



SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED
SEMESTER PATTERN CURRICULUM UNDER
CHOICE BASED CREDIT SYSTEM (CBCS) FOR

Faculty of Science
Under Graduate (UG) Programmes

SUBJECT: BOTANY

CLASS: B.Sc. SECOND YEAR

CURRICULUM DESIGNING COMMITTEE

- | | |
|---|----------|
| 1. Dr. Bodke S.S.
Yeshwant Mahavidyalaya, Nanded | Chairman |
| 2. Dr. (Mrs.) S.G. Pillai
Shivaji Mahavidyalaya, Parbhani | Member |
| 3. Dr. Mandge S.V.
Shri. SGM College, Loha | Member |

(With effect from Academic Year 2017-2018)



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INTRODUCTION

The SRTMUN is gearing up for several initiatives towards academic excellence, quality improvement and administrative reforms. In view of this priority and in-keeping with Vision and Mission; process was already initiated towards introduction of semester system, grading system and credit system. In the recent past, University had already implemented Credit based grading system to campus schools and Choice Based Credit System (CBCS) pattern for PG in all the affiliated colleges from the academic year **2014-2015**. These regulations shall be called as Choice Based Course Credit System & Grading, 2014. In short it will be referred as **SRTMUN CBCS REGULATION**.

Now University is going one step ahead to implement Choice Based Credit System (CBCS) pattern at UG level from the academic year **2016-2017** progressively for B.Sc. first year, second year and third year respectively. Revision and updating of the curriculum is the continuous process to provide an updated education to the students at large. Presently there is wide diversity in the curriculum of different Indian Universities which inhibited mobility of students in other universities or states. To ensure and have uniform curriculum at UG and PG levels as per the **SRTMUN CBCS REGULATION**, curriculum of different Indian Universities, syllabus of NET, SET, MPSC, UPSC, Forest Services and the UGC model curriculum are referred to serve as a base in updating the same.

The B.Sc. Botany (General) semester pattern course is running in different affiliated colleges of the SRTMUN. The course content has been designed under CBCS pattern. The course content of each theory paper is divided into units by giving appropriate titles and subtitles. For each unit, total number of periods required, weight age of maximum marks and credits are mentioned. A list of practical exercises and skills for laboratory work to be completed in the academic year is also given. A list of selected reading material and a common skeleton question paper for all courses are also provided at the end of the syllabus.



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OBJECTIVES

1. To provide an updated education to the students at large in order to know the importance and scope of the discipline and to provide mobility to students from one university or state to other.
2. To update curriculum by introducing recent advances in the subject and enable the students to face NET, SET, UPSC and other competitive examinations successfully.
3. To impart knowledge of plant science as the basic objective of Education
4. To develop a scientific attitude to make students open minded, critical and curious
5. To develop an ability to work on their own and to make them fit for the society
6. To expose themselves to the diversity amongst life forms
7. To develop skill in practical work, experiments, equipments and laboratory use along with collection and interpretation of plant materials and data
8. To make aware of natural resources and environment and the importance of conserving the same
9. To develop ability for the application of the acquired knowledge in the fields of life so as to make our country self reliant and self sufficient
10. To appreciate and apply ethical principles to plant science research and studies



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An Outline:

