enzymes involved & their roles

Objective: To get knowledge about photorespiration

Outcome: Students will get knowledge about Mechanism of photorespiration & its significance

Paper VIII

EMBRYOLOGY OF ANGIOSPERMS

30 Lectures

Unit 1: Structural organization of flower & Pollination mechanism

Objective: To get knowledge about different terms in plant embryology, structure of flower & types

Outcome: Students will get knowledge about different terms in plant embryology, structure of flower & types

Objective: To study different developmental stages of anther, stigma, types of ovule

Outcome: Students will get knowledge about microsporogenesis, megasporogenesis, development of male, female gamete

Objective: To get knowledge about process & mechanism of pollination & fertilization

Outcome: Students will get knowledge about types of pollination, process of fertilization

Unit 2: Embryo, Endosperm Development & Seed and fruit dispersal

Objective: To get knowledge about embryo & endosperm development

Outcome: Students will get knowledge about stages of endosperm development

Objective: To study Structure & development of dicot & monocot embryo

Outcome: Students will get knowledge about development process of monocot & dicot embryo

Objective: To study types of embryo

Outcome: Students will get knowledge about types of embryo in angiosperms

Objective: To get knowledge about seed & fruit dispersal

Outcome: Students will get knowledge about mechanism of fruit, seed dispersal, agencies & conditions required for seed & fruit dispersal by different agencies

Semester III
Paper V
Plant Anatomy

30 Lectures

(15 L)

Unit 1: Tissue & Tissue Systems

(2 L)

1.1 Meristems: Introduction, Characteristics and Classification of meristems based on position origin, function and plain of division.

1.2. Theories of structural development : Apical cell theory, Histogen theory and Tunica Corpus theory. (2 L)

1.3 Permanent tissue: **Simple and complex tissue** (3L)

structure and function of simple tissues a) Parenchyma . b) Collenchyma
c) Sclerenchyma

1.4 structure and function of Complex tissue (3L)

a) Xylem b) Phloem

15 Types of Vascular bundles

1.6. Epidermal tissue system, Secretory tissue system, Mechanical tissue system (5L)

Unit 2. Primary & Secondary structure of plant body.

(15 L)

2.1 Primary structure of Monocotyledon and Dicotyledon root. (2 L)

2.2. Primary structure of Monocotyledon and Dicotyledon stem. (2 L)

2.3. Normal secondary growth in Dicotyledon root and stem (3 L)

2.4 Anamalous secondary growth in Bignonia and Dracaena stem. (5 L)

Vascular cambium – structure and function

2.5 Periderm. Lenticel, Tylosis, (2 L)

2.6 Wood types (1L)

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Paper VI

Plant metabolism

30 Lectures

Unit 1: Mineral nutrition, Enzymes & Plant growth regulators

(15 Lectures)

- 1.1 Introduction of **mineral nutrition** (3L)
Macronutrients, Role of macronutrients (N, P, K), Role of Micronutrients (Fe, Mn.)
- 1.2 Introduction of enzymes, Classification, mechanism of enzyme action. (2L)
- 1.3 Properties of enzyme (1L)
- 1.4 Introduction of plant growth regulators, Discovery (2L)
- 1.5 Types of growth regulators (7L)
- PGR - auxins, gibberellins, cytokinins (Physiological role and practical applications of growth regulators)
- Growth inhibitors – ABA, Ethylene (Physiological role and practical applications of growth regulators)

Unit 2: Plant metabolism

(15 Lectures)

- 2.1 Introduction of Nitrogen Metabolism (2L)
- 2.2 Nitrogen cycle (3L)
- Biological nitrogen fixation – Definition, types and organisms involved, Mechanism of biological nitrogen fixation.
- 2.3 Significance of biological nitrogen fixation (1L)
- 2.4 Introduction of Carbohydrate metabolism (2L)
- 2.5 Broad classification (7L)
- Monosaccharides - Properties and examples (Triose, Tetrose, Pentose and Hexose)
- Oligosaccharides - Properties and examples (Sucrose, Maltose and Lactose)
- Polysaccharides - Properties and examples (Starch and Cellulose)

SEMESTER IV

Paper VII

Plant Physiology

30 Lectures

Unit 1: Plant response & Translocation

(15 Lectures)