Semester/ Annual	Course No.	Course Name	Instruction Hrs/week	Total Periods	Marks for		Credits (Marks)
					Internal (CA)	External (ESE)	
Semester-III	CCB-III (Section-A)	Morphology and Taxonomy of Angiosperms (P-VI)	03	45	10	40	Credits: 02 (Marks:50)
	CCB-III (Section-B)	Histology, Anatomy and Embryology of Angiosperms (P-VII)	03	45	10	40	Credits: 02 (Marks:50)
Semester-IV	CCB-IV(Section-A)	Gymnosperms and Palaeobotany (P-VIII)	03	45	10	40	Credits: 02 (Marks:50)
	CCB-IV(Section-B)	Ecology and Environmental Biology (P-IX)	03	45	10	40	Credits: 02 (Marks:50)
Annual Pattern	CCBP-II	Practicals based on CCB-III (Section-A) (P-X)	03	08 Practicals	05	20	Credits: 02 (Marks:50)
		Practicals based on CCB-IV (Section-A) (P-X)	03	08 Practicals	05	20	
	SECB-I	Any one skill from optional (SECB-I)	03	45	25	25	Credits: 02 (Marks:50)
Annual Pattern	CCBP-III	Practicals based on CCB-III (Section-B) (P-XI)	03	08 Practicals	05	20	Credits: 02 (Marks:50)
		Practicals based on CCB-IV (Section-B) (P-XI)	03	08 Practicals	05	20	
	SECB-II	Any one skill from optional (SECB-II)	03	45	25	25	Credits: 02 (Marks:50)
Total Credits Semester-III and IV					Marks: 60+50= 110	Marks: 240+50= 290	Credits: 12+04=16 (Marks: 300+100 =400)

CCB: Core Course Botany, **CCBP:** Core Course Botany Practical, **ESE:** End of semester examination,

CA: Continuous Assessment, **SECB:** Skill Enhancement Course Botany

Distribution of credits: 80% of the total credits for ESE and 20% for CA

- **CA of Marks-10:** 10 marks for Test / Record Book & Viva voce
- **CA of Marks 25:** 15 for marks Seminar & 10 marks for Test

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SEMESTER-III

CCB-III (SECTION-A): MORPHOLOGY AND TAXONOMY OF ANGIOSPERMS (P-VI)

Periods: 45

Credits: 02 (Maximum Marks: 50)

UNIT-I: MORPHOLOGY OF ANGIOSPERMS (10 periods)

Root: Definition, characters, types (tap root and adventitious) and functions. **Stem:** Definition, characters, modifications (stem tendril, phylloclade, tuber, rhizome, corm and runner) and functions. **Leaf:** Definition, structure of typical leaf (Hibiscus), functions, types- Simple (Hibiscus), Compound (unipinnate, bipinnate, tripinnate, unifoliate, bifoliate, trifoliate, multifoliate), venation- definition, types (reticulate, parallel), Phyllotaxy, **Inflorescence:** Definition, types- Racemose (characters), Cymose (characters), **Flower:** Definition, symmetry, actinomorphic, zygomorphic, types (hypogynous, epigynous, perigynous), structure of typical flower (Hibiscus), calyx (polysepalous, gamosepalous), corolla (polypetalous, gamopetalous), androecium (parts of a stamen), gynoecium –structure of carpel, apocarpous, syncarpous, placentation (axile, parietal, free central, marginal, basal) **Fruit:** Definition, types (true, false), forms- simple (dry, legume, fleshy, berry), aggregate (etaerio of berries), composite (sorus)

UNIT-II: TAXONOMY OF ANGIOSPERMS (10 periods)

Introduction, scope and objectives of angiosperm taxonomy, binomial nomenclature, taxonomic ranks, types of classification (artificial, natural and phylogenetic), salient features of Bentham & Hooker and Engler & Prantl's system of classification with merits and demerits

UNIT-III: STUDY OF FAMILIES-I (13 periods)

Distribution, vegetative morphology (habitat, habit, root, stem, leaf), Reproductive morphology (inflorescence, general description of flower, calyx, corolla, androecium, gynoecium, pollination, fruit) floral formula, floral diagram, systematic position (as per Bentham & Hooker's system), distinguishing characters and economic importance of plants (at least two) of the Families-**Annonaceae, Brassicaceae, Malvaceae, Meliaceae, Caesalpinaceae, Fabaceae, Apiaceae.**

UNIT-IV: STUDY OF FAMILIES-II (12 periods)

Distribution, vegetative morphology (habitat, habit, root, stem, leaf), Reproductive morphology (inflorescence, general description of flower, calyx, corolla, androecium, gynoecium, pollination, fruit), floral formula, floral diagram, systematic position (as per Bentham & Hooker's system), distinguishing characters and economic importance of plants (at least two) of the Families-**Asteraceae, Solanaceae, Euphorbiaceae, Lamiaceae, Liliaceae and Poaceae**

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SEMESTER-III

CCB-III (SECTION-B): HISTOLOGY, ANATOMY AND EMBRYOLOGY OF ANGIOSPERMS (P-VII)

Periods: 45

Credits: 02 (Maximum Marks: 50)

UNIT –I: HISTOLOGY (10 Period)

Meristematic Tissue: Definition, classification based on position and origin, Histological organization of root and shoot apices, Apical cell theory, Histogen theory and Tunica corpus theory.

Simple Tissues: Parenchyma, Collenchyma, Sclerenchyma.

Complex tissues: Xylem and Phloem.

Secretary tissues: Laticiferous tissues (Latex cells and vessels), Glandular tissues (External glands-digestive glands, nectary glands and internal glands-Oil glands, hydathodes)

UNIT II: ANATOMY (12 Period)

Vascular Bundles: Definition and types.

Primary structures:

Root anatomy of Monocotyledons (Maize) and Dicotyledons (Sunflower),

Stem anatomy of Monocotyledons (Maize) and Dicotyledons (Sunflower),

Leaf anatomy of Monocotyledons (Maize) and Dicotyledons (Sunflower),

Secondary Growth- Normal Secondary growth in root and stem of Dicotyledons (Sunflower), **Anomalous Secondary growth** in Achyranthes stem and Dracaena stem.

UNIT III: EMBRYOLOGY –I (13 Periods)

Introduction- Definition and Scope, **Microsporangium-** Structure (T.S. of typical anther), Microsporogenesis, Structure of Pollen grain, Pollination (self and cross pollination in brief), Development of male gametophyte, **Megasporangium-** Structure (L.S.of typical ovule), types of ovule

UNIT IV: EMBRYOLOGY –II (10 Period)

Megasporogenesis, Development of **Monosporic** (Polygonum type), **Bisporic** (Allium type) and **Tetrasporic** (Adoxa type) female gametophytes, **Fertilization-** Double fertilization and Significance, **Endosperm-** Definition and types (Nuclear, Cellular and Helobial endosperm) , **Embryo-** Definition, Development of Monocot and Dicot (Crucifer type) embryo, **Development of seed and Fruit** (Post fertilization changes)

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SEMESTER-IV

CCB-IV (SECTION-A): GYMNOSPERMS AND PALAEOBOTANY (P-VIII)

Periods: 45

Credits: 02 (Maximum Marks: 50)

UNIT-I: GYMNOSPERMS (10 periods)

Introduction, general characters and classification of Gymnosperms (as per D. D. Pant, 1957), Morphology of vegetative structures, anatomy of stem (primary and secondary growth) and anatomy of leaf, reproductive structures and life cycle (Developmental stages are not expected) and economic importance of ***Cycas***.

UNIT-II: PINUS (12 periods)

Morphology of vegetative structures, anatomy of stem (primary and secondary growth) and anatomy of leaf, reproductive structures and life cycle (Developmental stages are not expected) and economic importance of ***Pinus***.

UNIT-III: GNETUM (13 periods)

Morphology of vegetative structures, anatomy of stem (primary and secondary growth) and anatomy of leaf, reproductive structures and life cycle (Developmental stages are not expected), affinities and relationship with angiosperms and economic importance of ***Gnetum***.

UNIT-IV: PALAEOBOTANY (10 periods)

Introduction to palaeobotany, process of plant fossilization, types of fossils, geological time scale, Study of fossil Gymnosperms-***Lyginopteris oldhamia*** (stem), ***Bennettites*** (flower) and General characters of ***Ginkgo*** (A living fossil).