- 1.1 Photoperiodism – Definition, Classification (SDP, LDP, Day neutral plants);
Phytochrome: Definition, Role of phytochrome (red and far red light responses
on photo morphogenesis); 03
- 1.2 Vernalization: Definition, Mechanism, Significance. 03
- 1.3 Florigen concept
- 1.4 translocation in phloem: Definition, Symplastic transport and apoplastic transport, Phloem loading and
unloading. 03
- 1.5. Mechanism of translocation in phloem – Mass flow hypothesis 03
- 1.6 Source and sink relationship: During vegetative and reproductive phase. 02

2.1 Plant physiology

- 2.1 Introduction. (2L)
Photosynthetic Apparatus; Photosynthetic Pigments (Chl a, b, xanthophylls, carotene);
- 2.2 Light reaction – Cyclic and non cyclic (1L)
- 2.3 Dark reaction – C₃, C₄, CAM Pathway
- 2.4: Photorespiration: Introduction: Site of photorespiration, Mechanism of photorespiration (5L)
Significance (2L)
- 2.5: Respiration. Introduction, Structure of Mitochondrion, Types – Aerobic & anaerobic – (5L)
Glycolysis, Linkage stage and TCA Cycle,

Paper VIII

EMBRYOLOGY OF ANGIOSPERMS

30 Lectures

Unit 1: Structural organization of flower & Pollination mechanism

(15 Lectures)

- 1.1 Concept of flower as a modified Shoot, structure of typical flower. (3L)
- 1.2 structure of typical Androceium, Structure of tetrasporangiate anther and pollengrain.
Structure of typical Gynoecium: Structure of a typical ovule, Types of ovules.
- 1.3 Microsporogenesis, and development off male gametophyte (2L)
- 1.4 Megasporogenesis and development of female gametophyte: Monosporic (*Polygonum*) and Bisporic (*Allium*) (3L)
- 1.5. Pollination & fertilization - Definition, self and cross Pollination Mechanism in Anemophily (*Zea mays*), Entomophily (*Calotropis*) and Hydrophily(*Vallisneria*)
Fertilization: Entry of pollen tube, double fertilization and triple fusion. Significance of double fertilization.
(7 L)

Unit 2: Embryo, Endosperm Development & Seed and fruit dispersal

(15 Lectures)

- 2.1 Structure and development of embryo in Monocotyledons. (2L)
- 2.2 Structure and development of embryo in Dicotyledons (3L)
- 2.3. Development of endosperm,. (4L)
Types of endosperm- Nuclear, Helobial and Cellular.
- 2.4. Seed and fruit dispersal, Agents and mechanism of seed and fruit dispersal. (6L)

Practical- I

- 1) Study of shoot and root apex by permanent slides.
- 2) Study of simple and complex tissues with the help of permanent slides.
- 3) Study of primary structure of dicot and monocot root
- 4) Study of primary structure of dicot and monocot stem
- 5) Study of anomalous secondary growth in *Bignonia* stem by double stained micropreparation.
- 6) Study of anomalous secondary growth in *Dracaena* stem by double stained micropreparation.
- 7) Study of anatomy of porous (ring porous & diffused porous) and non porous wood by permanent slides.
- 8) Maceration technique.
- 9) Study of Epidermal tissue system.
- 10) Study of Secretary Tissue system.
- 11) Study of Mechanical tissue system.
- 12) Determination of rate of respiration during seed germination by Ganong's respirometer.
- 13) Janus green B staining technique for mitochondria.
- 14) Separation of photosynthetic pigments by ascending paper chromatography.
- 15) Study of Kranz leaf anatomy in C4 plants.
- 16) Estimation of TAN value in CAM plants.
- 17) Study of evolution of oxygen during photosynthesis.
- 18) Study of carbohydrates test: reducing and non-reducing sugars.
- 19) Determination of sugar percentage by hand refractometer.
- 20) Botanical Excursion Report.