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SEMESTER-IV

CCB-IV (SECTION-B): ECOLOGY AND ENVIRONMENTAL BIOLOGY (P-IX)

Periods: 45

Credits: 02 (Maximum Marks: 50)

UNIT –I: ECOLOGICAL FACTORS (10 Periods)

Introduction-Definition of ecology and environment, divisions, fields and scope of ecology, Environmental or ecological factors- Climatic factors (Atmosphere, atmospheric humidity, light and temperature), Edaphic factor (Soil components, soil formation and soil profile)

UNIT-II: ECOLOGICAL ADAPTATIONS IN PLANTS (10 periods)

Morphological, anatomical and physiological responses of plants to water, Morphological and anatomical adaptation in Hydrophytes (Hydrilla stem and Nymphaea petiole), Xerophytes (Casuarina stem and Nerium Leaf), Halophytes (General characters)

UNIT –III: COMMUNITY ECOLOGY (13 Periods)

Community Ecology- Community characteristics, frequency, density, life forms and ecological succession (Hydrosere), analysis of plant community (quadrant method), Ecosystem- Introduction and structure (Abiotic and biotic components) of ecosystem, Pond and grassland ecosystems, Energy flow in an ecosystem, Food chain and food web, ecological pyramids.

UNIT –IV: ENVIROMENTAL BIOLOGY (12 Periods)

Biogeochemical cycles- Water and Nitrogen cycle, Pollution- Causes, effect and control measures of water, soil and air pollution, Soil erosion- Types, methods of soil conservation, Bio geographical regions of India, Aforestation, Deforestation and Chipko movement.

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CCBP-II: PRACTICALS BASED ON SECTION-A OF CCB-III&IV (P-X)

Practical: 16

Credits: 02 (Maximum Marks: 50)

Practical Exercises:

1. Study of Morphology of angiosperms (Root, stem, leaf, inflorescence, flower and fruit as mentioned in syllabus of theory paper-VI) **(2 practical)**
 2. Description, floral formula, floral diagram, identification and classification of at least one plant belonging to each family as mentioned in the syllabus of theory paper-VI **(8 practical)**
 3. Morphological (vegetative and reproductive) study of **Cycas**: Male cone, Megasporophyll and ovule; **Pinus**: Male cone, Female cone and Ovule; **Gnetum**: Male cone, Female cone **(2 practical)**
 4. Preparation of double stained permanent slides of Cycas pinna, Pinus needle and Gnetum stem for the study of anatomical structures **(3 practical)**
 5. Palaeobotanical study of stem of *Lyginopteris oldhamia* and flower of *Bennettites* **(1 practical)**
 6. *One short and one long Botanical excursion are compulsory (Students should submit excursion report in detail in the practical examination for evaluation. The report shall carry marks)*
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CCBP-II: PRACTICALS BASED ON SECTION-A OF CCB-III&IV (P-X)

END OF SEMESTER EXAMINATION (ESE)

Skeleton question paper

Time: Four hours

Maximum Marks: 40

Note: (i) *Attempt all questions*

(ii) *Show your preparation to the examiner*

(iii) *Draw neat and well labelled diagrams wherever necessary*

Q1. Make a double stained permanent preparation, identify and describe the anatomical structures of the given specimen-A (Cycas pinna/ Pinus needle/ Gnetum stem for specimen-A may be given alternately to the students) **(10 marks)**

Q2. Describe, identify and classify the given Plant-B (Polypetalae) with floral formulae and floral diagrams (Flowering twig of the easily available plant for specimen-B may be given alternately to the students) **(10 marks)**

Q3. Describe, identify and classify the given Plant-C (Gamopetalae) with floral formulae and floral diagrams (Flowering twig of the easily available plant for specimen-C may be given alternately to the students) **(10 marks)**

Q4. Identify and describe the spots (Morphology-2 spots, Economic Importance-2 spots, Gymnosperm/Palaeobotany-1 spot) giving reasons **(10 marks)**





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CCBP-III: PRACTICALS BASED ON SECTION-B OF CCB-III&IV (P-XI)

Practicals: 16

Credits: 02 (Maximum Marks: 50)

Practical Exercises:

1. Study of Meristematic tissues with the help of Slides/Models/Charts/ Photocopies **(2 practical)**
2. Study of Permanent and secretory tissues with the help of Slides/Models/Charts/ Photocopies **(1 practical)**
3. Preparation of a double stained permanent slide of stem of Maize, Sunflower, Dracaena and Achyranthus for the study of internal structures **(4 practical)**
4. Study of T.S. of anther and L.S. of anatropous ovule with the help of permanent slides and models **(1 practical)**
5. Determination of minimum number of quadrants required for estimation of biomass in grassland **(2 practical)**
6. Study of frequency of herbaceous species in grassland **(1 practical)**
7. Measurement of plant biomass above the ground in grassland **(1 practical)**
8. Measurement of bulk density and porosity of soil **(1 practical)**
9. Study of morphological and anatomical structures of ecological interest in the Hydrilla stem, Nymphaea petiole, Casuarina stem and Nerium leaf **(3 practical)**
10. *One short and one long Botanical excursion are compulsory (Students should submit excursion report in detail in the practical examination for evaluation. The report shall carry marks)*



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CCBP-III: PRACTICALS BASED ON SECTION-B OF CCB-III&IV (P-XI)

END OF SEMESTER EXAMINATION (ESE)

Skeleton question paper

Time: Four hours

Maximum Marks: 40

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- Note:** (i) *Attempt all questions*
(ii) *Show your preparation to the examiner*
(iii) *Draw neat and well labelled diagrams wherever necessary*
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- Q1.** Make a double stained permanent preparation of the given specimen-**A**. Identify and describe its internal structure. (The Maize stem / Sunflower stem / Dracaena stem / Achyranthus stem for specimen-A may be given alternately to the students) **(12 marks)**
- Q2.** Make a temporary preparation of the given specimen-B. Identify and describe its internal structures of ecological interest. (The Hydrilla stem/ Nymphaea petiole/ Casuarina stem / Nerium leaf for specimen-B may be given alternately to the students) **(10 marks)**
- Q3.** Determine minimum number of quadrants required/ frequency/ plant biomass/bulk density and porosity of soil/ with the help of data given **(10 marks)**
- Q4.** Identify and describe the given spots (Histology- 2, Embryology -1, and Ecology-1) giving reasons **(08 marks)**
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SKILL ENHANCEMENT COURSE BOTANY

SECB-I

Periods: 45

Credits: 02 (Maximum Marks: 50)

SECB-IA: MEDICINAL PLANT PRODUCT PREPARATION SKILL

UNIT-I: MEDICINAL PLANTS (6 periods)

Introduction, Definitions, Scope and Importance, Concept of active principles

UNIT-II: STUDY OF MEDICINAL PLANTS (15 periods)

Description, Identification and Classification, medicinal uses of locally available medicinal plants (Awla, Adulsa, Ginger)

UNIT-III: PRACTICALS ON MEDICINAL PLANT PRODUCT PREPARATION (8 practicals)

Preparation of Awla candy, Awla masticator (Awla supari), Adulsa syrup, Ginger syrup and cake, Visit to a production industry in nearby area (Students are expected to prepare a model of production industry, a visit report and to submit the same at the time of practical examination).

OR

**SECB-IB: FUNGAL BIOMASS PRODUCTION SKILL
(MUSHROOM CULTIVATION)**

UNIT-I: FUNGAL BIOMASS AS NON CONVENTIONAL FOOD (6 periods)

Introduction, Concept and need, Advantages, disadvantages and Sources of non-conventional food

UNIT-II: MUSHROOM (PLEUROTUS) CULTIVATION (15 periods)

Introduction, Systematic position, thallus structure and fruit body of Pleurotus, Merits of Pleurotus cultivation, Commercial cultivation of Pleurotus, Cultivation details of Pleurotus (Substrate, Soaking, Pasteurization, Spawning, Cropping, Picking and Packing, Flow chart), Pleurotus products fresh and processed

UNIT-III: PRACTICALS ON MUSHROOM (PLEUROTUS CULTIVATION) (8 practicals)

Principle, Requirement, procedure, observations, Harvesting, results and records, Visit to a Mushroom cultivation laboratory in nearby area (Students are expected to prepare a model of Mushroom cultivation laboratory, a visit report and to submit the same at the time of practical examination).