Practical- II

- 1) Study of typical flower and its parts (floral whorls with their functions).
- 2) Study of young / mature anther by permanent slide.
- 3) Study of germination of pollen grains.
- 4) Detection of pollen fertility by staining technique.
- 5) Study of types of ovules (by permanent slide or photograph).
- 6) Study of dicotyledon and monocotyledon embryo (by permanent slide or photograph).
- 7) Study of endosperm from developing seeds (*Grevellia* / *Cucumis*).
- 8) Dispersal of seeds and Fruits.
- 9) Study of self pollinated plants and cross pollinated plants
- 10) Study of pollination mechanism (Maize, *Calotropis*)
- 11) Study of role and deficiency symptoms of N, P, K, Fe, Mn.
- 12) Effect of different concentrations of Auxins (IAA) on seed germination (any suitable dicotseeds).
- 13) Effect of different concentrations of Gibberellic acid (GA) on seed germination (any suitable monocot seeds).
- 14) Effect of different concentrations of Ethylene on fruit ripening
- 15) Study of effect of pH on Catalase enzyme activity.
- 16) Study of effect of temperature on Malate dehydrogenase enzyme activity.
- 17) Demonstration of fermentation.
- 18) Study of biofertilizers (root nodules and azotobactor)
- 19) Separation of Amino acids by Thin Layer chromatography / paper chromatography.
- 20) Horticulture Term Paper / Field Visit Report / Project Report

Plant Physiology and Metabolism

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9. G. Ray Noggle / G. Fritz- Introductory Plant Physiology. Prentice Hall of India Ltd. New Delhi – 110001.
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11. V.I. Paladin. Plant Physiology. Arihant Publishers. Jaypur, (India)
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19. Verma, V. (2007): Text Book of Plant Physiology. Ane Books India, New Delhi.
20. Nobel, P.S. 2009. Physicochemical and Environmental Plant Physiology. 4th edition Academic Press, UK
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27. S. Sundara rajan- Plants Physiology. Anmol Publications, Pvt. LTD. New Delhi. 110002.

Angiosperm Anatomy and Embryology

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2. B.P. Pandey - Plant Anatomy. S. Chand & Company, LTD. Ram Nagar, New Delhi. 110055.
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Punyashlok Ahilyadevi Holkar Solapur University, Solapur

B.Sc. II Practical Examination in Botany (CBCS)

March/April 2020

Center: Practical II

Date: Batch Total Marks: 40

N.B.-

- 1. Draw neat & labeled diagrams wherever necessary**
 - 2. Do not write about points of theoretical information unless asked specifically**
 - 3. Perform the experiment as per instructions given by the examiner**
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- Q.1. Double stain permanent micro preparation of a T.S. of specimen A and show it to the examiner (No written answer) 12
- Q.2. Macerate the given sample B & prepare a slide from it. Show the slide to the examiner (No written answer) 10
- Q.3. Perform the physiological experiment assigned to you and record your observations, submit the report to the examiner (written answer) 12
- Q.4. Set up the physiological experiment assigned to you and record your observations, submit the report to the examiner (no written answer) 10
- Q.5. Identification 16
- E- Identify & Describe
- F- Identify & Describe
- G – Identify & comment
- H - Identify & comment
- Q.6. A) Journal 10
- B) Excursion Report 10

Punyashlok Ahilyadevi Holkar Solapur University, Solapur
B.Sc. II Practical Examination IN Botany (CBCS)
Practical -III
March/April 2020

Center:

Date:

Total Marks: 40

N.B.-

- 1. Draw neat & labeled diagrams wherever necessary**
 - 2. Do not write about points of theoretical information unless asked specifically**
 - 3. Perform the experiment as per instructions given by the examiner**
-

Q.1.Determine the fertility of pollen / Perform practical for detection of pollen germination of given specimen A (Written answer) 12

Q.2 a). Describe the dicot or monocot embryo by using permanent slides/photographs – B (No written answer) 05

b) Identify the mechanism of pollination of given material - C (written answer) 05

Q.3 .Perform the practical to detect rate of respiration/Separate the given sample - D by TLC to detect amino acids. (Written answer) 12

Q.4.Detect the enzyme activity of given sample - E/Detect the mitochondria in given sample E by using specific staining method. (Written answer) 10

Q.5.Identification 16

F- Identify & Describe

G- Identify & Describe

H-Identify & describe effect of growth regulators

I-Identify the role & Deficiency symptoms

Que. 6

10

a) Journal

b) Horticulture Term Paper / Field Visit Report / Project Report - 10