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SKILL ENHANCEMENT COURSE BOTANY
SECB-II

Periods: 45

Credits: 02 (Maximum Marks: 50)

SECB-IIA: FUNGAL BIOMASS PRODUCTION FOR BIOCONTROL
(TRICHODERMA CULTIVATION SKILL)

UNIT-I: BIOCONTROL (6 periods)

Introduction, Definition, Biocontrol agents, Need of biocontrol, Concept of biocontrol (ways, limitations and factors affecting success of biocontrol, Environmental health hazards due to pesticides and fungicides), Plant based products (Azadirachtin, Neem cake, Indiar, Pyrethrines, Phermones, Trichoderma etc.)

UNIT-II: TRICHODERMA CULTIVATION (15 periods)

Introduction, Systematic position, thallus structure, Trichoderma as biocontrol agent, Mode of action, Uses, Trichoderma as a commercial biocontrol agent, Cultivation details of Trichoderma

UNIT-III: PRACTICALS ON TRICHODERMA CULTIVATION (8 practicals)

Principle, Requirement, procedure, observations, Harvesting, results and records precautions, Visit to a Trichoderma cultivation laboratory in nearby area (Students are expected to prepare a model of Trichoderma cultivation laboratory, a visit report and to submit the same at the time of practical examination).

OR

SECB-IIB: ALGAL BIOMASS PRODUCTION SKILL
(SPIRULINA CULTIVATION)

UNIT-I: ALGAL BIOMASS AS NON CONVENTIONAL FOOD (6 periods)

Introduction, Concept and need, Advantages, disadvantages and Sources of non-conventional food

UNIT-II: SPIRULINA CULTIVATION FOR SINGLE CELL PROTEIN-SCP (15 periods)

Introduction, Systematic position, thallus structure, Merits of Spirulina cultivation, Methods of cultivation- Small scale cultivation, Mass cultivation, Harvesting of Spirulina, Flow chart of Spirulina cultivation, Limiting factors for Spirulina cultivation, Spirulina products –Powder, Biscuits, Tablets

UNIT-III: PRACTICALS ON SPIRULINA CULTIVATION (8 practicals)

Principle, Requirement, chemicals, Sample or Inoculum of Spirulina, procedure (steps involved in Spirulina cultivation), observations, Harvesting, results and records, precautions Visit to a Spirulina cultivation laboratory in nearby area (Students are expected to prepare a model of Spirulina cultivation laboratory, a visit report and to submit the same at the time of practical examination).

Suggested Readings for SECB-I&II:

Vijaya Khader (1993): Mushrooms for livelihood, Kalyani publishers, Ludhiana-141 008, Page 1-64

Patil B.A. et al (2004): Applied Botany, Sunny publication, Pune, Page 1-214

Dhumal K.N. et al (1998): Plant Diversity & Plants and Human welfare, Nirali prakashan, Pune Page 1-296

Aneja K.R. (1993): Experiments in Microbiology, Plant pathology, Tissue culture and Mushroom cultivation, Vishawa prakashan

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SECB-I&II

END OF SEMESTER EXAMINATION (ESE)

Maximum Marks: 25

SEAT NO:

MARK SHEET

Sr. No.	END OF SEMESTER EXAMINATION (ESE)	Maximum Marks	Obtained Marks
1	Skill Work report submission	10	
2	Over all skill judgement	10	
3	Skill Work presentation	05	
4	Total Marks	25	

Name & Signature of:

Examiner- 1:

Examiner- 2: